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which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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No. 1

EDITORIAL

A Year's Legislation

THE year 1926 has, in many respects, been a memorable one; we should be glad to forget it, but are unable to do so. As we review it we find that it has been one of the wettest and least sunny of all the years: it has also been the occasion for the most disastrous strike that has ever occurred in this country. We shall make but little comment on the strike and its dire consequences: the ordeal by battle has been superseded by many modern expedients as a method of settling a dispute; let us hope that the chemical industry, if not all industries, will learn from this great struggle such lessons as any reasonable man may conveniently note. The chemical industry felt the strike very acutely, but perhaps less than might have been expected: it is an industry of recent and rapid growth; it is free from many embarrassing relics of the past: it has had more than the usual proportion of well-educated, clear-thinking and far-seeing men, and has built up sensible methods and traditions: it is essential that these should be maintained, for the chemical industry and the chemical branches of other industries are destined to be second to none in the kingdom. Legislation is State interference; it is sometimes necessary and is very seldom beneficial to well-conducted and reasonable people; so far as the chemical industry is concerned our New Year's wish is that there may be little legislation and little occasion for it. A few enactments, hardly of first-rate importance, require some special mention here. Of these, perhaps the most noteworthy is the Order of the Ministry of Health known as the Public Health (Preservatives etc. in Food) Regulations, which is already in force, except in respect of bacon, ham, butter, cream, and a few other articles of food. The order appears to us to adopt a novel, almost singular, expedient; it does not prohibit the preservatives that are known to be injurious, it prohibits all preservatives except sulphur dioxide and the sulphites and benzoic acid and the benzoates. It would seem to be of little use for the chemists to discover or invent new preservatives, and yet we can hardly

suppose that 20 years hence no other compounds will be known worthy to rank with the sulphites and the benzoates. We hope that the order will prove beneficial to the community, but our hope is accompanied by traces of misgiving. Aseptic surgery is probably better than antiseptic surgery, but there are many articles of food which are condemned by the present order and yet are more wholesome than food imperfectly treated with preservatives. In the next few years we shall probably become better acquainted with the flavours of sulphites and benzoates; if we get tired of these, how refreshing it will be to go to Jersey or Paris and enjoy the borates and salicylates and formates and any other prohibited compounds; it will be almost like the Americans coming here, not a reason for the journey, but an added pleasure. A less controversial order is being issued by another Government department, the Home Office, dealing with the conveyance of carbon disulphide by road; it is to be conveyed only in steel or iron containers of a specified type or in luted bottles packed in a particular manner; no artificial light capable of igniting inflammable vapour is to be allowed on the vehicle, and no one, while on or attending to such a vehicle, shall smoke. We suppose that the driver will occasionally, in some unfrequented locality, stop and leave the vehicle unattended, while he searches in his overcoat pocket for the remains of the gasper for which his soul has craved. Other regulations are being issued by the Home Office in pursuance of the Lead Paint (Protection against Poisoning) Act. The danger of lead poisoning arises from the process of dry rubbing down, and the regulations state that no painted surface shall be rubbed down or scraped by a dry process; women and young persons, with certain exceptions, are not to be employed in painting with lead paints, and there are other provisions for notification of lead poisoning and for the analysis of paints by inspectors of factories. It is not easy to give a general account of the Public Health (Smoke Abatement) Act, nor the Merchandise Marks Act, nor the Fertilisers and Feeding Stuffs Act. Some of these will

require careful consideration, but the really interesting features of such Acts depend on the study of their exact verbiage and its careful analysis. Manufacture in this country is the care of the Merchandise Marks Act; you may import your malt and sugar from one country, your yeast from another, your colouring matter from a third, your bottles from Czecho-Slovakia, your corks from Portugal, your labels from Germany, your packing cases from Norway, and still sell the liquor as Scotch. Probably there are many people who already know exactly what degree of home origin or home workmanship is necessary to escape the badge of "Made in Latvia." We are not of that number.

Looking Backward

The able surveys of past and future conditions furnished by Mr. Woolcock and Mr. Furness are worthy of very careful attention. They bring out many interesting features and tendencies. It seems that in the chemical industry the distinction between organic chemistry and inorganic chemistry has disappeared. The great merger resulting in Imperial Chemical Industries has brought into one organisation a number of industries, some of which have hitherto been in a state of dignified but precarious isolation. It would seem that there is room for a few other amalgamations in this country, and the pooling of knowledge gives an amalgamation a distinct advantage over several isolated undertakings. It is an extraordinary thing that there should exist in this country a company with a capital of sixty million pounds engaged in the manufacture of so considerable a variety of chemical compounds; it is difficult to imagine what will be the state of the chemical industry fifty years hence. The artificial silk industry has effected a revolution in the textile industry. Who can say what revolutions are in store for the coal industry, the iron and steel industry, the linen industry, the leather industry, and the rubber industry? The manufacture of pyroxylin varnishes grows apace; pyroxylin is a convenient term which includes all those cellulose nitrates which are soluble in amyl acetate and methyl alcohol. These solvents are now made in large quantities, and other solvents are also being developed. Every year we find that fresh manufactures are undertaken here: such compounds as formaldehyde and para-formaldehyde are now made here by Synthite Limited, and possibly other manufacturers; as each compound is made new solvents and new reagents have also to be made. The new ebontes, xylonites and such materials become of increasing importance. The last year has not been a time of rejoicing; delays and disappointments have been its special feature; in many respects the year has been wasted in this country, and we can never recover the waste. It is impossible to regain time spent in idleness. To many of us the only redeeming feature of the great strike was the fact that at one time it seemed as if it would be far worse.

Looking Forward

It is natural that the winter solstice should be a season for mental stocktaking, and that so soon as the mornings begin to be a little lighter we should all look forward to a year of fine weather, good times, prosperity,

and happiness. In the chemical industry we have every reason to feel confident that we shall be more prosperous in 1927 than we were in 1926, and one reason is that the chemical industry is conducted upon scientific principles. The application of science to business should not be confined to the laboratory. The essential scientific principles are that the same causes will in similar circumstances produce the same results, that an investigation of the causes and circumstances will enable you to predict the results, that you may learn to vary the circumstances so as to give you different results provided only that you have found out the laws which govern the operations, and that accurate observations will be a better guide than vague generalities. It is true that these principles are more manifest in the laboratory than in the counting house or the drawing office, but it is merely a question of degree. The solution of industrial problems whether in the works, in the markets of the world, in the laboratory, or in the domain of accountancy, requires the same sort of careful observation, of accurate recording of logical reasoning and hard thinking. The manufacturer who sees how quickly a chemist will perform some simple operation is apt to forget that this speed is the result of many years of study and many months of practice. The chemist who sees a manufacturer rapidly coming to a right decision may also forget how many years of accurate thinking, of acute observation, and of experience have been necessary for this process. The essential difference between the two classes of men is that the scientific man is usually in control of his circumstances; the manufacturer is usually controlled by them. The war, the waste of money it involved, the high taxation, the rise in prices, the industrial unrest, and the great strike were circumstances which the individual manufacturer was powerless to alter. He could merely adapt his plans to them. At the moment no specially disadvantageous circumstances are apparent: the world is poor, and willing to become richer; many people have realised that work is more profitable than arguing, squabbling or fighting; many people have realised the futility of large committees, divided responsibility, and the advice of large numbers of inexperienced and scantily informed enthusiasts. The scientific method is to take only the reliable observations as a guide and to ignore the unreliable. The atomic weight of molybdenum and the best arrangement of a banking system are not to be determined by the opinions of the first hundred people of both sexes you may meet in the Strand or the Whitechapel High Street. We are learning these facts, because of this and because of the lack of obvious elements of danger, we all feel that we are through the worst of the depression. We feel that things are beginning to mend; we look upon a serenest sky and anticipate the glorious sun. There is no reason why the year 1927 should not be a busy and a prosperous year; we have every confidence that it will be such; it will mean hard work, and we shall be glad to work hard. Things are already better, and we trust we shall soon be able to record that they are good. We publish in our advertisement columns greetings from a number of well-known manufacturers, hopeful and friendly greetings. Come, then: stir up, let us begin the good times.

LOOKING FORWARD—1927**By W. J. U. WOOLCOCK, C.B.E.**

Too great a confidence in the future is apt to engender a neglectful attitude to those essential details, attention to which is so necessary if industry is to progress; whereas the greater our hope for the future, the more intense become our efforts to advancement. It is, therefore, unnecessary at the commencement of another year to magnify unduly the events of the past year which have so daunted our assurance, or to regret that we have lost a great part of the confidence with which we faced the future a year ago. In the face of such a recollection it becomes all the more necessary to join in what has become a widespread attitude of hope in the year ahead, and in the case of chemical industry there is little difficulty in visualising the materialisation of our hopes if we give the events of the past twelve months their correct significance.

It must be remembered that, unlike rival countries, England is not prone to produce spectacular evidence of progress and much of the advance that has been made recently has been too little advertised at its inception. In these post-war days when the justifiable assurance of the earlier part of the century has had to give way to very tentative expectations of success, it is especially necessary to prove publicly the hvelness of a rapidly changing industry. We in England are too prone to keep our information to ourselves. Perhaps, however, there is a better realisation of the position of British chemical industry in other countries for within the past few weeks there have been published articles in the foreign press pointing, among other things, to the superiority of British fine chemicals and to the progressive trend towards technical development in the dye industry. In the case of the latter improvement in organisation is obvious. Greater facilities are being offered for rendering technical service to dye consumers; manufacturers are endeavouring to make their technical services as effective as those of their foreign competitors, and research is taking the place which is its right in an undertaking which has to meet keen competition in world markets. The enterprise of dyestuffs manufacturers was amply displayed and ultimately justified in the attempts made to produce novel colours for artificial silk (cellulose acetate) dyeing; and the careful observer can see many other signs of progress during the year. In spite of adverse influences imports of finished dyes show only slight changes from those of last year when compared with the variations during the past few years.

• In the case of the sister industry of fine chemical production there seems little doubt that progress will follow at the remarkable pace which has already been set. Little affected by the coal strike, this industry will find no difficulty in expansion both within and without the scope of the amended List II. Already there is a brighter outlook in this section of chemical industry, and on a reputation which is becoming increasingly recognised there will be based a policy of continued progress in this younger British industry.

In another expanding industry, that of synthetic nitrogen manufacture, the enterprise in the British concern leaves little room for doubt as to the progress which will continue to be made during 1927. Hampered as we are by a lack of natural power supplies, our research

workers, far from being dismayed, are giving increased attention to plant technique, which concentration is placing British processes well in the front line of modern methods, and the progressive policy in the industry has been as certainly though not as prominently displayed as in the case of the Continental concerns.

In the manufacture of commercial solvents which has become of such imposing significance during the past year or two it is particularly gratifying to find that English manufacturers have not been behindhand, and while production of some of the higher alcohols at low prices is already an established industry, research in the field of synthetic methanol and ethanol production is well on the way to a satisfactory culmination.

The older established industries heavy chemical manufactures for instance have undoubtedly passed through a very acute period of their history, and the derangement which was caused by the coal stoppage will not be overcome immediately. On the other hand, the fact that the disturbances were far from resulting in disaster is a matter for some considerable congratulation, and is a recollection on which we can base a firm hope for their future prosperity. Neither must we overlook the immense help that will be gained from association with the new combine in the case of member firms; and for all heavy chemical manufacturers in England there will be an indirect influence, in that international trade will be facilitated by the presence of the combine in foreign markets.

In the light of these reflections, it becomes impossible to take up any but an optimistic attitude towards the prospects in chemical industry during the coming year. After the surprises of 1926, we cannot pretend to affirm that the New Year will be undisturbed by unexpected influences; and without any ideas as to the shape that such factors may take, it is impossible to prepare ourselves for particular crises. But this cannot prevent us from proceeding with the work of recuperation, or from following the lines of investigation which are continually being opened up before us. Certainly British chemical industrialists are becoming more alert to the fact that the greatest factor in modern development is the amount of scope given to the researcher, whether it be in the laboratory, the design office, or the engineering shop, and this alone is ample justification for our taking the most hopeful view of the future.

THE HEAVY CHEMICAL AND ALLIED INDUSTRIES IN 1926**By REX FURNESS**

The record of British trade during 1926 is depressing indeed. The export and import figures show decreases of £105,132,639 and £59,013,963 respectively when compared with the 1925 figures, the December figures being excluded in each case. At the same time, the chemist—mayhap somewhat selfishly—is able to extract the proverbial crumb of comfort from the fact that the chemical industries have suffered less than any other major industry. In fact, the 11 months' figures for the years 1926 and 1925 show that imports of chemicals, drugs, dyes and colours have increased by only £1,000,000, whilst exports have decreased by £1,600,000. It has demanded no little courage, optimism and thought to carry on in the difficult conditions which have ruled

during more than half the year, but it is satisfactory to realise that essential products have been made available to industry in general, and that the export trade has been reasonably well maintained. Indeed, in certain instances, such as soap, glycerin and caustic soda, our export trade has increased. May we not hope that the spirit of optimism which has carried the industry through the dark days shall continue, and, with the aid of the good relationships which have long existed between employer and employee, and to which the record of the past year is due in considerable degree, find justification in a year of prosperity during 1927.

The most important commercial development of the year is, of course, the formation of Imperial Chemical Industries, Ltd., by the combination of Brunner, Mond & Co., Ltd., the United Alkali Co., Ltd., Nobel Industries, Ltd., and the British Dyestuffs Corporation, Ltd., into one great alliance. In international chemical relationships the British industry will be able to command a greater respect and attention in the future, whilst at home both general industry and the chemical industries will benefit by the economies which will materialise in due course. With the general financial re-arrangements and the possible executive and administrative economies which may result we shall not deal at this juncture although these are matters which the chemist neither places nor wishes to place without his consideration—but we may venture to reply to one criticism which has been somewhat widely made. The elimination of competition and the creation of a monopoly often leads to stagnation and self-satisfied ease, it is true, but the vitalising power of comprehensive research is sufficient to ensure true progress. The research records of the companies constituting Imperial Chemical Industries, Ltd., and of the individual members of the new Board of Directors, are worthy of the best traditions of British chemistry and chemical industry. To illustrate briefly, Brunner Mond recently developed synthetic ammonia production, the United Alkali Co. kept the Leblanc process in active competition with cheaper methods of alkali production by reason of the attention given to the winning of valuable by-products, Nobel Industries have recently placed pyroxylin lacquers upon the market, and are showing potential users how to master the technique of their application, and the British Dyestuffs Corporation has been very active in the production of new dyestuffs for special purposes, and of a range of organic chemicals not directly associated with the dyeing of textiles. Altogether it is difficult to believe that anything but good can come to British and Empire trade and industry as a result of the formation of Imperial Chemical Industries, Ltd.

The formation of Nitram, Ltd., by the British Sulphate of Ammonia Federation is another event of importance. The new company will market, in addition to ammonium sulphate, the newer nitrogenous fertilisers as well as composite manures. With the growing appreciation on the part of the farmer of the economic return from the use of complete manures, it is important that too narrow a commercial outlook be absent from a great sales organisation, and Nitram, Ltd., should be welcomed by all producers of fertilisers.

Synthetic nitrogenous fertilisers now form almost one-half of the world's consumption of nitrogenous

manures, so that the continued progress of Synthetic Ammonia and Nitrates, Ltd., at Billingham, is very gratifying. Further, the intensive experience in the conduct of reactions at high temperatures and pressures which has been gained makes many momentous developments probable. It should not come as a great surprise if the announcement were made that this company is to market synthetic methyl alcohol. It is already known that Brunner Mond—the parent company—is amongst those who are keenly and actively interested in the hydrogenation of coal by the Bergius method—a process which has been worked for some time upon a large experimental scale in Germany, and which, according to Bergius himself, has been proved to be financially sound. The production of synthetic methyl alcohol and liquid hydrocarbons in quantity, and the winning of large amounts of low boiling hydrocarbons from coal by direct hydrogenation or by one or more of the processes of low-temperature carbonisation of coal, which have received much attention during the year, may not materialize at once, but the present and prospective progress along these lines is enough to assure us that the British chemical industry will not be found wanting if and when the supply of “natural” motor fuels fails.

The trade in alkalis during the year has suffered somewhat in certain directions. Thus, the diminishing exports of soda ash, soda crystals, and soda bicarbonate from 1924 to 1925, when about 6,000,000 cwt. and 5,500,000 cwt. were exported, have continued during 1926. Up to the end of October there were exported only 3,950,553 cwt., as against 4,795,036 cwt. during the first ten months of 1925. The one satisfactory feature in these matters is the maintenance of the Empire demand. The trade in caustic soda, however, has a better aspect, for an increase in exports during the first ten months of 1926 is to be recorded, the figures being 1,480,291 cwt. against 1,417,670 cwt.

It is, perhaps, characteristic of the vitality of the alkali industry that Brunner, Mond & Co. have this year spent £100,000 upon new laboratories wherein work in connexion with the ammonia soda process will be conducted. It is a happy omen for the success of the new combine and for British chemical industry in general that such a gesture be made, indicating a conviction on the part of those in control that progress is not yet at an end, even in such a well-established and highly developed process.

Acid production has suffered considerably during the year under review, and the fact that the sulphuric acid plants of this country have been worked at about one-third of full capacity is unfortunately broadly illustrative of the position, and it can scarcely be hoped that the present justifiably high prices will be substantially reduced as yet. The effect of this upon sulphate of ammonia producers using by-product ammonia, and upon superphosphate manufacturers, already very greatly harassed, is severe.

The home trade in alkalis may be expected to increase with the commencement of manufacture on the part of several makers of artificial silk. Many of the companies formed during the boom period last year are commencing active production. The Kirklees Artificial Silk Company is producing viscose silk at Tottington,

Lancs., and at Gloucester. The Aintree works of British Enka, Ltd., have commenced production, and will proceed to full scale operations gradually—that is, to the manufacture of 20,000 lbs. of viscose per day. The Rayon Manufacturing Co. and the Western Viscose Co. are beginning production of the artificial fibre, whilst nitrocellulose and viscose are being made at Stowmarket by the Bulmer Rayon Co., which is hoping eventually to turn out 8,000 lb. per week of the former type of fibre and 60,000 lb. per week of the latter. Courtaulds, whose greatly-increased activities are well known both in this country and abroad, are reported to be about to produce acetate silk, in addition to their well-established viscose silk. Advances in production, dyeing and marketing are to be recorded in connexion with Celanese acetate silk.

A word must be given regarding the possibilities of artificial wool. The best known type, produced in a manner very broadly similar to that of artificial silk manufacture by the viscose process, is probably that of Snia Viscosa, the important Italian firm, but other types are being pressed forward. Claim and counter have been made, but the so-called artificial wool has probably a future, possibly not in competition with natural wool, but in conjunction therewith for obtaining special effects in the finished goods. Similarly, immunised cotton obtained with the aid of *p*-toluene sulphochloride has many special properties, including its affinity for basic dyestuffs and its dyeing characteristics (resembling those of cellulose acetate in marked degree), whilst the material is more resistant to alkalis than the cellulose ester products. The work of the chemist in the production of specially treated natural fibres such as immunised and amideised cotton and in the manufacture of "synthetic" fibres will place new materials in the hands of the textile manufacturer, and will enable many novel effects to be realised.

Although it cannot be said that there have been spectacular developments in the soap industry, it is very satisfactory to note that the quality of British soap stands as high as ever throughout the world, and that in a year, during a great portion of which work has been carried on under difficulties, exports have actually increased as compared with 1925. The export figures for the first ten months of the years 1926 and 1925 were respectively 1,298,971 cwt. and 1,233,295 cwt., whilst imports were slightly higher, as the figures 240,691 cwt. and 211,655 cwt. show.

The increase in demand for edible oils and fats has continued, so that refining methods in the soap industry have still claimed considerable attention, for the quality of British soaps must not suffer, and, initially, somewhat lower grade oils have had to be taken. There is no question of the success of such refining methods, as the evidence of the soaps themselves amply demonstrates. Hydrogenated oils have again not been so fully utilised as was at one time expected, not, however, due to any inherent inferiority when their properties and usage are thoroughly understood, but to economic reasons. The relatively slight difference in price between hard fats and soft oils makes hydrogenation uneconomical in many instances. The study of activity of catalyst, elimination of catalyst poisons from raw oils, the production of hydrogen, and kindred problems still proceeds,

and the hydrogenation process may represent more than an insurance against unwarranted rises in the prices of hard fats at no distant date.

The edible oils and fats industries have also carried on in a remarkable fashion, and a slightly greater export trade has been done during 1926 than 1925. Here again no radical development in process has occurred, but refining methods command constant attention, and treated bleaching earths and decolourising charcoals are constantly being offered, with accompanying claims of superiority which are sometimes justifiable.

A new continuous extraction plant has been described and demonstrated in which very small charges of seed are treated upon a counter-current principle with solvent. The rapidity of extraction is a prominent feature of the apparatus, but oil extractors have not been unanimous in accepting the small charge idea, either in this country or in America.

Glycerin has been much in demand during 1926, and a considerable increase in exports has to be recorded. Many substitutes have been offered in the past, especially during the war years, but none has won its way. To-day, however, the claims of ethylene glycol have to be considered, for it has been shown to nitrate well to a non-freezing explosive which may prove a valuable material either in combination with or in substitution of trinitroglycerin. Its physiological properties, too, fit it for many uses now served by glycerin. Methods for producing the glycol from the ethylene of oil gas *via* ethylene chlorhydrin are being developed, and glycerin producers may have to watch ethylene glycol carefully. The proof of the value of glycol ethers as pyroxylin solvents has been given during the year, and a possible demand may allow the production of glycol to be intensified, with consequent reductions in price.

The mention of pyroxylin solvents recalls the fact that motor-car body makers in this country are following the very definite American example of using pyroxylin lacquers in their finishing operations. Nobel Industries, Ltd., have come strongly into this market, and have built a large demonstration centre where the new lacquers are being exhibited and the art of their application taught to prospective users. The manufacture of suitable solvents—the higher alcohols etc. by fermentation processes—has been stimulated.

It may not be strictly correct to class beet sugar as a heavy chemical, but the progress of the industry, in which many chemical engineering methods are applied, merits consideration. The acreage under beet has almost doubled each year since 1924, and this season around 130,000 acres have been cultivated. The rise in yield per acre has also been noticeable, and to-day an average eight tons of beet is grown per acre. British sugar factories this season will produce about 120,000 to 130,000 tons of sugar. The location of the factories is not generally known, and it may be well to give a list of those operating this year as follows:—Cantley, Kelham, Colwick, Spalding, Ely, Ipswich, Kidderminster, Cupar, Felstead and Poppleton, Bury St. Edmunds, Wisington, Peterborough, and Greenock. The total share capital of these organisations is £2,925,507, and the total subsidy paid by H.M. Government up to November 6, 1926, was £2,085,010.

Much attention has been paid to types of extraction

process, refining methods, seed selection and cultivation, fertilisation of beet grounds and so forth, and the industry is making a bold bid to establish itself against the day when State help will come to an end.

The heavy chemical industry in this country is not yet faced with a chlorine problem so acutely as are those of other lands, and large amounts of the gas are used for making bleaching powder and liquors, either within or without chemical works proper, whilst other outlets are being developed. Textile works and paper mills take large quantities of bleach, and much bleaching powder is used now in petroleum products refining.

Paper-making is widely distributed, but consolidation and combination is not absent in this industry. Thus the most recent development of note concerns the Inveresk Paper Co., Ltd., which controls many paper works. Controlling interest in a large German paper and chemical works has been acquired. We have here, therefore, a large and scientifically-controlled paper organisation with supplies of raw materials assured. The use of silicate of soda in paper-making is advancing, and recently disclosed research reveals much of interest to the paper maker in this direction.

The portland cement industry is progressing along the lines of making ordinary cement in rapid hardening form by careful attention to proportioning and fine grinding of clinker. Such rapid hardening cements compete with the aluminous cements of French origin, which must be offered at prices considerably higher than that of portland cement. The plea for much greater practical interest in cement research may, however, be endorsed.

Research in glass technology has been maintained at a high level, and a passing word must be given to many high quality products of the industry, such as optical glass, British Pyrex, chemical glassware, etc., and to the newer Vita glass, the claims of which have been steadily advanced during the year. The valuable effects of ultra-violet radiation upon health are now established, and the property of Vita glass, which allows the rays to pass, is being proved in the results of many carefully controlled investigations with school children and others.

Coal-tar industries have naturally suffered during the year, but reference to the papers given at the Tar Products Exhibition makes it clear that the industry is still very much alive. Problems of low-temperature carbonisation of coal, pulverised coal firing of boilers, coal hydrogenation, gas purification, safety in mines, coal blending and cleaning, etc. do not lie within the scope of this review, but it is satisfactory to note that Britain need feel no shame in regard to her activities in general coal research.

The chemical engineer and plant manufacturer and the metallurgist have had much of interest to record during the year, and the special steels and alloys for use in plant required for specific resistance to chemicals etc. for high temperature-high pressure work as well as non-ferrous alloys and other materials of construction are receiving more and more attention.

Even with the shadow of 1926 still darkling upon us, let us repress any desire to assume the mantle of a Daniel and to interpret the handwriting on the wall into a warning of disaster. Let us rather join the band of hard-working optimists, and in a spirit of determination and hope look forward eagerly to 1927.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

SUPPLY OF JOURNAL TO MEMBERS

It has been arranged that all Members of the Society shall be supplied with the first four issues of the JOURNAL for January irrespective of whether their subscriptions for 1927 have been received or not. Those who have not yet remitted the amount to the Society's offices are recommended to do so as soon as possible in order to ensure that the issues subsequent to that for January 28 are despatched to them on publication.

LONDON SECTION

At meeting, held on January 3, Mr. C. S. Garland presiding, a paper entitled "Modern methods of sewage disposal," by Lieut.-Col. W. Butler, M.B., D.P.H., and Mr. J. H. Coste, F.I.C., F.Inst.P., was read by the latter author.

Mr. Coste first discussed the limitations of the process of sedimentation and showed that mere sedimentation in long channels would remove from 60% to more than 70% of the total suspended matter. If perfect sedimentation on a large scale were possible, however, the effluent would still be unfit for discharge into a river unless the flow of the river were many times greater than that of the effluent. Improved sedimentation could not yield sufficiently good material when a stable effluent was desired, i.e., one which would remain offensive. After considering sewage disposal by irrigation on land, the history of the intensive biological treatment of sewage was given, leading to the development of the activated sludge process by Fowler and his colleagues.

Types of plant for treatment with activated sludge were then dealt with, extensive experiments with both air-diffuser and mechanical agitation plants being described. Experiments made with roughly-sedimented sewage led to the conclusion that ordinary sedimented effluent was a more favourable liquid to treat than crude sewage, and it was found that greater volumes of sedimented sewage could be treated in the paddle (agitation) plant. Dealing with the re-aeration of returned activated sludge, it was found that separate re-aeration of the sludge after separation from the final effluent was a more satisfactory means of keeping it in active condition than that of allowing the whole liquid to remain longer in the treatment tanks.

The nature of activated sludge and experiments on its mode of action were then discussed. It was shown that oxidation plays a large part in the changes produced by activated sludge and figures were given indicating that although a mixture of activated sludge and sewage did not change in character during five hours in the absence of air, yet an immediate change had been effected, practically at the moment of mixing. The "immediate" action of activated sludge varied with the proportion of active material mixed with the sewage, though large proportions did not appear as efficient as smaller ones, probably because the action slowed down as the oxidisable matter in solution decreased in amount. The useful action of activated sludge was associated with the moist solid and not with the liquid portion. The paper concluded by giving the results of experiments

which suggested that the depth of tank had little effect on the results of treatment of activated sludge with diffusers.

An interesting discussion followed, in which questions relating to the disposal of sewage sludge were raised, contributions being made by the chairman, Dr. Calvert, Dr. Voelcker, Dr. Ormandy and several others.

OTTAWA SECTION

At the regular meeting held on December 16, Mr. A. E. MacRae presiding, it was agreed to hold the January meeting on the 19th instead of the 20th, as stated in the programme.

Dr. A. E. MacIntyre, in reviewing a few semi-popular books on chemistry, drew attention to the increasing desire of the man in the street for scientific information; he suggested that books catering to this demand would make ideal Christmas gifts.

Mr. D. W. Stewart, National Research Council, contributed a paper entitled "Some Metallurgical Problems." As a preliminary he ran through the actual ore-dressing operations of a particular mine in British Columbia which produces a lead zinc ore. The metals are practically completely separated by flotation processes. The problems which the speaker then took up embraced such things as, the difficulty of grinding to average run on account of the varying toughness of the ore, the enormous wear on pumps handling daily thousands of tons of material, corrosion problems arising from condensation on the outer surface of pipe lines, and filtering troubles. Selective flotation of either lead or zinc in the presence of one another is accomplished but offers trouble in control, and laboratory tests are most useful at this stage, and are also used for checking the mine flow.

Discussion of this paper, in which many took part, centered largely on details of flotation processes, and was contributed to from first-hand knowledge by Messrs. W. B. Timm and C. S. Parsons.

CALENDAR OF FORTHCOMING EVENTS

- Jan. 10. INSTITUTE OF METALS, *Scottish Local Section*. 39, Elmbank Crescent, Glasgow, at 7.30 p.m. Discussion on "The value of research," by Prof. J. H. Andrew.
- Jan. 10. INSTITUTION OF THE RUBBER INDUSTRY, *London and District Section*. Engineers' Club, Coventry Street, W.1, at 8 p.m. "Ageing of raw and vulcanised rubber," by G. Martin.
- Jan. 10. CERAMIC SOCIETY. North Staffordshire Technical College, Stoke-on-Trent, at 7.30 p.m. "The chemistry of coal," by Prof. R. V. Wheeler.
- Jan. 11. INSTITUTION OF PETROLEUM TECHNOLOGISTS. Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m. "The conditions governing the occurrence of oil in Burma," by Dr. L. Dudley Stamp.
- Jan. 11. SOCIETY OF CHEMICAL INDUSTRY, *Birmingham and Midland Section*. University Buildings, Edmund Street, Birmingham, at 7.15 p.m. "A study of the rotary dispersion of certain derivatives of hydroxy-acids," by C. E. Wood.
- Jan. 11. INSTITUTE OF METALS, *North-East Coast Local Section*. Armstrong College, Newcastle-on-Tyne, at 7.30 p.m. "Some aspects of the corrosion of metals," by U. R. Evans.
- Jan. 11. INSTITUTE OF METALS, *Birmingham Local Section*. (Arranged by the Co-ordinating Committee.) Engineers' Club, Waterloo Street, Birmingham, at 7 p.m. "Forces set up in strip rolling," by H. S. Caswell.
- Jan. 11. SOCIETY OF CHEMICAL INDUSTRY, *South Wales Section*. Technical College, Cathays Park, Cardiff, at 7.30 p.m. "Magnesium and its alloys," by W. R. D. Jones.
- Jan. 11. INSTITUTE OF CHEMISTRY, *Manchester and District Section*. "Air pollution," by Prof. J. B. Cohen.
- Jan. 12. SOCIETY OF CHEMICAL INDUSTRY, *Nottingham Section*. With the co-operation of the Fuel Section. University College, Nottingham, at 7 p.m. "The production of liquid fuels from coal," by Dr. J. G. King.
- Jan. 13. INSTITUTE OF METALS, *London Local Section*. Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W.1, at 7.30 p.m. "Hardening," by W. Rosenham.
- Jan. 13. SOCIETY OF CHEMICAL INDUSTRY, *Manchester Section*. Joint meeting with the Manchester Section of the Institution of the Rubber Industry. 16, St. Mary's Parsonage, Manchester, at 7.30 p.m. "Rubber solvents," by Dr. D. F. Twiss.
- Jan. 13. OIL AND COLOUR CHEMISTS' ASSOCIATION. Rooms of the National Federation of Paint Manufacturers, 8, St. Martin's Place, Trafalgar Square, W.C.2, at 8 p.m. "Cadmium colours and their application to the paint industry," by H. W. D. Ward.
- Jan. 14. INSTITUTE OF METALS, *Sheffield Local Section*. The University, St. George's Square, Sheffield, at 7.30 p.m. "Gas furnaces and their heating," by P. Hopkinson.
- Jan. 14. SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group*. Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "Thermo-electric and resistance pyrometry in industry," by J. A. Hall.
- Jan. 20. SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY. *Edinburgh and East of Scotland Sections. Joint Meeting*. The Pharmaceutical Hall, 36, York Place, Edinburgh, at 7.30 p.m. "The importance of fuel research in the coal problem," by Dr. C. H. Lander.
- Jan. 21. SOCIETY OF CHEMICAL INDUSTRY, *Liverpool Section*. The University, Liverpool, at 6 p.m. "Some physico-chemical and bio-chemical aspects of malignant growths," by Prof. W. C. McC. Lewis.
- Jan. 21. SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY. *Glasgow and West of Scotland Sections*. Engineers' and Shipbuilders' Institute, 39, Elmbank Crescent, Glasgow, at 7 p.m. "The volatility and carbonisation of oils for cylinder lubrication," by J. W. Donaldson.
- Jan. 22. SOCIETY OF CHEMICAL INDUSTRY, *Birmingham and Midland Section*. Annual Dinner.
- Jan. 22. SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY. *Birmingham and Midland Sections*. Chemists' Dinner. The Queen's Hotel, Birmingham, at 7 p.m. The guests will include the President of the Institute of Chemistry, Prof. G. G. Henderson, and the President of the Society of Chemical Industry, Mr. F. H. Carr, C.B.E.

INSTITUTION OF CHEMICAL ENGINEERS

The fifth annual corporate meeting of the Institution will be held in London on Friday, March 11, 1927, instead of in July. The programme of the Conference on March 9, 10 and 11 is arranged provisionally as follows:

Wednesday, March 9: Papers on "Lead-burning," by W. S. Freeman, and "Lead as a constructional material in chemical engineering," by S. J. Tunney. Papers on "Modern methods of sulphuric acid manufacture," by Dr. H. J. Bush, A. Grounds, B.Sc., W. G. Mills, W. A. S. Calder and J. Fox.

Thursday, March 10: Works visit. Paper on "Rubber in chemical engineering," by B. D. Porritt, M.Sc. Paper on "Effect of heat on strength of materials," by Prof. F. C. Lea.

Friday, March 11: Fifth Annual Corporate Meeting—President's Address. Paper on "The cracking of oils," by F. H. Rogers. Annual Dinner.

SOCIETY OF GLASS TECHNOLOGY

The President, Mr. Walter Butterworth, Senr., M.A., presided at a meeting held in University College, London, on December 15, 1926. Five papers were presented.

"Further note on sillimanite as a glass works refractory" by Prof. W. E. S. Turner, D.Sc. A pot ring made from a mixture of 5 parts of fine, 1 part of medium, and $\frac{1}{2}$ part of coarse sillimanite, with 3 parts of ball clay, was broken in use after doing service for ten weeks in a pot melting a potash-lead oxide silica glass. The ring showed little sign of attack by the glass. A sillimanite pot, holding 30 lb. of glass, had been in use, in the Department of Glass Technology at Sheffield, for melting a series of soda-ferric oxide silica glasses. The pot stood up well under this work, exhibiting no signs of honey-combing. This result was rather remarkable, since sillimanite usually offered little resistance to the attack of ash rich in iron compounds. An illustration was given to show the great resistance offered by sillimanite to changes in temperature.

"Some corrosion and erosion phenomena and their bearing on the macrostructure of refractories," by J. F. Hyslop, R. Gumm, and H. Biggs. The importance of the macrostructure of refractories was emphasised in connection with corrosion and erosion phenomena. The use of an indirect method, such as that employed, indicated that the characteristics and grading of grog were factors of considerable moment. Data were given which showed that the disintegration in a solvent of a composite material, such as wax loaded with burnt clay particles, depended on (a) the density of the solute-rich layer relative to the solvent, and (b) the size of the particles. If a light upward flowing layer was formed the material with large particles would be more rapidly broken up than that containing small particles. The reverse holds if a dense downward flowing layer is formed, the finer the particles the more rapid being the corrosion. Laboratory experiments on clay rods immersed in chosen glasses confirmed the above statements in respect to the corrosion of clay by glass. In a lead glass the clay with the larger grog was more corroded than that with the finer, but in a soda-lime glass the finer material was the more attacked. Consistent with safety in other direc-

tions, the evidence indicated that a refractory meant to withstand corrosion by a lead glass should contain as large a fraction of fine grog as possible, whereas one for use with a soda lime glass, say, should contain the maximum of large grog. It was also shown that where erosion was the principle factor in the break-up of the refractory, the conditions demanded different characteristics in the grog in that the material must hold the maximum of fine particles.

"A note on the X-ray patterns of mullite and sillimanite," by J. F. Hyslop and H. P. Rooksby. In two former notes it was stated that sillimanite and mullite gave X-ray patterns which could be distinguished, and the object of this further note was to record the data which had been obtained for several alumina-silica materials. It was concluded that there were, on close inspection, real and consistent differences between the patterns of sillimanite and of the crystalline substance formed in the samples examined. Further, these differences, although small, had been found sufficient for identification, since they depended upon the relative spacing of the lines, and not on differences in intensity which could be caused by preferential orientation of the crystals.

"Note on the design of parison moulds," by Dr. S. English. Of the three moulds, the ring, parison and blow moulds, ordinarily used in the making of bottles by machines, the parison mould was by far the most difficult to design properly. There was only one feature of a parison mould that could be determined even approximately by a study of the finished bottle it was desired to reproduce, and that was its internal size or glass-holding capacity: but even in this respect allowance had to be made for the preliminary blow up, which varied from one machine to another and from one type of bottle to another. For the purpose of parison mould calculations it was convenient to use the volume occupied by 1 oz. of hot glass. Assuming that 1 oz. of glass at 1250° C. occupied 0.75 cb. in., a gob of glass to form a 24-oz. bottle should have a volume of 18 cb. in. In regard to the shape of parison moulds, the only feature which was recognised as essential was the absence of sharp corners. The inner surfaces should always be continuous smooth curves.

The primary function of parison moulds was to give a preliminary shaping to a quantity of glass, and the moulds could only do this efficiently by cooling the glass surface in contact with the mould. It had been found that a heavy-walled mould always kept cooler than a light-walled mould under similar conditions. The thicker mould required less external cooling and retained its good condition longer than the thinner one, but it was much heavier, and in the case of a charge of moulds it heated up to the proper working temperature so slowly that a considerable loss of output was entailed. Cast iron appeared to be perfectly satisfactory as a parison mould material. It was suggested that stainless steel might be tried for the purpose.

The fifth paper was presented by Mr. V. H. Stott, M.Sc., and was entitled "The viscous properties of glass." Owing to lack of time, the reading of the paper on "The effect of cullet on the melting of glass," by Prof. W. E. S. Turner, D.Sc., was postponed.

PERSONAL AND OTHER ITEMS

We are glad to learn from the New Year Honours List that Sir Charles Greenway, chairman of the Anglo-Persian Oil Co., Ltd., becomes a Baronet, as does Sir John Scott Hindley, commercial adviser to the Mines Department. The new Knights include Mr. H. Spencer Morris, K.C. (president of the Industrial Court), and Mr. D. Milne Watson, governor of the Gas Light & Coke Co.

Major Charles Arthur Mander, of the firm of Mander Bros., paint and colour manufacturers of Wolverhampton, has been appointed a deputy lieutenant for Staffordshire.

Mr. E. Matthews, M.Sc., has been appointed demonstrator in the Chemistry Department of Guy's Hospital Medical School.

Mr. R. K. S. Mitchell has been awarded the degree of D.Sc. of Edinburgh University for a thesis on "Some β -octyl esters of substituted acetic acid."

Mr. John Baddeley, the Secretary of Mines, and Minister of Labour in the New South Wales Cabinet, accompanied by a mining expert, is to visit America and Europe to study the saving of coal, the treatment of coal for the recovery of its by-products, road construction, and various industrial matters.

The Council of the Institute of Chemistry has sanctioned the formation of a local section for the Dominion of New Zealand. Prof. T. H. Easterfield is the chairman of the new section.

A new research laboratory for physical and inorganic chemistry, the gift of Mr. and Mrs. H. Cohen, has been opened at East London College in the department of Prof. J. R. Partington. The laboratory is equipped for research in physical and inorganic chemistry and chemical microscopy and includes a small library.

The *Chemiker-Zeitung* has celebrated the fiftieth anniversary of its foundation by the issue, on December 29 last, of a special number containing congratulatory messages from prominent personalities in the chemical world.

New Year's Prospects for Chemicals

In a New Year message to the British Industries Fair number of the *Advertising World*, Mr. W. J. U. Woolcock, C.B.E., General Manager, the Association of British Chemical Manufacturers, writes:—

"The prospects for the British chemical industry in 1927 are distinctly good. Probably no other industry has suffered less as a result of the coal dispute. Therefore recovery in the new year is likely to be at least as rapid as, and probably more rapid than in any other industry. The chemical exhibits in the British Industries Fair will show how every firm is extending its range of goods and that very considerable progress has been made in the last year, particularly in regard to fine chemicals. So far, chemical products, apart from those like soap, have not been widely advertised because their appeal is not to the general public but to the trade buyer. The Fair brings the manufacturer into direct touch with him. It is of immense propaganda value also in emphasising the importance of the application of science to industry. If we are to maintain our industries against world competition, science, which

finds its greatest application in this industry, must permeate every industry to a like extent.

"Despite the fact that the recent great chemical 'merger' did not take place until after all space had been booked in the chemical section of the Fair, Imperial Chemical Industries, Ltd., is to exhibit, arrangements having been made to take over the centre space reserved for one of the constituent companies. This, of course, will be the new company's first exhibit and will include heavy chemicals, dyestuffs and intermediates."

Peace Industrial and International

The Annual Dinner of Messrs. Arthur Duckham (1920), Ltd., was held at the Trocadero Restaurant on December 23. The Chairman of the Company, Sir Arthur Duckham, K.C.B., presided. There were present over 180 members of the staff of the company.

After proposing Loyal Toasts, Sir Arthur said that there was one further toast which he would like to give the Company, namely, "Peace—International and Industrial." He felt that the prosperity of the country, and indeed, the Company, collectively and individually, depended upon the general acceptance of international peace and peace in industry. Subsequently, Sir Arthur took the opportunity of congratulating the staff of the Company in having brought to commercial success a number of important developments upon which they had been engaged during the past few years.

Canadian Mineral Industry in 1926

The preliminary estimate of the Dominion Bureau of Statistics places the output of the Canadian mineral industries for 1926 at \$242,886,000, which is 7.1% above the previous year and \$16,000,000 above the previous highest year—1920. The output of non-metallic minerals, excluding coal, increased 10% to \$24,841,000, and that of coal by 3,000,000 tons to 16,000,000 tons, with a total value of \$58,000,000, which is 18% above the value of last year's output. The production of metals rose by \$2,500,000 to \$119,881,000. Gold production remained practically stationary at 1,729,377 fine ounces, silver rose by 1,500,000 fine ounces to 21,907,000, nickel fell by 6,250,000 lb. to 67,551,000 lb., copper rose by 28,000,000 lb. to 139,000,000 lb., lead rose by 28,000,000 lb. to 281,000,000 lb., and zinc rose by 38,000,000 lb. to 148,000,000 lb.

Pollution of Rivers

Lord Balfour, on behalf of the Prime Minister, will shortly receive a deputation organised by the British Waterworks Association and the Salmon and Trout Association, with the object of persuading the Government to set up a central authority to deal with the question of rivers pollution and to organise research on the best methods of dealing with harmful trade effluents.

Beit Fellowships for Scientific Research

The fourteenth election of Beit Fellows will be held on or about July 15, 1927. Applications for the three Fellowships which may be awarded must be received on or before April 19. All information may be obtained, by letter only, from the Rector, Imperial College, South Kensington, London, S.W. Sufficient additional funds having been provided, the three Fellowships awarded in 1926-27 were given for two years, subject,

in regard to the second year, to a favourable report on the research; and it is probable that similar action may be taken in respect of future awards. The annual value of a Beit Fellowship is £250.

Element 61

At a recent meeting of the Società Italiana per il Progresso delle Scienze, Prof. Rolla gave further information about the independent isolation by Rolla and Fernandes of element 61. The new element was obtained (in the concentration of 0.5%) by repeated fractional crystallisation of didymium earth. The absorption spectrum of the material shows interesting peculiarities. A full account of the work, which dates from 1922, is given in the *Gazzetta Chimica Italiana* for September.

Report on the Nitrate Industry

The annual report on the nitrate industry issued by Messrs. Aikman (London) states that during the year under review the chief feature in the market for nitrogenous fertilisers has been the large increase in the production of synthetic nitrogen and the improvement in the condition in which many of these products have been marketed. This has placed the Chilean nitrate industry in a very critical position, and would remain so unless steps were taken by the Chilean Government to cancel the export duty, so that a large reduction could be made in the selling price. Two years ago a reduction in the export duty would have sufficed, but now nothing short of the abolition of the duty could save the industry. During the coming year a considerable increase in the production of synthetic nitrogen products was anticipated, especially in Germany, where two large combines have recently been formed to erect important plants under new processes of production. It would appear, therefore, that a nitrogen price war was fast approaching. Chilean nitrate was still generally recognised as the best nitrogenous fertiliser, being free from all the disadvantages of manufactured chemical manures, and there was every reason to believe that if it could again be marketed at a competitive price consumers all over the world would return to its use. To achieve this object the price should be £1 10s. to £2 per ton lower, based on present prices of synthetic nitrogen fertilisers, or £3 10s. to £1 per ton lower if the latter are subject to a further cut of £2 per ton next season. Sales by the Producers' Association for delivery during the nitrate year which commenced July 1, 1926, amount to only 575,000 tons, compared with 1,415,000 tons sold at this date last year.

The Reported Transmutation of Mercury into Gold

In the News Edition of "Industrial and Engineering Chemistry" (December 10, 1926), Messrs. H. H. Sheldon and R. S. Estey describe an investigation into the process by which Dr. A. Miethe claimed to have transmuted mercury into gold. After several months' work, the authors have been unable to produce a detectable amount of gold, either by using apparatus identical with that used by Miethe or using quartz burners of their own design.

The Conversion of Hydrogen into Helium

In a recent article (*Chem.-Z.*, No. 110, 905) Dr. H. Herbst discusses the claim of Prof. Paneth to have converted hydrogen into helium (cf. *CHEM. & IND.*,

December 3, 1926). Dr. Herbst draws attention to the capacity of palladium for the adsorption of hydrogen and as well as of helium, and suggests that any preparation of palladium will contain a certain quantity of helium derived from the atmosphere. It would therefore be of interest to examine whether the conversion takes place when other catalysts are used, and particularly when use is made of a pure preparation of palladium which has previously been treated with hydrogen (to drive out any helium) and heated in a high vacuum.

Purification of Helium

Completion of a helium gas purification unit mounted on a railroad car at Scott Field, Belleville, Ill., the lighter-than-air instruction centre of the U.S. Army, has been announced by Major-General Mason M. Patrick, chief of the U.S. Army Air-Corps. A great reduction in the cost of purifying helium is expected to result by the use of such a unit. It is estimated that the cost of purification with the new unit will be about \$1.50 per 1,000 cb. ft., as compared with \$12.26 per 1,000 cb. ft. necessary for freight charges alone from Scott Field to Lakehurst, N.J., the only point where impure helium has been treated hitherto.

International Rubber Exhibition

The Seventh International Rubber Exhibition, which will be held in the Grand Palais, Paris, from January 21 to February 6, 1927, will be opened on Friday, January 21, by M. Léon Perrier, Minister for the Colonies. On the day following, a formal visit will be paid by the President of the Republic and by the Lord Mayor of London. The Director-General of the Exhibition, which deals not only with rubber, but with other tropical products and their related industries, is Mr. H. Greville Montgomery.

Tar as a Fuel.

A Diesel engine of the usual type, driving two dynamos, has now been run successfully for over a year, with lignite tar as fuel, by the Berliner Maschinenbau A.-G. The tar (m.pt. 40–50°) was kept liquid by a jacket fed with the cooling water, and paraffin was used to start the engine. The average consumption during the year was 350 g. per kw.-hr., or 260 g. tar and 90 g. paraffin.

German Dye Trade

Exports from Germany of dyes and colours of all kinds from January to August, 1926, amounted to 958,962 metric quintals, compared with 1,253,584 m.q. for the year 1925, 926,849 m.q. for 1924, and 2,176,969 for 1913. These figures show an increase during the first eight months in 1926 of about 15% over the figures for 1925. The exports to Great Britain amounted to 352,080 m.q. in 1913, and 117,254 m.q. in 1925, whilst during the first eight months of 1926, 70,998 m.q. were exported. The United States took 227,530 m.q. in 1913, 32,767 m.q. in 1925, and 20,920 m.q. in the first eight months of 1926. Germany's largest customer is Holland, and China retains the second place, which she occupied before the war. The United Kingdom is now third instead of first, and the United States has been overtaken by British India, Sweden, Russia, and are closely followed by Japan, which took in 1926 (six months) already more than the quantity imported from Germany during the whole of the previous year.

REVIEWS

THE HYDROUS OXIDES. By H. B. WEISER. Pp. x + 452. London: The McGraw-Hill Publishing Co., Ltd., 1926. Price 25s.

The critical re-statement of chemical facts in the light of advancing knowledge is often long delayed, as it is much simpler to copy the conclusions of earlier workers than to verify them. This is particularly true of the study of the hydroxides of the metals, as the fundamental researches of Van Bemmelen have not hitherto received the attention they deserve. It is, moreover, essential that the author of a book of this type should have practical acquaintance with the problems he is discussing, and in this respect Prof. Weiser is amply qualified, though his own work is introduced with commendable unobtrusiveness.

The term "hydrus" is used advisedly to indicate a general and variable attachment of water to the oxides, the word "hydroxide" being reserved for definite chemical compounds. This distinction is the more necessary as it is shown that very many of the hydroxides described in the older literature owe their apparently constant composition to the accidents of a particular method of preparation or of drying. The bulk of this monograph is naturally devoted to a systematic description of the gelatinous hydroxides, related ones being dealt with together and the space devoted to the various substances being varied according to their importance and the information at present available. There are ample references both to old and new work, though the reader is not confused by an attempt to include all the possible nineteenth century papers. An introductory chapter on the general properties of jellies gives an unusually impartial account of the many theories of gel structure. The last hundred pages are devoted to a discussion of practical applications of the hydrus oxides and related compounds, and in this space interesting accounts of the processes of tanning and water purification, and of the chemistry of mordants, cements and the soil are included. The book is, indeed, a useful and readable addition to the literature of inorganic and colloid chemistry.

P. C. L. THORNE

STARCH-MAKING AND THE MANUFACTURE OF DEXTRIN. STARCH SUGAR, SYRUP AND SUGAR COLOURING. By FELIX REHWALD, translated from the fifth revised German edition by CHAS. SALTER. Pp. viii + 264. London: Scott, Greenwood & Son, 1926. Price 12s. 6d.

It is fifteen years since the fourth (German) edition of this work was published, and the present edition is the first to be translated into English.

Processes in the starch and allied industries have not undergone much alteration on the chemical side recently, but numerous improvements in machinery have been made, and these improvements are fully illustrated and described in the present work, which is mainly devoted to the manufacture of starch from potatoes, wheat, maize and rice, and of the more important starch products. The descriptions of the various processes are clear and concise, and the book should be very useful to those engaged in the industries concerned. Too much space,

however, is given to the manufacture of wheat starch by the fermentation method; this method is obsolescent if not obsolete, and part of the space devoted to it might have been given with advantage to a fuller account of more recent processes. Methods of preparation of the less important starches are briefly described.

In the chapter on the properties of starch (Ch. II) the short account of the nature of the starch molecule (or should it be "molecules"?) is marred by several errors, and the enormous amount of work that has been done in the past few years on the constitution of starch remains practically unnoticed.

Mr. Salter has performed the task of translation very well on the whole, the text being very free from errors, although such a slip as "such starch manufacturers as go in for the removal of the germs," on p. 161, is almost inexcusable. Our literature on the starch industry is rather scanty, and the present work should be a welcome addition to it.

LEWIS EYXON

A TEXT-BOOK OF INORGANIC CHEMISTRY. Edited by J. NEWTON FRIEND, D.Sc., Ph.D. Vol. VII, Part III: CHROMIUM AND ITS CONGENERS. By R. H. VALLANCE, M.Sc., and A. A. ELDRIDGE, B.Sc. Pp. xxvi + 380. London: Charles Griffin & Co., Ltd., 1926. Price 18s.

This volume deals with the four elements chromium, molybdenum, tungsten and uranium. Each element is discussed under the headings of occurrence, history, preparation, physical and chemical properties and uses, followed by the preparation and properties of its compounds and the methods for its detection and estimation. Copious references are given to the original works from which the data have been obtained, and in this respect the book maintains the high standard set by the previous volumes in this series. As a painstaking compilation of the compounds at present known to exist, coupled with the excellent references to the original literature, the volume is of value both to the student and to the technical and research chemist.

The book deals only briefly with manufacturing details, but it is to be regretted that so little care has been taken to state these few details correctly. The authors, in making their abstracts from the several sources, have frequently confused one process with another. For example, the description of the preparation of tungsten from the ore commences by stating that scheelite is to be preferred as a source of tungsten, but the description which follows of the preparation of tungstic acid from the ore is, in reality, one for the treatment of wolframite, and not, as the student would assume, for scheelite. The outline of the manufacture of sodium chromate could not be more muddled than it is. The process for the manufacture of this chemical has been well described in books on industrial chemistry and in the technical press, and the authors might at least have consulted one of these sources before completing their notes. The mention of the use of a 50% iron ore containing 3% of chromium as "a source of chromium" is very misleading. It is doubtful if an ore of this composition could be marketed in this country or elsewhere; it certainly is not marketable for its chromium content.

ALBERT R. LUCAS

PLANT PRODUCTS. By S. HOARE COLLINS, M.Sc., and G. REDINGTON, M.Sc. Second edition. Pp. xiii + 262. London: Baillière, Tindall & Cox, 1926. Price 10s. 6d.

This is a second edition of Mr. Collins' "Plant Products and Chemical Fertilisers," published in 1918. A good deal of new matter has been incorporated, particularly in the sections on soils and crops, and the discussion of economic and labour questions in the older edition has been deleted since it had special reference to war-time conditions. The general plan of the book is, however, unchanged. Artificial fertilisers and organic manures are first dealt with: reference is made here to the important changes in the composition and solubility of basic slag due to the general adoption of the open-hearth process of steel manufacture, and some recent work on problems connected with farmyard manure is noted. Three chapters are devoted to soils, soil improvers (lime etc.), and soil reclamation: and this is followed by the section on crops, which includes an account of photosynthesis and chapters on the production of carbohydrates, oils, nitrogenous compounds, and other substances by plants. The final part deals with the use of plant products as food for the production of meat and milk.

The subject matter thus includes almost the whole of agricultural chemistry as it is usually understood. This is a very large field to cover in a volume of 250 pages, and a high degree of condensation is necessarily imposed. It says much for the method of presentation that the authors have produced an interesting and readable book, forming a useful survey of the whole subject, and demonstrating particularly the close interrelation of agriculture and other industries. The inclusion of a greater number of more recent references in the bibliographies at the end of each chapter would have further increased its value. (C. T. G.)

THE SECRET TRADITION IN ALCHEMY: ITS DEVELOPMENT AND RECORDS. By A. E. WAITE. Pp. xxii + 415. London: Kegan Paul, Trench, Trubner & Co., Ltd., 1926. Price: 15s. net

Mr. A. E. Waite, the celebrated authority on occult literature and tradition, has in this book performed a real service to the history of chemistry. Largely owing to the influence of the "Suggestive Inquiry into the Hermetic Mystery," published in 1850 by Mary Anne South, afterwards Mrs. Atwood, a tendency has arisen in certain circles to maintain that practically the whole of alchemical literature does not in fact deal with chemistry and transmutation, but is symbolic in nature. The true subject matter, it has been maintained, is the soul and its progress along the Mystic Way. Mr. Waite's skilful and careful analysis of the evidence has, once and for all, exploded this myth, and chemists may well feel grateful to him for the labour he has spent on the task and the successful conclusion to which he has brought it. Incidentally, the book, which is admirably produced, contains much interesting information on alchemy and the alchemists which the author has gleaned from his life-long study of the literature. Any chemist who cares for the history of his subject will find it a worthy addition to his shelves.

E. J. HOLMYARD

REPORT: MINES

Fifth Annual Report of the Secretary for Mines for the year ended December 31, 1925, and the Annual Report of H.M. Chief Inspector of Mines for the same period, with a Statistical Appendix to both Reports. Mines Department. Pp. 212. H.M. Stationery Office, 1926. Price 6s. net.

This report, which marks the completion of the fifth year of the existence of the Mines Department, contains, in addition to the report of the Chief Inspector of Mines, a review of general subjects arising out of the regulation and inspection of mine and quarry working, and also deals with the conduct and encouragement of research and inquiry, the testing and approval of safety lamps and explosives, and the testing of samples of mine air and dust, and other subjects.

Part I is devoted to a review of the coal mining industry in 1925, of the operation of the National Wages Agreements, and of colliery developments and legislation. The quantity of coal raised in 1925 was lower than in any year since 1905, except in the abnormal war and post-war years 1918-21. Up to the middle of May between 5 and 5½ million tons a week were raised except in holiday seasons; but during August and September the weekly output declined by a million tons a week. Improvement, however, occurred towards the end of the year, accompanied by an increased output per unit of labour. Altogether 243.2 million tons of saleable coal were raised in 1925, or 23.9 million tons less than in 1924, 44.2 million tons less than in 1913, and 26.4 million tons less than the average annual output in 1909-13. The number of wage-earners on colliery books was 1,041,100 in August of the year, rising to 1,084,600 at the end of 1925, compared with 1,140,000 during 1924. A reduction is recorded in the accident rate at coal mines. During 1925 the number of persons killed was 1128, and of persons injured 177,347.

The output of minerals in the United Kingdom is shown in the appended table:—

	1925 Tons	1924 Tons
Coal	243,176,231	267,118,167
Iron ore and ironstone (total)	10,142,878	11,050,589
All other minerals—		
(1) Non-ferrous ores		
Tin ore, dressed (black tin)	4,032	3,547
Lead ore, dressed	15,578	14,294
Zinc ore, dressed	1,603	2,817
Tungsten ore, dressed	1	2
Uranium ore, dressed	114	20
Copper precipitate	148	192
Manganese ore	820	2,457
Chromite	448	1,043
(2) For chemical and allied industries		
Arsenic (white) and arsenic soot	2,545	3,207
Arsenical pyrites	—	296
Iron pyrites	5,288	5,589
Bog ore	4,701	3,200
Ochre, amber, etc.	11,224	10,469
Salt brine	1,810,581	2,027,450
Barytes and witherite:		
Not ground	36,338	40,126
Ground	12,345	13,841
Celestine (sulphate of strontium)	1,072	1,450
Gypsum	414,302	371,289
China clay	850,180	806,864
Micaceous clay	20,834	28,683
Potters' clay	206,828	225,951
China stone	57,379	54,703
Felspar	—	1,058
Felsic	86,127	35,908
Calc spar	12,807	9,808
Alum shale	—	1,709
Oil shale	2,464,829	2,857,108
Petroleum	383	312

	1925 Tons	1924 Tons
(3) Minerals used in iron and steel making and other smelting processes :		
Fluorspar	39,070	49,492
Ganister (including silica rock, silica stone, and silica sand used as refractories) ..	404,293	634,431
Moulding and pig-bed sand	679,659	648,840
Fireclay	2,240,529	2,189,348
(4) Minerals for building and road making and for all other purposes :		
Limestone	13,060,753	12,813,471
Chalk	5,035,350	4,402,600
Sandstone	2,888,741	2,531,017
Slate	305,763	287,705
Clay and shale	13,073,940	10,843,418
Chert, flint, etc.	134,688	148,279
Gravel and sand	3,741,901	2,922,485
Igneous rocks	8,185,856	7,432,806

Coal.—The average declared value of the coal exported declined from 23s. 5d. per ton f.o.b. in 1924 to 19s. 10d. per ton in 1925. The average price of coal at the pit for home consumption in December, 1924, was about 19s. 3d. per ton sold commercially. Subsequently the figure dropped to rather less than 16s. 6d. in the period August to November, 1925. In December of 1925 the corresponding figure was about 17s. per ton. The total quantity of coal exported in 1925 was 50.8 million tons, compared with 61.7 million tons in 1924, and 65.5 million tons the average annual export in 1909—13. Home consumption of coal amounted to 169.6 million tons in 1925, which was about 10 million tons less than in 1924 and 1920, but slightly greater than in 1923 and substantially more than in 1922.

Iron.—The output of pig iron for the year amounted to 6,236,200 tons with an average of 149 furnaces in blast, as compared with 7,307,400 tons in 1924 with 185 furnaces, and 10,260,300 tons with 338 furnaces in 1913. The steel output for 1925 was 7,397,300 tons, as against 8,201,200 in 1924, and 7,663,900 in 1913. Imports of iron and steel into this country in 1925 amounted to 2,721,003 tons as against 2,429,385 tons in 1924, and exports were 3,731,023 tons, compared with 3,851,435 tons in 1924. The number of persons employed in the mining and quarrying of iron ore and ironstone during the year 1925 averaged 12,819, compared with 15,167 in 1924, 23,369 in 1920, and 22,900 in 1913.

Tin. The production of dressed tin ore ("black tin") in Great Britain increased during the last half of the year under review, the figures for the four quarters being 990, 966, 1038, and 1038 tons respectively, making a total of 4032 tons as compared with 3547 tons in 1924, 4858 tons in 1920, and 8355 tons in 1913. The number of persons employed in the tin mining industry (including arsenic) at the end of each quarter of the year were 2626, 2655, 2720, and 2868 respectively.

Lead.—The output of dressed lead ore (80% metal) in Great Britain for 1925 totalled 15,578 tons. This is an increase of 9% on the previous year's production, but it is less than 65% of that of 1913.

Zinc.—There was a good demand for this metal in the United States and France, and the production of dressed zinc ore (46% metal) for the year 1925 was 1603 tons, a decrease of 31% on that for 1924. It is only 9% of the production for 1913. Production is practically limited to four mines, Nentsbury and Threlkeld in Cumberland, Great Laxey in the Isle of Man, and Mill Close in Derbyshire. The average number of persons employed in the lead and zinc mining industry during the year was 1540.

Minerals used in the chemical and allied industries.—The aggregate value of the minerals of this group obtained in 1925 was £4,175,000, and was £544,000 less than in 1924. The reduction in value occurred chiefly in oil shale, salt, arsenic, and barytes. The output of oil shale in 1925 was 2,464,829 tons, estimated to yield 49½ million tons of crude oil and 44,000 tons of sulphate of ammonium. This is 392,274 tons or 14% less than the output of oil shale in 1924. The number of persons employed during the year in the oil shale mining industry was 4395, as compared with 4390 in 1924. In addition, 2567 men were employed in 1925 in the works where the products are extracted from the shale.

Minerals used in iron and steel making and other smelting processes.—The outputs of limestone and dolomite for fluxing purposes and of ganister and silica rock in 1925 reflect the depressed condition of the iron and steel industry, and were 15% and 22% less, respectively, than in 1924.

Minerals used in building and road making and for all other purposes.—The total amount of limestone for all purposes in 1925 reached 13 million tons. Its chief uses were for lime and cement making, road making, and as a flux in blast furnaces, these three uses absorbing 85% of the total production.

Part III of the report deals with proceedings under Part I of the Mines (Working Facilities and Support) Act, 1923, Part IV with the washing and drying accommodation at mines, Part V with the health and safety in the mining and quarrying industries, and Part VI with the Annual Report of H.M. Chief Inspector of Mines. The whole report contains numerous tables and charts.

COMPANY NEWS

LOW TEMPERATURE CARBONISATION, LTD.

The ninth annual ordinary general meeting, held on January 2, was presided over by Sir Arthur Wheeler, Bart., chairman, who stated that the reorganised finances of the company (cf. CHEM. AND IND., Dec. 17, 1926, p. 962) had provided a new working capital of about £135,000, which, subject to certain claims, would be utilised for reconstructing the Barnsley works and for working capital. Until these works were in successful operation the Board had decided to take no remuneration. The new plant has been carefully designed and standardised by the company's consulting engineers and Mr. Charles Parker, the Parker process having been successfully proved for technical efficiency under the tests of the Fuel Research Board. The total cost of the new works, including erection, is estimated at £75,000, the plant including five batteries, one in reserve and four in work, totalling 160 retorts, with a combined carbonising capacity of 250 tons of coal per day, thus ensuring the continuous treatment of 200 tons daily. The contractors had undertaken to deliver the whole of the plant in good working order by the end of May next, and to deliver one battery of 32 retorts by the middle of March. It was expected that the company would be turning out between 400 and 500 tons of Coalite per week, with the other by-products, by the end of May. When the whole plant has been completed, apart from the continuous production of 1000 tons per week of a perfect

domestic fuel, the process will be able to show large profits from its production of fuel oil, motor spirit, sulphate of ammonia and rich gas, which latter it was anticipated would have an enormous influence upon the cost of the generation of electric power. Mr. W. H. Belreus, Mr. H. Langham-Reed, Mr. Francis R. Wade, and Mr. R. P. Wilson were re-elected directors.

BRITISH PLATINUM AND GOLD CORPORATION, LTD.

The ordinary general meeting was held on December 31, and was presided over by Mr. T. J. Ive (chairman and managing director). The accounts for the year to June 30 last showed a loss of £12,712, as against a loss of £31,000 for the previous year. Owing to the high floods of the Ologodo River in December, 1924, which burst the dam, operations were suspended for more than half a year, but from August, 1925, to June, 1926, No. 1 dredger recovered 2902 oz. platinum and 881 oz. gold, as against 1909 oz. and 634 oz. respectively, valued at £65,261, against £45,163. No. 2 dredger, operating on the Casajero property, recovered during 11 months 445 oz. platinum and 85 oz. gold, compared with 343 oz. and 105 oz. respectively, valued at £9785 against £8112. The No. 2 dredger has been out of commission for four months, and may be so for another three, entailing a loss of at least £20,000 to £30,000 of revenue. With both the dredgers in full swing, a return of 500 oz. of platinum per month might be expected, yielding an income of about £110,000 per annum. Owing to the abnormal drain on cash resources, the Board, with the approval of the shareholders, has created a 6% participating convertible debenture stock amounting to £50,000, of which £20,000 will be utilised to satisfy and pay off certain outstanding liabilities, the remaining £30,000 being offered by way of rights to the shareholders whose names appear on the register on December 16, 1926, in the proportion of £1 of debenture stock for every 20 or multiple of 20 shares held. The Hon. Lionel Guest, Major F. W. D. Gwynne, and Mr. Chantry Luchbald have consented to act as an advisory committee to the Board, and to examine the position and ascertain what improvements and economies might be advisable.

SULPHIDE CORPORATION, LTD.

The thirtieth annual ordinary general meeting was held on December 22, the Right Hon. the Earl of Kintore, K.T., G.C.M.G. (chairman), presiding. The profit of £192,034 for the year was more than three times last year's figure, and dividends were declared of 10% on the preference shares and 10% on the ordinary shares, a substantial sum being placed to reserves. It was expected that by June 30 next the company would be practically freed from the enormous yearly outlay involved by the fire in 1923. In addition to the Central ore, there was now a second source of supply from the Junction mine, estimated to contain 500,000 tons of ore, purchased in 1923 for £75,000. In addition to the 80,000 tons of crude ore raised during the past year from these two mines, 29,238 tons of slimes from the dump at Central mine and 5840 tons from the Broken Hill Proprietary Company's mill were treated. The percentage of metal recoveries in the milling operations and the grade of the lead and zinc concentrates produced were higher than in the previous year, the recoveries increasing

from 88.7% to 90.9% of the silver, 86.2% to 89.6% of the lead, and 91.2% to 92.7% of the zinc. The cost of production of the lead concentrates fell from £14 18s. 3d. a ton to £12 12s., and of zinc concentrates from 36s. 3d. a ton to 30s. 10d. It was anticipated that the price of silver during the coming year would show a substantial decline, the conditions in China being the chief cause of the fall in this metal. The acid plants at Cockle Creek produced 18,333 tons of Mono acid, compared with 15,822 tons in the previous year, of which 10,598 tons were utilised for the manufacture of superphosphate, and 7435 tons were sold. The hydrochloric acid plant produced 258 tons of acid, compared with 77 tons, and the production of superphosphate increased from 29,074 tons in the previous year to 34,833 tons, and it was anticipated that before long production and sales would reach the 40,000-ton capacity of the plant. An important feature of the work at Cockle Creek during the year was the commencement of the production on a large scale from the first unit of the new cement plant, the output amounting to 24,328 tons. The quality of the cement was good; it is quick setting, easily passes all Government tests, and has been favourably received by the trade, and from its rapid hardening will be of great service for road making and road repair. The second unit, which will also have a capacity of 30,000 tons, is expected to begin operations in March next. The coal strike stopped the production of spelter at the English works at Seaton Carew, which would otherwise have slightly exceeded the previous year's figure of 4955 tons.

BENN BROS., LTD.

An interim dividend has been declared of 6½%, less tax, payable on January 1, being the same as last year's interim.

INVERESK PAPER CO., LTD.

The fourth annual general meeting was held on December 23, Mr. William Harrison, LL.B. (chairman), presiding. After referring to the increase of capital from £350,000 to £1,200,000 made in October last (cf. CHEM. AND IND., November 12, 1926, p. 843), the chairman drew attention to the rumours in the Press reports of the sale of the company's German interests, and warned the shareholders against giving credence to unofficial statements. These German works were purchased at a very low figure compared with the real value, primarily with a view to safeguarding an assured supply of first-class sulphite pulp, and since then the company has received many offers to purchase at a large profit. But the company will not entertain any offer to sell their ordinary shares in the International Pulp Co., Ltd., unless the prospective purchasers make a binding offer to purchase the participating preference shares in the company as well. Another condition is that the Inveresk and its associated paper-making companies shall be assured of the supply of all the pulp they need from the Koenigsberg mills at English market prices ruling, for a period of at least ten years. Negotiations were in progress, and when there is anything to communicate an official announcement will be made to the shareholders. A final dividend was declared of 17½%, less income tax, on the ordinary shares, making 25% for the year, compared with 15% for the previous year.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d. - 6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime £7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s. £20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
 Copper Sulphate. £25—£25 10s. per ton.
 Methylated Spirit. 61 O.P.—Industrial, 2s. 5d. - 2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate. £38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate 3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45 - £50 per ton. Chloride of ammonia £37 - £45 per ton, carr. paid.
 Salt Cake. £3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots, £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included.
 Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
 Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—2s. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 2d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime, Brown, £9 per ton. Scarce. Grey, £17 5s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal. £8 5s.—£10 per ton and upwards, according to grade and locality. Very scarce and fair demand.
 Iron Liquor.—1s. 6d. per gal. 32° Tw.; 1s. 2d. per gal. 24° Tw.
 Red Liquor.—10d. - 11d. 16° Tw. per gal.
 Wood Creosote.—2s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 10d. - 4s. per gal., 60° O.P. Solvent, 4s. per gal., 40% O.P. Both scarce and in fair demand.
 Wood Tar.—£4—£5 per ton and upwards, according to grade.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, about 7d. per lb. Crude 60's, 1s. 8d.—1s. 10½d. per gal.
 Acid Cresylic, 99/100.—2s. 3d. per gal. Steady. 97/99.—2s. 2s. 6d. per gal. Pale, 95%, 1s. 10d. - 2s. 6d. per gal. Dark, 1s. 9d. 2s. 3d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40% - 3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 4d.—1s. 5d. per gal., ex works in tank wagons; Standard motor, 2s.—2s. 3d. per gal., ex works in tank wagons; Pure, 2s. 3d. - 2s. 6d. per gal., ex works in tank wagons. Steady.
 Toluole.—90%, 2s. to 2s. 3d. per gal. Firm. Pure, 2s. 3d.—2s. 6d. per gal.
 Xylol.—2s. 3d.—2s. 6d. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal.
 Naphtha.—Crude, 10d.—1s. 1d. per gal., according to quality. Solvent 90/160, 2s.—2s. 2d. per gal. Solvent 95/169, about 2s. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £9 per ton.
 Naphthalene.—Crystals, £11 10s.—£12 per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—112s. 6d.—140s. per ton, f.o.b. according to district. Scarce. Prices nominal.
 Pyridine.—90/140.—12s.—17s. per gal. Nominal. 90/180.—8s. 6d.—9s. per gal. Heavy.—7s.—10s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—2s. 2d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—9½d. per lb., naked at works.
 Aniline Salts.—9½d. per lb., naked at works.
 Anthranilic Acid.—6s. 6d. per lb. 100%
 Benzaldehyde.—2s. 1d. per lb.
 Benzdine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
o-Cresol 29/31° C.—4d.—4½d. per lb. Quiet.
m-Cresol 98/100%.—2s. 3d. per lb. Fair enquiry.
p-Cresol 32/34° C.—2s. 3d. per lb. Fair enquiry.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dimtrobenzene.—9d. per lb., naked at works.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10½d. per lb. d/d.
α-Naphthol.—2s. per lb. d/d.
β-Naphthol.—11d.—1s. per lb. d/d.
α-Naphthylamine.—1s. 3d. per lb. d/d.
β-Naphthylamine.—3s. per lb. d/d.
p-Nitraniline.—1s. 9d. per lb. d/d.
m-Nitraniline.—3s. per lb. d/d.
o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—9d. per lb. d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
o-Toluidine.—9d. per lb., naked at works.
p-Toluidine.—2s. 2d. per lb. ex works, naked.
m-Xyline Acetate.—2s. 11d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Firm.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity.
 Acid, Boric B.P.—Cryst. £40 per ton. Powder £44 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 3½d.—1s. 4½d. per lb. Less 5% Weak market.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 5½d. per lb. Firm and good enquiry. Technical 1s.—1s. 0½d. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 0½d. per lb. Less 5%
 Amidol.—9s. 6d. per lb. d/d.
 Acetanilide.—1s. 7d.—1s. 8d. per lb. for quantity.
 Amidopyrim.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Aspirin.—2s. 4d.—2s. 5d. per lb. Good demand.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzophenanthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carry paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 2d.—2s. 3d. per lb. Potassium.—1s. 9d.—1s. 10d. per lb. Sodium.—2s.—2s. 1d. per lb. All spot.
 Calcium Lactate.—1s. 4d.—1s. 6d. per lb.
 Chloral Hydrate.—3s. 3d.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—6s. 6d.—7s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 8d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perochloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £33 per ton net. Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%; Heavy Pure 2s.—2s. 3d. per lb., according to quantity.
 Menthob.—A.B.R. recryst. B.P., 18s. 9d. per lb. net. Synthetic, 11s.—12s. per lb., according to quantity. Liquid (95%), 12s. per lb. Detached cryst., 15s. per lb.
 Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb.; Levig., 6s.—6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 10d.—4s. 11d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 4s. 11d.—5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. mg., 4s. 10d.—4s. 11d. per lb.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonal.—15s. 6d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. 9d.—4s. per lb.
 Phenazone.—5s. 9d.—6s. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 82s. per cwt., less 2½% for ton lots. Dearer.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6½d. per lb. spot.
 Quinine Sulphate.—2s. per oz.—1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s.—4s. 3d. per lb. spot.
 Saccharin.—55s. per lb. Quiet.
 Salol.—3s.—3s. 3d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—80s.—85s. per cwt. net, according to quantity.
 Sod. Salicylate.—Powder, 1s. 10d.—1s. 11d. per lb.; Crystal, 1s. 11d.—2s. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton, according to quantity, 1-cwt. kegs included.
 Sulphonol.—10s. 6d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
 Thymol, Purif.—11s. 6d.—12s. per lb., according to quantity. Natural.—17s. 6d. per lb

PERFUMERY CHEMICALS

Acetophenone.—8s. 3d. per lb.
 Aubepine (*ex Anethole*).—12s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21.22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. 3d. per lb. Benzyl Alcohol free from Chlorine.—2s. 3d. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 4d. per lb.
 Cinnamic Aldehyde.—Natural, 18s. per lb.
 Coumarin.—11s. per lb.
 Citronellol.—15s. per lb.
 Citral.—9s. 6d. per lb.
 Ethyl Cinnamate.—10s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—9s. 9d. per lb. Geraniol (Palmarosa).—19s. per lb. Geraniol.—6s.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Shui Oil*) 12s. per lb.—(*ex Bois de Rose*) 17s. per lb. Linalyl Acetate.—(*ex Shui Oil*) 15s. per lb.—(*ex Bois de Rose*) 18s. 6d. per lb.
 Methyl Anthranilate.—9s. 3d. per lb.
 Methyl Benzoate.—4s. 6d. per lb.
 Musk Ketone.—36s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—11s. per lb.
 Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—18s. 6d.—19s. 6d. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—31s. 6d. per lb. Bourbon Geranium.—12s. per lb.
 Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—5½d. per oz. Citronella.—Java 85/90%.—2s. 4d. per lb., Ceylon, Pure, 1s. 11d. per lb. Clove, pure.—6s. 6d. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—French 38/40%.—21s. per lb. Lemon.—9s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—9s. 9d. per lb. Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—10s. per lb. Peppermint.—Wayne County, 25s. 6d. per lb. Japanese, 9s. 6d. per lb. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Feb. 28th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Jan. 13th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Altpeter. Centrifuges. 32,648—9. Dec. 24.
 Brassert & Co., Ltd. (Brassert). 32,724. See II.
 Carrier Engineering Co., and Groom. Conditioning gases. 32,719. Dec. 24.

Duchemin. 32,283. See II.
 Excelsior Feuerlöschgeräte A.-G., and Treichel. Production of foam. 32,536. Dec. 23. (Ger., 24.12.25.)
 Gibbs. Apparatus for concentrating and evaporating liquids. 32,482. Dec. 23.
 Gibson. Filtering-machine for acid liquors etc. 32,537. Dec. 23.
 Hardinge Co., Inc. Apparatus for classifying pulverised materials. 32,573. Dec. 23. (U.S., 28.8.25.)
 Hofmann. Mixing etc. machines. 32,229. Dec. 20. (Switz., 30.12.25.)
 I.-G. Farbenind. Production of active silica. 32,191—2. Dec. 20. (Ger., 19.12.25.)
 Kreutzberg. Pulverisers. 32,346. Dec. 21. (U.S., 5.11.26.)
 Parc Engineering Co., Ltd., and Player. Means for mixing gases and liquids. 32,522. Dec. 23.
 Plumbridge, and Salt Union, Ltd. Apparatus for concentrating and evaporating liquids. 32,482. Dec. 23.
 Reavell. Furnaces. 32,435. Dec. 22.

II.—Complete Specifications

20,178 (1925). Lever Bros., Ltd., and Cloudsley. Filtering apparatus. (262,840.)
 22,667 (1925). Saureschutz Ges. Coating vessels etc. to render them chemically stable. (250,525.)
 27,851 (1925). Johnson (Badische Anilin & Soda Fabrik). Feeding solids into or removing solids from vessels under pressure. (262,901.)
 28,056 (1925). Grimbale, Caird, and Coombs. Centrifugal separators for liquids. (262,902.)
 32,361 (1925). Baker Perkins, Ltd., and Dewhurst. Hydro-extractors. (262,954.)
 12,740 (1926). Mortensen. Centrifugal separators or clarifiers. (263,021.)
 17,860 (1926). Carrier, and Carrier Engineering Corp. Refrigerating methods. (263,052.)
 *31,421 (1926). Morterud. Evaporation of liquids. (263,132.)
 *31,903 (1926). Siemens-Schuckertwerke. Crucibles. (263,171.)
 *32,191 and 32,192 (1926). I.-G. Farbenind. Production of wide-porous active silica. (263,198—9.)

II.—Applications

Akt. Ljungströms Angturbin. Producing an air mixture for combustion in furnaces. 32,212. Dec. 20. (Sweden, 22.12.25.)
 Brassert & Co., Ltd. (Brassert). Apparatus for washing gas. 32,724. Dec. 24.
 Broadhead, and Dempster & Sons. Manufacture of gas. 32,151—4. Dec. 20.
 Donald. Carbonisation of coal etc. 32,606. Dec. 24.
 Duchemin. Gas-scrubber. 32,223. Dec. 20. (Fr., 31.12.25.)
 Evans (Kohlenveredlung A.-G.). Distillation of carbonaceous etc. substances. 32,434. Dec. 22.
 Halden. Carbonisation of coal etc. 32,189. Dec. 20. (Fr., 21.12.25.)
 Humphreys & Glasgow, Ltd. Apparatus for carburetting water gas. 32,715. Dec. 24. (U.S., 1.3.26.) Apparatus for making gas. 32,716. Dec. 24. (U.S., 1.3.26.)
 Laing and Nielsen. Manufacture of gas. 32,248. Dec. 20. Soc. Ammonia. Purifying gas. 32,714. Dec. 24. (Fr., 4.1.26.)
 Steinschneider. Distillation of oils etc. 32,598. Dec. 23. (Czecho-Slovakia, 15.1.26.)
 Stettiner Chamotte-Fabrik. Coking etc. ovens. 32,325. Dec. 21. (Ger., 24.12.25.)

II.—Complete Specifications

15,997 (1925). Chavanne. Gasification of solid fuel and volatilising or reducing ores. (237,883.)

16,014 (1925). Nielsen and Laing. Manufacture of gas. (262,834.)

*25,920 (1925). Flow Coal Washery Co., Ltd., Russell, and Austin. Coal-washing and like apparatus. (262,890.)

*32,751 (1925). Forrest and Hayden. Destructive distillation of bituminous materials etc. (262,959.)

*13,343 (1926). Florentin, Kling, and Matignon. See XX.

*31,826 (1926). De Bataafsche Petroleum Maatschappij. Manufacture of refined lubricating and like oils. (263,167.)

*32,019 (1926). Siemens & Halske A.-G. Manufacturing mineral oils and tar products. (263,186.)

*32,189 (1926). Halden. Low-temperature carbonisation. (263,197.)

III. Complete Specification

*32,019 (1926). Siemens & Halske A.-G. See II.

IV. Applications

I.-G. Farbenind. Production of benzanthrone dyestuffs. 32,194. Dec. 20. (Ger., 18.12.25.) Anthraquinone dyestuffs. 32,225. Dec. 20. (Ger., 23.12.25.)

Production of anthraquinone dyestuffs. 32,301. Dec. 21. (Ger., 22.12.25.) Manufacture of dyestuffs. 32,555. Dec. 23. (Ger., 23.12.25.)

Newport Co. Tetrakisazo dyes. 32,187. Dec. 20. (U.S., 6.2.26.)

Scottish Dyes, Ltd., Morgan, Thomas, and Thomson. Dyestuffs. Dec. 20.

Soc. Chem. Industry in Basle. Manufacture of dyestuffs. 32,693. Dec. 24. (Switz., 24.12.25.)

IV.—Complete Specifications

26,801 (1925). I.-G. Farbenind. Manufacture of vat dyestuffs of the isodibenzanthrone series. (242,620.)

28,946 (1925). Kalle and Co. Producing nitriles of the benzanthrone series. (243,026.)

32,700 (1925). Brit. Synthetics, Ltd., and Higgins. Manufacture of intermediates for the preparation of azo-dyestuffs. (262,958.)

12,259 (1926). Brit. Dyestuffs Corporation, Ltd., Rodd, and Everatt. See XX.

*31,813 (1926). I.-G. Farbenind. Manufacture of azo-dyestuffs. (263,164.)

*31,907 (1926). I.-G. Farbenind. Manufacture of thiomorpholines of the anthraquinone series. (263,179.)

*32,107 (1926). Chem. Works (Sandoz). Production of substantive dyestuffs of the stilbene series fast to alkali. (263,192.)

*32,194 (1926). I.-G. Farbenind. Manufacture of vat dyestuffs of the benzanthrone series. (263,200.)

*31,978 (1926). I.-G. Farbenind. Manufacture of condensation products of the anthraquinone series. (263,178.)

V.—Applications

Brit. Celanese, Ltd. Phosphoric acid solutions of cellulose. 32,530. Dec. 23. (U.S., 30.12.25.)

Brit. Celanese, Ltd., and Kinsella. Manufacture of artificial silk etc. 32,531. Dec. 23.

Brit. Dyestuffs Corp., Ltd., and Hailwood. Manufacture of derivatives from ligninsulphonic acid. 32,322. Dec. 21.

Butterworth and Conlong. Spinning artificial silk etc. 32,142. Dec. 20.

Courtaulds, Ltd., Hazeley, and Hegan. Production of threads etc. from viscose. 32,193. Dec. 20.

Hands, and Spievers, Ltd. Manufacture of sheets of compositions containing cellulose esters etc. 32,582. Dec. 23.

V.—Complete Specifications

17,548 (1926). Heberlein & Co. Chemically varying vegetable fibres. (255,453.)

*2442 (1926). I.-G. Farbenind. Production of celluloid-like masses. (263,076.)

*27,718 (1926). Meyer-Sansboeuf Ges. Improving vegetable textiles. (263,102.)

*31,154 (1926). I.-G. Farbenind. Manufacture of cellulose esters. (263,128.)

VI.—Applications

I.-G. Farbenind. Treatment of animal fibres. 32,421. Dec. 20. (Ger., 7.1.26.)

Silver Springs Bleaching & Dyeing Co. Ltd., and Hall. Dyeing etc. textile materials consisting of cellulose acetate silk. 32,374. Dec. 22.

VI.—Complete Specifications

22,771 (1925). Sazanoff. Printing with basic dyestuffs. (262,849.)

26,800 (1925). I.-G. Farbenind. See XIII.

4001 (1926). Bloxam (I.-G. Farbenind). Producing fast printings. (262,987.)

*18,215 (1926). I.-G. Farbenind. Dyeing of fast mixed shades on silk. (263,088.)

*31,844 (1926). Karrer. Treatment of cotton fibres, preparatory to dyeing. (263,169.)

VII.—Applications

Gibson. 32,537. See I.

I.-G. Farbenind. 32,191. See I.

Vohl and Co. A.-G. Purification of solutions of metal salts. 32,518. Dec. 23. (Ger., 24.12.25.)

VII.—Complete Specifications

23,647 (1925). Boderer. See XVI.

30,105 (1925). Tennant (N. V. Gloeilampfabriek). Manufacture of fluorine. (262,918.)

14,805 (1926). Harris (Heberlein). Manufacture of stannic acid or oxides of tin. (263,034.)

*32,191 (1926). I.-G. Farbenind. See I.

VIII. Complete Specifications

1766 (1926). Deutsche Gasglühlicht-Auer-Ges. Manufacture of refractory articles of pure oxide of zirconium. (246,481.)

*32,126 (1926). Scheidhauer & Gessing. Process of manufacturing refractory acid-proof, and other ceramically-bonded products. (263,194.)

*32,127 (1926). Fibremo Soc. Co-operative. Enamelling objects of fibrous-cement with vitreous enamels. (263,195.)

IX.—Applications

Roberts. Building material. 32,590. Dec. 23.

Schantz. Preserving wood etc. 32,251. Dec. 20. (Ger., 16.1.26.)

IX.—Complete Specifications

14,991 (1925). Landman. Producing cellular or porous concrete. (243,308.)

*30,882 (1926). I.-G. Farbenind. Production of cements. (263,124.)

*31,823 (1926). Andreas. Burning cement, lime, hydraulic lime, etc. (263,166.)

*31,919 (1926). Malenkovic. Preservation of wood. (263,173.)

*32,127 (1926). Fibremo Soc. Co-operative. See VIII.

X.—Applications

County Chemical Co., Ltd., Hambrecks, and Hill. Soldering-flux. 32,140. Dec. 20.

Dreaper. Alloys. 32,671. Dec. 24.

Kohlswa Jernverks Akt. Manufacture of steel. 32,535. Dec. 23. (Sweden, 23.12.25.)

Siemens A.-G., Durrer, and Sprenger. Manufacture of steel. 32,680. Dec. 24.

X.—Complete Specifications

15,997 (1925). Chavanne. See II.

31,553 (1925). Johnson (I.-G. Farbenind.). Manufacture of pure iron. (262,938.)

12,104 (1926). Metallbank und Metallurgische Ges. Electrothermic production of aluminium silicon alloys. (252,160.)

- 17,454 (1926). Internat. Copperclad Co. Apparatus for electrodeposition. (255,113.)
 24,695 (1926). Canzler. Alloy for welding copper. (260,565.)

XI.—Applications

- Alber. Electrodes for secondary cells. 32,617. Dec. 24.
 Brit. Thomson-Houston Co., Ltd. Electric furnaces. 32,181. Dec. 20. (U.S., 24,12,25.)
 Campbell, Taylor, and Electric Furnace Co. Electric furnaces. 32,224. Dec. 20.
 Rogers (Ela Elektrische Grubenlampen- und Accumulatoren Ges.)• Electric accumulator. 32,197. Dec. 20.

XI.—Complete Specifications

- 23,084 (1925). North. Electric furnaces. (262,859.)
 12,104 (1926). Metallbank und Metallurgische Ges. See X.
 12,824 (1926). Stone. Electric storage batteries. (263,024.)
 17,454 (1926). Internat. Copperclad Co. See X.

XII.—Application

- Lewis. Apparatus for extracting oils, fats, etc. from animal etc. matter. 32,429. Dec. 22.

XII.—Complete Specification

- 30,073 (1926). Böhme A.-G. Sulphurising of fatty acids and their esters. (263,117.)

XIII.—Application

- Jeremias. Production of waterproof impregnating etc. coatings. 32,232. Dec. 20.

XIII.—Complete Specifications

- 26,800 (1926). I.-G. Farbenind. Colouring of plastic materials. (242,274.)
 22,817 (1925). Meister, Lucius, und Bruning. See XX.
 *30,543 and 30,549 (1926). New Jersey Zinc Co. Manufacture of lithopone. (263,119 and 263,120.)
 *31,948 (1926). I.-G. Farbenind. Manufacture of oil lacquers and varnishes. (263,175.)
 *32,006 (1926). Siemens und Halske A.-G. Producing protective and resistant coatings. (263,183.)
 *32,007 (1926). I.-G. Farbenind. Manufacture of oil lacquers and varnishes. (263,184.)

XIV.—Application

- Dunlop Rubber Co., Ltd., Thomas, and Twiss. Manufacture of rubber etc. 32,150. Dec. 20.

XIV.—Complete Specification

- 32,957 (1925). Illeman Waterproof composition. (262,961.)

XV.—Complete Specification

- 7882 (1926). Magnus. Manufacture of artificial leather. (263,004.)

XVI.—Application

- Carpmael (I.-G. Farbenind.). 32,209. See XXIII.

XVI.—Complete Specifications

- 14,986 (1925). Adelantado. Manufacture of phosphate fertilizer. (262,833.)
 23,647 (1925). Bodero. Manufacturing superphosphate. (262,878.)

XVII.—Complete Specification

- 16,475 (1926). Corn Products Refining Co. Producing dextrose from starch-bearing materials. (254,729.)

XIX.—Application

- Baker Perkins, Ltd. Producing refined cocoa. 32,437. Dec. 22.

XIX.—Complete Specification

- 11,011 (1926). Bu. Preparation of a cattle food-stuff. (263,014.)

XX.—Applications

- Franklin, and Synthetic Ammonia and Nitrates, Ltd. Production of methanol etc. 32,483. Dec. 23.
 Grouchkine. Diiodotrimethylamine product. 32,725. Dec. 24.
 Timmis, and Wellcome Foundation, Ltd. Manufacture of therapeutic compound. 32,497. Dec. 23.

XX.—Complete Specifications

- 22,817 (1925). Meister, Lucius, und Bruning. Improving decaamphorated oil of turpentine. (239,878.)
 22,892 (1925). Rupe. Manufacture of hydro-cyclic- ω -amino methyl compounds. (240,814.)
 30,792 (1925). Riedel. Manufacture of barbituric acid derivatives. (244,122.)
 12,259 (1926). British Dyestuffs Corporation, Ltd., Rodd, and Everatt. Manufacture of dinikrotoluene. (263,018.)
 *13,343 (1926). Florentin, Kling, and Matignon. *Obtaining light hydrocarbons from oxygenated organic compounds. (263,082.)
 *31,612 (1926). Binz and Rath. Production of 2-oxy-3-bromo-5-pyridinecarboxylic acid. (263,142.)
 *31,732 (1926). Naef et Cie. Preparation of monocyclic ketones having more than nine ring members, and of their alkyl derivatives. (263,153.)
 *31,812 (1926). I.-G. Farbenind. Manufacture of polycyclic compounds containing oxygen. (263,163.)
 *31,751 (1926). Schröder. Manufacture of protective and curative agents from glandular organs. (263,155.)
 *32,106 (1926). Chemical Works (Sandoz). Production of 2-amido-4-nitrophenoxymethanol or propandiol. (263,191.)

XXI.—Complete Specification

- 29,191 (1926). Soc. du Film en Couleurs Keller-Dorian, and Richard. Colour photography. (263,115.)

XXIII.—Applications

- Carpmael (I.-G. Farbenind.). Fungicides. 32,209. Dec. 20.
 Jackson. Apparatus for treatment of sewage. 32,184. Dec. 20.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department, and stating the specific reference number:—
Brazil: Earthenware, glassware (734); *Colombia*: Cement, iron bars, asbestos roofing, paint, varnish, lubricating oil, linseed oil (735); *Danzig*: Pharmaceutical chemicals (726); *South Africa*: Pig iron, ferro silicon (A.X. 4037); *United States*: Glycerin (B.X. 3116).

Safeguarding of Industries Act, 1921

The Board of Trade has published additional lists of articles chargeable with duty under Part I of the Safeguarding Act (H.M. Stationery Office, 11 pp., price 2d.). The lists relate to optical instruments and glass, scientific glassware, laboratory porcelain, scientific instruments, synthetic organic chemicals (other than synthetic organic dyes and intermediates), analytical reagents, all other fine chemicals (except sulphate of quinine of vegetable origin), and chemicals manufactured by fermentation process. Some hundreds of compounds are covered by the list of synthetic organic and fine chemicals.

British Visada Artificial Silk Co., Ltd.

It is expected that this company will start production on a commercial basis at the Python Mill, Littleborough, in a few days. Good arrangements have been made for coal supplies, and the mill will produce about 27,500 lb. of artificial silk weekly. Mr. S. S. Napper, who for eighteen years was chief of works and research chemist with Courtaulds, Ltd., has been made a director, and will act as consulting chemist. The company is in a strong position, and after carrying out its full programme is left with a working capital of £100,000.

Second Anglo-Scottish Beet Factory

The second Anglo-Scottish Beet Sugar Corporation factory at Preston Hall, Cupar, Fife, was opened on December 11. The factory, which cost over £400,000, had been built in less than a year, and is producing excellent sugar.

New Viscose Factory in Bristol

The factory of the Western Viscose Silk Mills Company, capable of a weekly output of 12 tons, was opened on December 7 by the Lord Mayor of Bristol. The company was formed in 1925, with an authorised capital of £400,000, to manufacture superior quality fine Denier artificial silk yarn by means of the viscose process.

Electricity Supply

The sixth annual report of the Electricity Commissioners for the year ended March 31, 1926 (H.M. Stationery Office, 3s. net), states that at the end of the period there were 596 authorised undertakings (including 238 in the hands of companies and persons) in Great Britain. Altogether 584 stations generated 8,122,961,823 units, an increase of 9.5%, and the fuel consumed included 8,263,880 tons of coal, 142,876 tons of coke breeze and 38,810 tons of fuel oil. The consumption of coal and coke thus increased by about 5.2% compared with the previous year, whilst the consumption of fuel oil decreased by 15,600 tons a reduction of over 28%.

For Photographers

Amongst the many special diaries now issued, that published by Wellington & Ward, Ltd., has long gained the favour of the photographer. The 1927 edition contains, in addition to the usual diary, exposure tables, standard development formulæ, tables and other information for development, and notes on the use of light filters with the Spectrum panchromatic plate. Since the last edition was published, the firm has added Wellington portrait films, X-ray films and a new development paper to the list of Wellington products. The information given is just of the kind required, and photographers will find the diary particularly useful.

A Diary for Dyers

Scottish Dyes, Ltd., have produced a neat diary which should appeal to users of dyes, as the usual matter common to pocket diaries is enriched by the inclusion of information about the Caledon, Solway, Celatene and Soledon colours made at Grangemouth by this firm. There are tables of fastness, tables for identifying various dyes, instructions for dyeing and printing various materials, and other information useful to the dyer, whilst a separate notebook is included within the covers.

PUBLICATIONS RECEIVED

LUBRICATION IN COLLIERY PRACTICE. By N. Simpkin, M.Sc. (Tech.). A.I.C. Assoc. M.J.Min.E., and A. Dave, B.Sc. (Tech.). A.I.C. Pp. xiv + 167. London: The Colliery Guardian Co., Ltd., 1926. Price 10s.

CATALOGUE OF OPTICAL AND GENERAL SCIENTIFIC INSTRUMENTS. The Optical Convention, 1926. Pp. x + 326. London: The Secretary, The Optical Convention, 1926. Price 6s. net.

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JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY

CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

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which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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EDITORIAL

Fuel Research Board

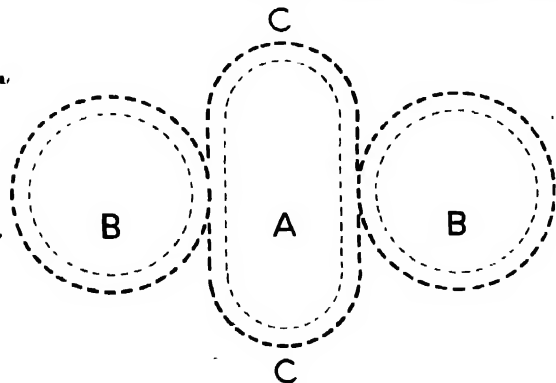
THE Department of Scientific and Industrial Research has just published the Report of the Fuel Research Board for the year 1925. The coal strike last year prevented its earlier publication. One of the most interesting parts of this report deals with the question of low-temperature carbonisation. It is pointed out the gas industry has for very many years been engaged in the carbonisation of coal, and has from time to time varied and adapted its processes so as to obtain every therm, every by-product, and every residue, in the most saleable and valuable condition and at the lowest possible cost. An industry in which more than a hundred and fifty million pounds sterling is employed, which has been experimenting for a century and has been commercially successful, is not likely to adopt a less remunerative method of carbonisation nor to refuse to adopt a more remunerative method. In the words of the report, "Although it is apparent from what has been said that low-temperature carbonisation is not likely to displace the present processes used in the gas industry, it holds out certain prospects of which the industry is fully aware. If millions of tons of coal, otherwise consumed in the raw state, could be replaced by smokeless fuel, a field would be opened up for an extension of the operations of the companies, and which might be justifiable even if the profit per ton were less than that obtainable by existing methods." The economics of the problem is in this case the whole problem. On one point we have by our own experience come to a definite conclusion. A good smokeless fuel such as we have burned in our own grates for three years, and will burn again so soon as supplies are available, is beneficial to the whole community because it pours no smoke into the air; it is pleasant in the house, and after the first month it has been preferred by all the feminine element in our domestic economy; an editor who keeps many papers lying about in his study will prefer it because his room will be much cleaner and he will never be called upon in a hurry to remove all his

books and papers to prepare for a visit at dawn from the chimney sweep. We have never made an exact comparison of the heating effect in our grates of coalite and coal, but we would certainly pay rather more for a ton of a good smokeless fuel than for a ton of best Derby Brights. We have every hope that some day in the future a system of carbonisation will be devised which will give us our smokeless fuel, give the nation its oil, and give the shareholders a reasonable dividend. Our hope is clear and bright, parts of it we know can be realised, we have not received really convincing evidence that the whole of it can be realised. The investigation of fuels is by no means confined to an examination of low-temperature carbonisation. A survey is being made of the coal resources of the country, and the many varieties of coal which are found here, and it seems that the whole question of fuels and their use is being carefully and methodically investigated. The problem is so vast and the material to be examined is so diverse that no private body could undertake the task. Only a government department could do the work properly, and, in our opinion, the work is being well done, and the information is published in a convenient and proper manner. The treatment of coal by hydrogenation and by the addition of oil or steam is also being watched with interest. We gather from the *Morning Post* that International Combustion, Ltd., has taken steps to form a merger of a number of coal, fuel and power interests, and that the company has secured a contract to construct the Hams Hall Super Power Station, near Birmingham, at a cost of about £1,500,000. It is said that the company intends to develop a great low-temperature carbonisation scheme, and that Sir Harry McGowan, Mr. B. E. Todhunter, and Col. G. P. Pollitt have joined the board of International Combustion, Limited. As these gentlemen are also on the board of Imperial Chemical Industries, it is obvious that the fuel question will have the advantage of the experience and technical knowledge which has been acquired by the most active and enlightened

chemical industry in this country. Scientific knowledge, combined with experience and good sense, can solve any problem; the solution may be satisfactory or not; no one can achieve the impossible. It seems that all these factors are now placed at the disposal of those who, whether in government departments or in private industrial concerns, are trying to put the fuel industry on to a good basis.

Valency

Valency is a measure of the combining power of an element; in some elements the valency never alters; in others the valency is sometimes one number, sometimes another; a few elements can in different circumstances have three or more different valencies. A divalent element like oxygen can occasionally exist as a quadri-valent element; when it is divalent one atom of oxygen can combine with two atoms of hydrogen and the molecule will have some definite configuration in space. If we regard an atom as a small nucleus with electrons, also small, revolving round it at distances very great in comparison with the diameter of the nucleus, we shall find it very difficult to draw an exact boundary between the empty space which is included in what we roughly consider as the atom and the empty space excluded from it; there is no boundary: when we have ascertained the positions of the nuclei and the electrons all the rest is reduced to a number of electrical attractions and repulsions which no doubt become rapidly feebler as we get away from the vicinity of the nuclei and electrons. The atom has no defined shape like a crystal; it has a definite position in the molecule, and the valencies of the atoms determine the general configuration of the molecule. If we consider one divalent atom A with two monovalent hydrogen atoms B and place the nuclei as in the diagram, it seems probable that the attraction between the various electrons and the nuclei in the line B A B will tend to compress, in that part of the molecule the vague volume



which we regard as the atom A, and there will be no corresponding force to compress the atom A in the direction C C. We suppose, after due reflection, that this is what Mr. Murgatroyd means by the rather awkward phrase he uses about the oxygen atom being the shape of a bolster. It is in this sort of way that valency expresses itself in the configuration of the molecule. The shape of the molecule depends almost entirely on the number of the nuclei and the valencies associated with each nucleus: these will arrange themselves in accordance with the laws of electrical attraction, and if

the final arrangement results in the nuclei in one line being closer to each other than the nuclei in other lines, we can, we suppose, think of the atom concerned being flattened or lengthened or tetrahedral and so on. Ninety per cent. of the atom is nothingness, and when it adjoins some other nothingness there is neither boundary nor change nor anything else to show or imagine. Pope and Barlow some years ago developed a hypothesis that four spheres of unit size arranged in a tetrahedron could conveniently represent a carbon atom, two spheres of unit size adjoining each other would represent an oxygen atom, and that one sphere of unit size would represent a hydrogen atom. The combination of the proper number of such spheres gave results which in most cases seemed to agree with the measurements of crystals of the compounds concerned, but the hypothesis cannot yet be said to be either proved or disproved. The analysis by X-rays of a number of organic compounds will in due course throw much light on this particular problem: it has hardly thrown much up to now.

British Chemical Standards

A few years ago an organisation was formed to prepare a number of standards for use primarily in the iron and steel trade. The organisers have now presented a report covering the three years working up to September, 1925. The report shows unmistakable signs of progress and efficiency. There is a certain amount of modesty which hides the names of those most actively engaged in the work, but the standing of the organisation is shown by the co-operation of such well-known men as Dr. J. T. Dunn, Dr. B. Dyer, and Dr. Voelcker, who are included in the list of referee analysts, and of such well-known firms as Messrs. Pease & Partners, Consett Iron Company, Alfred Hickman, Hadfields, Cammell Laird & Co., W. Beardmore & Co., and Bolckow Vaughan & Co. Standards of various materials are supplied at a low cost as a guide to purchasers. The standards are in use in this country, in Belgium, France, South Africa, the United States, and several other countries; the use of these standards appears from the report to be steadily and slowly growing, not only in the iron and steel industry, but also in the paint industry, explosive industry, in mines, and by public analysts and educational establishments. The standards already prepared and distributed include a dozen different varieties of steel each suited for a particular type of material, two nickel steels, two other alloy steels, three varieties of cast iron, a basic slag, an iron ore, a manganese ore and a non-ferrous white metal suitable for bearings and packing. It is intended to proceed with the preparation of standards of other non-ferrous alloys. We are glad to notice that the organisers urge "the importance of not reporting analyses in such a way as to imply a greater accuracy than can be reasonably expected in practice," and it is recommended that analyses should not be reported to more than three significant figures. It appears that during the first year the organisation involved a deficit of about six hundred pounds, which has been made good in the course of the next two years. The report is worth reading, and may be obtained from the organisers of British Chemical Standards, 3, Wilson Street, Middlesbrough. A casual perusal of it suggests that the organisation is well run, and will grow until its standards are very familiar.

STATISTICS IN INDUSTRY: SOME USES AND LIMITATIONS*

By H. C. MARRIS, M.I.Chem.E.

For the purpose of this paper Industry may be divided into three sections: (1) Buying; (2) Manufacture; and (3) Selling. As every purchase involves a sale, the first and third sections may be considered together, the one being a mirror image of the other.

As sections one and three are severally at least as important as section two, and collectively are of more consequence, any statistical information which aids efficient buying and selling is of paramount importance.

Could not efficient buying be defined as selecting that moment for buying when the market is at its lowest, and purchasing sufficient quantities to suffice until the upward trend is passed and the price is again at its lowest? The mirror image of this, as defining efficient selling, might be regarded as selecting that moment when the market is highest and unloading the greatest amount possible of goods at that price.

To be able to meet the conditions of these definitions it is necessary to know, as far as possible in advance, the prospects of supply and demand for the goods concerned, both as raw material and completed article. That is to say, one should be in a position to forecast what is about to happen in industry.

Trade forecasting might be divided into two sections: (1) Long term forecasts, such as those applying to the exhaustion of natural resources like coal or food; these are usually unpleasant prophecies and are generally thoroughly unreliable, but have the advantage to the prophet that he is dead before he can be repudiated. The second section might be considered as composed of (a) trade cycles and (b) short term forecasting affecting immediate requirements.

As the one influences the other, and there is no sharp line dividing them, they will be considered together.

Trade cycles are rhythmic fluctuations in which the general level of prices rises for a period of years, reaches a maximum, dies down, reaches a minimum, and starts all over again, and, of course, have enormous influence on trade by increasing or reducing the purchasing power of the community.

If it were possible to predict the start of the rise of the trade cycle, then efficient buying would be much simplified; again, it would be extremely valuable to know when the peak of the cycle had been attained.

According to Sir William Beveridge, although this rhythmic movement is common to all advanced industrial countries, yet the movement, though rhythmical, is quite irregular in length. The time required for trade to pass through all the phases of the

cycle—depression, revival, prosperity, strain or crisis, liquidation, to depression again—may be as little as six years or as much as eleven. In exceptional cases the time may exceed these limits, and there is nothing to suggest any fixed periodic influence. The range of the movements is equally irregular. One maximum of prices may be markedly higher or lower than the one before; when prices fall again they may drop to about the level from which they arose, or much further, or not so far.

Short time forecasting is affected by natural phenomena, such as wet or dry seasons, by social upheavals, such as war, revolutions, strikes, by the more ordinary alterations in levels of production and consumption, and by financial influence such as alterations in bank rates and foreign exchanges.

It is unnecessary to consider long term prophecies, but how far do available statistics help as regards trade cycles and short term forecasting? Statistics are defined by Bowley as numerical statements placed in relation to each other; they can be classified as amongst that group of interesting and important things which are carefully put on one side until more time is available; for this reason actual statistics have been left out of this paper as far as possible.

Statistics are regarded as being quite a modern innovation, but bills of exchange were used in Germany in the thirteenth century and banking started in Italy a little later, which must have involved statistical work of some sort, though no doubt of a rudimentary nature. In the seventeenth century the Plague of London was the cause of sufficient interest being taken in mortality returns as to produce regular reports of the number of births in London, and Captain John Graunt in 1662 presented to the Royal Society his "Observation on the bills of mortality," which is probably the foundation of statistics in this country.

In connexion with the means for forecasting the movements of trade cycles, Beveridge states that all factors in the economic life of a country are affected by the trade cycle and show a roughly simultaneous rise and fall, though the movement in all cases is only roughly and not absolutely simultaneous. Some factors appear to lag behind, rising and falling many months after the rest. Other factors appear to lead the movement; they begin the rise and they begin the fall; they can be used to suggest when the turn of the cycle from rise to fall, or vice versa, is approaching. Statistics describe and compare large groups or aggregates, but it must be understood clearly that they generalise, and an application of a generalisation or average to a particular

* Paper read before the Institution of Chemical Engineers at the Conference held at the Science Museum, London, on Dec. 9, 1926.

business use must be done very carefully indeed and by one thoroughly familiar with the inner meaning of the statistics employed.

Bowley points out that statistics can be used for the following purposes:-

(1) To give correct views based on facts as to what happened in the past.

(2) To afford material for estimates as regards the present.

(3) To make possible a forecast for the near future by studying changes that have taken place in the near past.

In 1922 the Harvard Economic Service published the results of an inquiry for providing "first a record of fluctuations during alternating periods of business prosperity and depression; and, secondly, a basis for forecasting at any time business conditions of the period immediately ahead." The Harvard University Committee of Economic Research arranged their factors in three main groups: "A—Speculation"; "B—Business"; "C—Money". "A" included the Prices of Industrial Stocks, of Railroad Stocks and Bonds, and Town Clearings at New York Banks; "B" included Commodity Prices, Pig Iron Production and Country Clearings; "C" included rates on four to six months and on 60 to 90 days commercial paper, and Loans and Deposits at New York Clearing Banks. The Committee plotted the movements of these groups over the twelve years 1903–1914, and they showed how in that period the movements of "A" both up and down came almost regularly four to six months before those of "B," and these in turn roughly six months before those of "C." These movements have been plotted as curves, and are given in the paper by Beveridge published by the London and Cambridge Economic Service in January, 1923.

In England the London School of Economics studied the question of forecasting on similar lines, but applying English conditions, and reached similar results to the Harvard investigation. That is to say, movements in one statistical group follow or precede movements in another group, but the law is subject to exceptions, especially when applied to the use of any particular industry.

Dr. Snow, in some work entitled "Trade Forecasting and Prices," read before the Royal Statistical Society recently, examined the question as applied to trade in general and to the leather industry in particular, and studied the relationship between a large number of pairs of published statistics. But the general impression to be obtained from his paper is that (1) the movements do not coincide in a sufficiently large degree to be of much practical use; (2) the statistics available are by no means reliable; (3) the delay in the compilation and issue of statistics may cause an event to happen before its forecast can be prepared.

As a further illustration of the difficulties facing the statistician, Rowe, in an article on the "Physical Volume of Production," states that "we have very little evidence as to the amount of increase in the volume of production required to balance the increase in population from year to year, and we cannot estimate

what the production each year might be expected to be; many of the products of industry are not capable of quantitative measurement at all. In textile manufacture much of the product alters its quality and design from year to year, and comparative statistics are out of the question. Again, in the case of the engineering industry there are not even standard lines, and comparative measurement is absolutely impossible. Even if all the possible statistics of production are assumed to be available, we have the fundamental problem of combining tons of wheat and tons of pig-iron in proportion to their importance as national assets.

"We are forced to the conclusion that for purposes of trade forecasting at present the statistical help available is very limited, but, as Beveridge points out, one who systematically studies the movements of the trade barometer may get a hint when the turn of the cycle from rise to fall or fall to rise is coming sooner than he would do without such study. It may even prove possible to give some help in allowing for the chief 'disturbing factors.' The effect on the trade cycle of harvest success or failure in different countries and at different stages of the cycle can be studied. The discovery of periodic laws regulating harvests themselves may not be beyond human powers. Whether and when an industrial dispute will lead to a stoppage cannot be foretold; but consideration of the times when conciliation agreements run out and have to be revised, or of applications to raise or lower wages, may give useful warnings. A disturbing factor of some importance, the influence of tariffs and other measures of governments, such as currency inflation or deflation, may also be watched and allowed for."

An interesting and useful publication in this connexion is the two charts, one on United Kingdom conditions and the other applying to the conditions in the United States of America, provided at the beginning of the Monthly Bulletin issued by the London and Cambridge Economic Service, which is run jointly by the London School of Economics, the University of Cambridge, and the Federation of British Industries.

The banks might add to their issue of statistics periodically the total amount of overdraft or credit balance belonging to industry, as this might be a valuable indication of trade tendency, the argument being that when trade is good overdrafts increase, but when trade is bad firms realise their stocks and cease to buy such large amounts of raw material, and the balance of money coming in accumulates in the bank. Some trades might be flourishing whilst others languish, but if overdrafts started to decrease, then possibly this would be an indication that general bad trade might be in sight, due allowance being made for any abnormal condition, such as coal strikes.

The defects and limitations of statistics for our purpose are mostly a question of degree and of detail rather than of principle, and efforts are being made to improve them. Recently the General Economic Sub-Committee of the Imperial Conference passed the following resolution:-

"The Imperial Conference, impressed by the need for more complete, more prompt statistics regarding the production, stocks, and consumption of wool through-

out the world, recommends that such steps as are found to be most suitable should be taken to secure the co-operation of foreign countries in this matter, and, further, that the Governments of the Empire represented at this conference should consider the adoption of such measures as are necessary and feasible to secure the provision and publication of such statistics, provided that foreign countries materially concerned, either as producers or consumers, are prepared to take similar action."

Other industries are moving in the matter of improving their statistics, and research is being undertaken by statisticians in their particular science to find the best way of dealing with such figures when obtained.

When all this work and research bears fruit, will not the man who makes use of these aids have an advantage over his rivals who neglect them?

Turning now to the use of statistics in actual manufacture. Here the figures are under better control, the methods of obtaining yields, costs, accounts, etc., are more or less standardised, but, nevertheless, there are differences of opinion as regards the best methods to employ to obtain such statistics, and as the subject is an important one and far too large for the remaining limits of this paper, reference will be made to only one example of works' statistics.

English manufacturers are gradually, but very slowly, following the American policy of pooling knowledge. This process has not proceeded very far, even amongst manufacturers of the same product, but surely if we are to reduce costs sufficiently to meet the intensive competition now in force, both at home and abroad, then we

must pool all our knowledge not only with immediate competitors, but, whenever circumstances permit, the whole of industry must throw its common knowledge into the scales.

There is an important section of an industrial concern which is common to nearly all factories, and that is the generation of power and steam.

A firm generating its own current can compare the cost of its electricity with the charges of the local public power station supply, and can satisfy itself definitely that it is cheaper to make electricity than to buy it, but the economic efficiency of a boiler house cannot be obtained so readily.

With an efficient costing system all the debits of the boiler house can be obtained, and from them the cost per unit of steam made. Now the technical efficiency of a boiler house may be very good indeed; still the cost of the steam it generates may be too high: that is to say, the technically efficient boiler house may be economically inefficient, with the consequence that the whole of the goods manufactured by the aid of such steam are too costly.

We may be confident that our own boiler houses are all that they should be, yet if we had available a standard similar to the electric supply charges we might change our opinion, but unfortunately there appears to be no standard market price for steam.

The Bulletin of the National Heating Association, of October 15, 1925, gives the names and rates of about 150 concerns in the United States which supply heat in the form of steam or hot water to whoever may require it. The rates vary enormously, and in New

WILLIAM WALKER & SONS, LTD., BOLTON

STEAM PRODUCTION COSTS

Financial Half-Year—April 1/1926—September 29/1926

Capital Account				Analysis of Overheads cost per 1000 lbs. Available Steam			
£				£			
Fuel Burnt	{ Weight	Tons 4412.976	Land ...	141.000	Bank Charges		.006
	{ Value	£ 4569.820					
Tan Burnt	{ Weight	Tons 2076.200	Buildings ...	12,268.000	Depreciation		
	{ Value	£ 103.810			Buildings ...	...	.006
					Plant ...	...	.023
					Machinery ...	...	.003
					Repairs ...	...	.010
Water	{ Weight in 1000 lbs.	53,256.950	Plant	28,154.500			
	{ Value ...	£ 399.427			Salaries, Directors & Engineers		.008
Steam used on plant in 1000 lbs.		5325.695	Machinery	4,023.750	Insurance, Fire & Workmen's		
Available steam in 1000 lbs.		47,931.255			Compensation		.002
Labour ...		£ 770.911	Working Capital	219.000	Electricity		.012
Stores plus charges		£ 245.892			Rents, Rates & Taxes		.001
Traffic plus charges		£ 137.739			Alloc. of General Dept.		.006
Invoices—Rent of coal space and cartage during General			Total	44,806.250	Alloc. of Counting House		.004
Strike ...		£ 40.350					
Total direct costs		£ 6,267.949					1/7½d.081
Overheads		£ 3,880.994					
Total cost		£ 10,148.943					

Typical Coal Analysis before May 1/26.		Typical Coal Analysis after May 1/26.	
Direct costs per 1000 lbs. avail. steam	£ .131 = 2/7½d.	Moisture ...	23.100
Total cost per 1000 lbs. avail. steam	£ .212 = 4/3d.	Ash ...	29.500
Cost of fuel per 1000 lbs. avail. steam	£ .098 = 1/11½d.	Gross calorific value	11,328
Cost of labour per 1000 lbs. avail. steam	£ .016 = 4d.		
% Tan on coal burnt	47.048		
Lbs. available steam per lb. coal	4.849		

York the charge for 1000 lb. steam varies from \$1.75 as the highest retail charge, to 50 cents as the lowest wholesale rate, and there are additional charges varying with the cost of coal. Therefore, although there is in U.S.A. a definite market for steam, and a definite supply, yet we cannot get a market price to serve our purpose. Again, it is true that public electric undertakings in England give figures from which it is possible to calculate the cost of their steam, but this is not a fair comparison, as such concerns need much reserve in the form of boilers standing-by under steam to meet their peak-loads and to allow for fogs. For this reason a public electricity station is far less efficient economically than that of a chemical works which has a steady load.

As the obtaining of a standard market price for steam appears so difficult, an alternative would be to obtain a standard cost, and if owners of modern well-equipped and efficiently run boiler houses would give detailed information concerning their steam costs, a valuable standard could be set up, and the economically inefficient plants would soon find out their shortcomings, and would set their houses in order with a consequent reduction of manufacturing costs all round.

It is in the hope of other concerns following their example that the Directors of William Walker and Sons, Ltd., of Bolton, permit the publication, of the accompanying steam production costs of their boiler house, which was only just completed and in working order before the General and Coal Strikes. The figures are not put forward in any sense as an example of efficiency, but to serve as a basis for discussion to obtain a standard method of showing such statistics and to bring forward similar figures from others.

BRITISH STANDARD SPECIFICATIONS

The British Engineering Standards Association has issued British Standard Specification No. 261 1926 for Ready Mixed Linseed Oil Paint (Oil Gloss), Genuine White Lead; No. 262—1926 for Ready Mixed Linseed Oil Paint (Oil Gloss), Tinted Paints (White Lead Base); No. 272—1926 for Red Oxides of Iron (Class 1, Natural or Mixed Iron Oxides) for Paints; No. 273—1926 for Zinc Oxide Oil Paste for Paints; and No. 274—1926 for Extra Hard Drying Varnish. The specifications contain clauses regulating the composition, together with standard reception tests, for the purchase of these materials, together with appendices giving methods of carrying out the tests. These specifications have been prepared at the request of the paint manufacturers by a committee representative of both the buying and manufacturing interests, and, as in the case of all British Standard Specifications, they will be reviewed as experience of their working or progress in the industry renders it necessary, and revised issues will be published from time to time. Other specifications dealing with red oxide of iron oil paste (Classes 1 and 2), lead chromes, Prussian blues, lithopone, lithopone oil paste, carbon black, gold size, zinc oxide, and tinted zinc oxide ready-mixed paint are in course of preparation. Copies of the new specifications (Nos. 261, 262, 272, 273 and 274—1926) can be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d. each, post free.

THE SUGAR INDUSTRY IN SOME OF ITS CHEMICAL ASPECTS*

By DR. C. A. BROWNE†

Probably no other food commodity has had so strong a fascination for the economist, the agriculturist, the chemist, and the engineer as sugar. In the first place, no other food product has been so frequently subjected to tariff laws, bounties, cartels, and other regulations. In the second place, the operations of producing sugar cane and sugar beets are the best examples of a system of agriculture which, although highly specialised, is probably unrivalled in the extent and complexity of its relations. In the third place, sugar is the only food commodity which is supplied to the consumer in a state of complete chemical purity, the removal of the last traces of contaminating material thus acting as a continuous challenge to the ingenuity of the chemist. Lastly, the numerous operations of sugar manufacture present a greater variety of attractive problems to the engineer than is offered by any other branch of industry. Chemists distinguished in other fields, like Sir William Crookes, have gone out of their way to write treatises upon sugar manufacture, and engineers distinguished in other fields, such as Sir Henry Bessemer, have gone out of their way to invent new machinery for the extraction of sugar. Important epoch-making appliances, like the vacuum pan and multiple effect, now used extensively in all branches of applied chemistry, found their first industrial application in the manufacture of sugar.

Engineers and chemists have too often neglected the agricultural side of sugar production. The costs of planting, cultivating, fertilising, and harvesting make up over two-thirds of the total cost of a pound of sugar, thus leaving less than one-third for the expenses of manufacture. Sight has often been lost of the fact that the cane or beet plant is the real sugar factory, the extraction, evaporating, and crystallising equipment being simply the means of separating the sugar that nature had already produced. The neglect of the more important agricultural chemical processes in the field, where the sugar is synthesised by the plant from its elementary constituents, is of far greater moment than an attitude of indifference to the chemistry of factory operations.

THE SOIL AND THE CROP

Chemistry assists the agriculture of sugar production in determining the character of soils and fertilisers, the varieties of crops, and the conditions of cultivating and harvesting which are best suited for obtaining a maximum yield of sugar per acre. Surprisingly little attention has been given to the soil when selecting the sites of some tropical sugar plantations. A newly created plantation in the West Indies with a most expensive modern factory equipment was brought to the verge of ruin through failure to determine in advance the character of the land. The soil proved to be very salty, with the consequence that the sugar cane grown upon it yielded juices of extremely low purity, and so heavily charged with soluble chlorides that profitable sugar manufacture was almost impossible. Extensive drainage has been required to

* Read before the Montreal Section on January 18, 1926

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free the fields of this plantation from their excess of salts, and to bring them into a condition suitable for successful sugar production. A preliminary survey of the undeveloped land by an agricultural chemist would have prevented the initiation of such a costly mistake.

The proper treatment of soils where there is a dangerous accumulation of soluble salts is a problem which the growers of sugar crops (both the cane and the beet) must occasionally consider. In the alluvial cane lands of Demerara Mr. Maurice Bird has found the soil solution to contain at times over 1% of soluble mineral matter, consisting of the chlorides, sulphates, and carbonates of sodium, potassium, calcium, and magnesium, which tend to accumulate in the surface soil as a result of capillarity and evaporation. This enormous excess, due partly to the concentration of soil water during protracted droughts, may result in serious damage to the growing crop by causing a diseased condition of the cane known as withering. The dissolved magnesium salts are particularly toxic to the cane unless their influence is counterbalanced by the favouring action of sufficient calcium bicarbonate, for producing which a rich supply of decomposing organic matter is needed in the soil in order to supply the necessary carbon dioxide.

In order to facilitate the removal of salts from defective cane lands it is sometimes advantageous to break up the subsoil to provide better drainage. Periodic flooding of the land is also beneficial. The chemical processes of oxidation, hydration, and nitrification advance with great rapidity in tropical soils, the elements of plant food being made available in a much shorter period than in temperate zones. This would be a great advantage were it not that the forces which impair fertility are equally rapid. As one result of these chemical changes the soils of the heavy clay sugar lands in Demerara become markedly alkaline during cultivation, a condition made evident to the eye by the solution of humus which colours the drainage waters a dark brown. It is imperative for the maintenance of fertility that the organic matter removed by oxidation and leaching be fully restored.

A peculiarity of Demerara sugar cane juices and sugar products, to which Professor Francis, the former Government analyst in British Guiana, called attention forty years ago, is the low optical activity of the reducing sugars. I discussed this interesting question, when I visited Demerara seven years ago, with Sir John Harrison and other scientists. Mr. Maurice Bird attributes the phenomenon to the alkaline condition of Demerara soils, the effect of dilute alkali being to bring the polarizing power of a mixture of reducing sugars to the point of inactivity. Owing to this characteristic of Demerara raw sugars, some refiners, because of the loss of the favourable differential between direct polarisation and sucrose content, which with the raw cane sugar of other countries amounts to several tenths of one per cent., have held that it was less profitable to refine sugars from this colony. The high purity of the Demerara raw sugars, however, nullifies this apparent disadvantage, which, it should be stated, is not equally pronounced at all seasons.

The value of chemical analyses of soils as a means of determining their toxicity is generally unquestioned,

but there is a wide difference of opinion as to the value of such analyses as a means of determining the manurial requirements of a sugar crop. So many factors enter into the question that deductions from soil analyses in one location do not apply to similar analyses in a different environment. It may be said, however, that for a given region of similar agricultural and climatic conditions, soil analyses, when made in conjunction with carefully conducted field experiments over a period of years, make possible the formulation of certain general conclusions as to fertiliser requirements. Thus in Hawaii it has been observed that if the amount of P_2O_5 dissolved from a soil by a 1% citric acid solution exceeds 0.004% with an accompanying quantity of 0.15% soluble lime and silica, no response is obtained when phosphatic fertilisers are applied to sugar cane. In the same way it has been observed that soils with a citric acid soluble potash content above 0.03% and a fair amount of accompanying soluble lime do not generally give increased yields of sugar cane with applications of potash fertilisers.

THE NEED FOR NEW VARIETIES

While the production of new varieties of sugar cane and sugar beets is a subject that falls within the realm of plant breeding, the selection of the particular variety of best composition for sugar production devolves largely upon the chemist. The need of constantly improving the existing varieties of our sugar producing crops is always dominant. Certain established varieties may give good returns for hundreds of years, and then show a sudden degeneration from failure to resist new diseases. Thus the old Bourbon variety of sugar cane, which for centuries had been the chief source of the world's sugar supply, began to decline in vigour about forty years ago, and to succumb to the attacks of fungous diseases. The yields of cane fell off enormously, and the sugar industry of the West Indies would have been ruined had Harrison and Bovell, in Barbados, not discovered at this time the fertility of sugar cane seed, thus opening the way to the production of new varieties that were resistant to fungous disease. But now another malady of the sugar cane, the mosaic disease, has appeared, and, as the fungus-resisting canes are not immune to this new enemy, there has arisen an urgent demand for hardier varieties. Considerable success has already been obtained in producing canes which are resistant to disease and cold. During the past five years the Louisiana Experiment Station has been conducting experiments upon the growing of sugar beets in different parts of the State. The results of the preliminary work indicate that beets planted in November are ready for harvesting the following May, with a yield of about 20 tons of roots to the acre, a sugar content of 12.5%, and a purity of over 84. If a beet crop can be harvested in Louisiana in May—June, and a cane crop in November—December, the economic losses from idle factory equipment will be greatly reduced.

SOURCES OF LOSS

One of the most serious chemical losses in both the sugar cane and sugar beet industry is the destruction of sucrose in the crop between the time of harvest and manufacture. This loss may result from the inverting action of enzymes after the cane has been cut, or from

the fermentation of the crop as a result of injury by freezing, insects, and other causes, or from the natural processes of cellular respiration which take place in all stored plant materials. In the tropics, where sugar cane is sometimes transported long distances, a week or more may elapse between the times of cutting and milling, with the result that under the favourable conditions for bacterial growth the stalks reach the mill in a state of deterioration, the expressed juice being sour and slimy from the presence of acid and gummy decomposition products. The clarification of such juices gives the factory chemist a vast amount of trouble. With very badly fermented cane, sugar making is an impossibility: working up the juice into industrial alcohol is the only hope of salvaging anything from the wreck.

It has been estimated that the actual destruction of sucrose from cellular respiration during the storage of sugar beets, between digging and slicing, amounts each year in the United States to \$5,000,000, and that another \$5,000,000 loss occurs in the factory owing to the inability to recover as much sugar because of the accumulation of objectionable nonsugars which have been rendered soluble by metabolic changes in the beets during storage.

The saving of the immense losses which result each year from the deterioration of sugar cane and sugar beets has long engaged the attention of chemists. Immediate dehydration of the sliced stalks and roots has been proposed, the advocates of this scheme holding that among other advantages the dried material can be pressed into bales and preserved for an indefinite period before being worked up for sugar, thus enabling the sugar factories to operate all the year instead of for only a few months as at present. The insufficient margin of profit in dehydrating sugar cane and sugar beets at the present high cost of fuel and low selling price of sugar has been the most serious obstacle to this process of sugar manufacture.

PLANT

Leaving now the agricultural side of our topic, it remains to discuss raw sugar manufacture in some of its chemical aspects. Manufacturers of sugar have probably been more imposed upon by the purchase of undeveloped and impracticable patented processes and appliances than have those of any other product. It is instructive to visit the sugar factories in Cuba and other tropical countries, and to note the expensive equipment discarded after a brief period of use as uneconomical or useless.

The sugar planter has always shown willingness to adopt any suggested improvement, whether it be a new appliance, such as a filter press or evaporator, or whether it be an entirely new process of manufacture. When the new scheme is backed by capital and well-organised propaganda, the isolated manufacturer is almost helpless if he desires to ascertain the disadvantages of the proposed innovation. Trade publications, whose columns should be thrown open to a free discussion of the pros and cons of every process, are rarely useful in such an emergency. What is needed is a forum of open public discussion in which both the successful and unsuccessful users of the process can state their experi-

ence, for it is only upon the basis of widely disseminated experience that progress can be made. Too often in cases of this kind the purchaser has been sold a problem instead of a well-developed process. Many engineering chemists can no doubt recall in their own fields instances of a hastily exploited device in which the basic principle was sound, but the mechanical or technical development was so imperfect that after it had been tried upon the manufacturing public the original appliance had to be entirely changed.

One thing which always impressed me, during my occasional visits to tropical plantations, was the wonderful durability of the old British sugar-house machinery. I have seen in operation walking beam engines and other appliances that have been in constant use for over 80 years. In commenting once to Sir Francis Watts, the former Imperial Commissioner of Agriculture in the West Indies, upon the excellent lasting quality of this old Scotch and English sugar-house equipment, he remarked jokingly that it was too good, as the purchase of machinery which will never wear out, and which its owner, therefore, will never care to replace, is not always the best economy. Indeed, some hold that the building of appliances to last for more than 20 years is an extravagance, as new, more economical devices which have been perfected should then be installed in their place without further delay. Machinery built for a short existence, however, has the frequent defect of structural weakness, and the heavy over-burden, which sugar making equipment must sometimes bear, demands the most durable kind of construction. This is particularly true in the case of sugar mills, which in grinding the new mosaic-resisting varieties of cane with high fibre content are subjected to enormous strains, far exceeding anything that the designers of these mills imagined.

The tendency of late years has been towards increasing the crushing, shredding, and rolling capacity of sugar cane mills. This is largely due to the desire for better sugar extraction, but it is also partly the result of an effort to obtain a more closely matted blanket of bagasse for retaining the clarification mud, which in certain processes of manufacture is pressed out between the rollers of the mill. High pressure crushing and milling, however, has brought in its train a number of disadvantages. Much of the bagasse is reduced to a fibrous powder, which finds its way through to the final sugar, and by its moisture retaining capacity exerts an undesirable influence upon the keeping quality of the product. High milling also removes more of the gums and other colloidal impurities of the cane, thereby increasing the difficulties of clarification.

COLLOIDAL IMPURITIES

The U.S. Bureau of Chemistry during the past few years has devoted considerable study to the colloidal impurities of sugar cane and sugar beet juices, the removal of which is the most fundamental process in sugar manufacture. The accurate determination of all the colloidal impurities in juices, syrups, molasses, massecuites, and sugars is a somewhat difficult procedure. The Bureau of Chemistry has employed ultrafiltration by means of standardised collodion membranes as the most suitable means of separating colloids for quantitative determination.

These membranes will retain not only all the material which is held by the filters of the sugar factory, but also the minutely divided colloidal particles that pass through. The results of such determinations upon the successive washings of different sugars showed that the colloidal impurities were distributed rather evenly throughout the crystals, which would indicate a continuous adsorption of impurities of this type upon the surface of the growing crystals while in the vacuum pan. It is evident that no manner of washing a sugar in the factory centrifugals will free it from the contaminating colloidal impurities.

The "water soluble" colloidal fraction from one sugar sample examined by the Bureau of Chemistry was found to have a specific rotation of -36° , which is approximately the value for the specific rotation of a gum prepared at the Bureau by Paine and Walton by dialysing beet molasses. This gummy impurity of the sugar did not reduce Fehling solution until after hydrolysis by hydrochloric acid. This indicates that it is a polysaccharide, probably extracted from the beets in the process of diffusion.

The presence of uneliminated colloidal impurities is not only responsible for various sugar factory difficulties, such as poor filtration, bad vacuum-pan boiling, and delayed crystallisation, but it is also a most common cause of off-colour sugar. These impurities may be of an inorganic as well as of an organic nature. In Demerara much colloidal silica finds its way from the soil into the cane juices and causes trouble in the factory by interfering with the clarification and by producing scale upon the coils of the evaporators. Superheating the juice before clarifying with lime has been found to eliminate much of this colloidal silica, and to cause a marked improvement in the yield and quality of the raw sugar produced.

The liming of juices for clarification has for centuries been one of the most important steps in sugar manufacture, yet until very recently but little effort has been made to place the control of this operation upon a strictly scientific basis. Owing to the well-known destructive action of alkalis upon reducing sugars, with the formation of dark decomposition products, great care is needed in the application of lime to sugar-cane juices. The theoretical quantity of lime for neutralising the free acid in a given quantity of cane juice may be measured, but, because of imperfect facilities and the lack of opportunity for a rapid intermixing of lime and juice, there may occur local zones of liquid that are over- and under-limed. Thus considerable damage may result from the destruction of reducing sugars at one instant by over-liming and from the inversion of sucrose at the next instant by under-liming.

Owing to the fact that the juices expressed from the cane are of constantly varying acidity, it has been impossible to devise a perfectly satisfactory continuous method of liming. The operator who tests the reaction of the juice with phenolphthalein at given intervals may obtain an average ratio of lime for a given flow of uniform juice that is fairly satisfactory, but if the reaction or rate of flow of the juice should suddenly change he may not detect the difference of conditions in time to prevent damage.

To correct the defects of this system of control the Bureau of Chemistry recently conducted experiments in Porto Rico upon continuous electrometer p_H measurements of cane juices by means of an automatic recorder. It was found possible by means of this device to detect rapid fluctuations in the reactions of juices which were not revealed by the intermittent methods of measurement, whether by titration or by p_H determination. With the reading of the automatic recorder constantly before him, the operator was able to adjust the lime control the instant a change in the reaction of the juices was indicated. The results obtained by the use of this new instrument were exceedingly favourable, the extreme fluctuations in reaction, due to temporary or local over-liming and underliming, disappearing. The existence of a continuous permanent record of the daily juice reactions is also of value to the factory superintendent for reference. The next obvious step in clarification control will be an extension of the automatic recorder to an automatic device for regulating the addition of lime to the juice. In fact, the accomplishment of this ideal is well on the way to realisation.

The recent war gave an impetus to the manufacture of white sugar on tropical plantations. Some enthusiasts predicted that in a very few years all the cane-sugar refineries of the world would have to go out of business, since they deemed it far more economical to make white sugar right where the cane was grown. This prophecy has never been realised for the reason that no plantation has yet found it possible to manufacture white sugars equal in purity and uniformity of grade to refined sugars. Notwithstanding, however, the failure of the prediction regarding the expansion of the tropical white sugar industry, there has been a vast improvement since the war in the quality of the raw sugars produced upon cane plantations.

This improvement in the purity of plantation raw sugars has not, however, always been accompanied by an improvement in keeping quality, which is a characteristic of the utmost importance when the output of a factory has to be stored over long periods of time. The keeping quality of a sugar is conditioned by two factors—the moisture content and the purity. Sugars of high purity and high moisture content deteriorate very rapidly as a result of the activity of yeasts, moulds, and other micro-organisms. The higher the percentage of soluble impurities in a sugar, the greater the amount of moisture it can retain without danger of deterioration. Various tables and rules have been devised for predicting the keeping quality of a sugar. The best known of these is the so-called "factor-of-safety" rule of the Colonial Sugar Refining Company of Australia, according to which the moisture of a sugar must not exceed one-half the non-sugar if the product is to keep. Experiments conducted over a long period of years at the New York Sugar Trade Laboratory upon raw cane sugars of West Indian origin showed that the moisture should not exceed one-third the non-sugar. This is now the generally accepted figure.

But like all other rules the "factor-of-safety" formula must be intelligently applied. A sugar conforming to the requirements of the formula will not deteriorate only so long as there is no disturbance in

the even distribution of its moisture. Let there be, for example, an uneven distribution of temperature in the sugar, and the moisture will be forced to migrate from the warmer to the cooler portion of the mass. There will then be produced zones of sugar with a moisture content above that prescribed by the safety factor, and in these places deterioration will at once begin.

The risk of moisture migration in stored sugar increases with the size of the containing parcels. Smaller packages offer a proportionately larger radiating surface for the same weight of sugar than bigger ones, and hence tend to hold the mass at a more uniform temperature, with less probability of dangerous high moisture regions being formed. It is for this reason that the storing and shipping of raw sugar in large bulk is a hazardous proposition.

Several instances have been recorded where the deterioration of raw sugars proceeded so rapidly that spontaneous combustion of the product took place with almost explosive violence. The evolution of so much heat, far exceeding the tolerance of the most resistant micro-organisms, is difficult to explain. The first stages of the process are unquestionably fermentative. During this phase the product may reach a temperature of 70° or 80°, which approaches the thermal death-point of the organisms involved. The second stages of the process, when the temperature mounts rapidly upward to the point of ignition, are of a vastly different character. Whether this results from the rapid oxidation of some unsaturated fermentation product, from the sudden decomposition of some unstable endothermic compound produced under anaerobic conditions, from the effect of some highly reactive catalytic agent, or from some violent exothermic reaction of an unknown character is a matter upon which at the present time we can only speculate.

Spontaneous decompositions very similar to fermentations may take place in concentrated syrups and molasses under absolutely sterile conditions. For twelve years I have had under observation several samples of molasses that have undergone a slow inversion of sucrose, a gradual destruction of reducing sugars, and a slight evolution of gas, with a constantly increasing darkening of colour. Bacteriological examinations have failed to give positive indications of the presence of yeasts or other organisms. The change seems to be a subdued example of the old hot room froth fermentation, which is not bacterial, and is now attributed by some investigators to a reaction between amino acids and reducing sugars. It is known that under favourable conditions this so-called froth fermentation of molasses may proceed violently, with the evolution of a large volume of gas and enough heat to carbonise the entire contents of the tank.

THE SUGAR INDUSTRY

The application of strict scientific principles has been followed more energetically in beet sugar manufacture than in cane sugar manufacture. This we would expect, for the beet industry was developed in the highly civilised European countries, where skilled labour was abundant, and the cane industry was maintained in

primitive tropical countries, where labour was shiftless and unskilled. In 1852, taking the whole supply of the world, six times as much cane sugar as beet sugar was manufactured. Beet sugar kept gaining, however, until by 1884 the production of the two kinds of sugar was about equal, a little over 2,500,000 tons each. Beet sugar then took the lead, until in 1899 its production was about 5,500,000 tons, against a cane sugar production of about 3,000,000 tons. Then came the ending of the Cuban war, and with it the application of the scientific principles worked out for the beet industry to the dilapidated cane factories of Cuba and Porto Rico. Modern methods of manufacture had also been busy reorganising the cane industry in Hawaii, Java, Australia, and other countries. The production of beet sugar in 1901 reached nearly 7,000,000 tons, and since then has remained practically stationary. But the increase in cane sugar production, however, has gone forward each year by leaps and bounds. In 1907 the cane had caught up to the beet, the production of each kind being a little over 7,000,000 tons. In 1908 cane sugar was over 600,000 tons ahead, and in 1909 nearly 2,000,000 tons ahead, out of a total world's production of about 15,000,000 tons.

During the World War the beet sugar industry of France, Belgium, and other European countries suffered a serious set-back, large fertile sugar beet areas having been within the zone of conflict and many hundreds of factories destroyed. In order to make up the deficiency thus caused in the world's sugar supply, a great impetus was given to the cane sugar industry of the tropics. At the close of the war the total production of the world's beet sugar had fallen to 3,259,380 tons, while that of cane sugar had advanced to 11,957,232 tons, over 78% of the entire sugar production. Since 1919 the beet sugar industry of Europe has been rapidly recovering, the total production of the world's beet sugar for the present crop year (1925—1926) being 8,287,000 tons, which is 33.9% of the entire sugar production of the world (24,398,214 tons).

The future development of the world's sugar industry will probably be more extensively confined to sugar-cane growing countries. This is due principally to the lower cost of producing cane sugar, because of the cheaper labour of tropical countries, and the much greater yield of sugar per acre which the cane gives over the beet. Under the best systems of cultivation and manufacture, such as are found in Hawaii and Java, more than four tons of sugar can be produced per acre. Germany, which leads in the production and yield of beet sugar, can raise barely two tons of sugar per acre. Yet notwithstanding the natural advantages possessed by the sugar cane, the production of beet sugar is bound to increase for many years to come. The sugar beet, as a root-producing plant of deep-feeding character, plays a most beneficial part in the systems of crop-rotation which are best suited to diversified farming. It is a crop which from the standpoint of both agriculture and national economy should always meet with the most favourable consideration in countries which, like the United States and Canada, are climatically suited to its best development.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

TAR CONFERENCE PAPERS

The Papers that were presented before the Manchester Tar Conference in November last, together with the full discussion, will be published in bound form towards the end of this month, at the price of 2s. 6d., post free.

* It was felt that the contributions proved so valuable that many of those interested would like to retain, for immediate reference, a complete account of what transpired at the Conference.

A limited number of copies will be available. It is consequently advisable for any who require copies to apply to the General Secretary of the Society of Chemical Industry, Central House, Finsbury Square, London, E.C.2, at once. Orders should be accompanied by the appropriate remittance.

CONGRESS OF CHEMISTS HANDBOOK

This Handbook, which has been prepared by the Committee of the Congress under the Editorship of Mr. W. H. Coleman, contains, in addition to a full programme of the meetings, an account of some of the more important chemical and allied industries in and around London. A useful map of Central London accompanies it. A copy of the book was presented to every member attending the Congress, but a considerable number of copies is still on hand, and the General Secretary will be pleased to send one to any member who was not present at the Congress, on receiving his name and address, with 6d. in stamps to cover the postage.

BRISTOL SECTION

At a meeting held at the University on January 6, Prof. Francis presided over an excellent attendance. After apologising for the absence of the chairman through indisposition, Prof. Francis introduced Mr. Geo. Hider, M.I.M.E., A.M.Inst.C.E., of Swansea, who read a paper on "Water softening."

Mr. Hider treated the subject from the standpoint of the engineer, and illustrated his remarks by a series of excellent lantern slides. It was stated that natural water always contains salts in solution: hardness-forming salts, and easily soluble salts which are not precipitated even when the water is boiled under pressure. With the advent of steam boilers, troubles arose from these salts, which deposited on heating surfaces and also caused undesirable concentrations. It was found that water could be partially softened by adding lime, and more completely by adding soda also. Many "lime and soda" plants were thus produced, but, even with the best attendance, these could not entirely prevent scale and sludge in the boiler, and blowing-off to waste was also necessary to prevent high density.

Trouble was experienced with soda concentration if enough of this substance was added to remove all the permanent hardness. Zeolite softeners were then introduced, and they did produce zero hardness, a condition which, however, had serious disadvantages well known to engineers. A means of controlling the quality of the water in the boilers was evidently essential for a solution of the problem, and, after much experiment and research,

a scheme was developed, now known as the "Neckar" system of water treatment and boiler control. In this system the water is abstracted continuously from the boilers to prevent concentrations of all kinds, the water being returned to the softener.

The lecture produced an excellent discussion, in which Messrs. Marsden, Andrews, Rixon, Shackel and others took part. A hearty vote of thanks was accorded to Mr. Hider.

CALENDAR OF FORTHCOMING EVENTS

- Jan. 15. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS. The Mining Institute, Neville Hall, Newcastle-upon-Tyne, at 3 p.m. "Dry cleaning of coal," by J. S. Carson.
- Jan. 17. INSTITUTION OF THE RUBBER INDUSTRY. Sales Section. Engineers' Club, Coventry Street, W.1. "Retail selling," by H. G. Selfridge, junr.
- Jan. 17. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Cantor Lecture 1). "Recent progress in optics," by Prof. L. C. Martin. (Also on Jan. 24.)
- Jan. 18. INSTITUTE OF BREWING, Scottish Section. Caledonian Station Hotel, Edinburgh. "Beer from the brewery to the consumer," by J. Carmichael.
- Jan. 18. HULL CHEMICAL AND ENGINEERING SOCIETY. Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m. "The Lodge-Cottrell electrical precipitation process," by H. W. C. Henderson.
- Jan. 18, 19. SOCIETY OF GLASS TECHNOLOGY. College of Technology, Manchester, on January 18, at 2.30 p.m. (1) "The effect of cullet on the melting of glass," by Prof. W. E. S. Turner. (2) "Investigation of the glassy state by the method of forced crystallisation," by Prof. J. F. Ponomareff. (3) "The durability of some soda-lime magnesia glasses," by V. Dumbleby and Prof. W. E. S. Turner. (4) "The thermal expansions of some borate containing glasses," by Prof. W. E. S. Turner and F. Winks. On Wednesday, January 19, a visit will be paid to the Manchester Ship Canal at 10.0 a.m. Luncheon will be taken in the Grand Hotel, Manchester, at 1 p.m., and at 2.30 p.m. a Conference will begin, when two addresses will be given—"The present position of the glass industry in Germany," by Prof. W. E. S. Turner, and "Developments in the glass industry in Russia," by Prof. J. F. Ponomareff.
- Jan. 19. INSTITUTE OF CHEMISTRY, Bristol and S.W. Counties Section. The University, Woodland Road, Bristol, at 7.30 p.m. "Researches on the nutrition of fruit trees," by T. Wallace. Members of the Society of Chemical Industry are invited to attend.
- Jan. 19. INSTITUTION OF CIVIL ENGINEERS, Students' Meeting. Great George Street, Westminster, S.W.1, at 6.30 p.m. "The testing of heat engines," by H. R. J. Burstall.
- Jan. 19. INSTITUTE OF CHEMISTRY, London and South Eastern Counties Section. Visit to the Government Laboratory, Clement's Inn Passage, Strand, W.C.2. Tea will be served at the Laboratory before the visit at 4.30 p.m.
- Jan. 19. SOCIETY OF GLASS TECHNOLOGY. Meeting in Manchester.

- Jan. 19. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Ordinary Meeting). "Development of the petroleum industry in Persia," by Sir John Cadman. The Rt. Hon. Viscount Inchcape will preside.
- Jan. 19. ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY, Northampton Polytechnic Institute, St. John Street, Clerkenwell, E.C.1, at 8.15 p.m. "Electrodeposited coatings for prevention of corrosion," by H. Sutton.
- Jan. 20. UNIVERSITY OF LONDON, University College, Gower Street, London, W.C.1, at 5 p.m. "The biological action of light," by Dr. D. T. Harris. (Also on Jan. 27.)
- Jan. 20. CHEMICAL SOCIETY, Burlington House, Piccadilly, W.1, at 8 p.m. *Ordinary Scientific Meeting.*
 (1) "The glow of arsenic," by H. J. Emeléus.
 (2) "On the origin of the spectrum of the glow of phosphorus," by H. J. Emeléus and R. H. Purcell.
- Jan. 20. BIRMINGHAM METALLURGICAL SOCIETY, Engineers' Club, Waterloo Street, Birmingham, at 7 p.m. (Arranged by the Co-ordinating Committee.) "Refractories," by Prof. W. G. Fearnside.
- Jan. 20. INSTITUTION OF MINING AND METALLURGY, General Meeting, Burlington House, Piccadilly, W.1.
- Jan. 20. SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY, *Edinburgh and East of Scotland Sections. Joint Meeting.* The Pharmaceutical Hall, 36, York Place, Edinburgh, at 7.30 p.m. "The importance of fuel research in the coal problem," by Dr. C. H. Lander.
- Jan. 21. INSTITUTION OF MECHANICAL ENGINEERS, Storey's Gate, St. James's Park, London, S.W.1, at 6 p.m. "Use and economy of high-pressure steam plants," by Prof. A. L. Mellanby and Prof. W. Kerr.
- Jan. 21. SOCIETY OF CHEMICAL INDUSTRY, *Liverpool Section.* The University, Liverpool, at 6 p.m. "Some physico-chemical and bio-chemical aspects of malignant growths," by Prof. W. C. McC. Lewis.
- Jan. 21. SOCIETY OF DYERS & COLOURISTS, *Manchester Section.* 36, George Street, Manchester, at 7 p.m. "Modern industrial chemistry," by R. S. Horsfall.
- Jan. 21. SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY, *Glasgow and West of Scotland Sections.* Engineers' and Shipbuilders' Institute, 39, Elmbank Crescent, Glasgow, at 7 p.m. "The volatility and carbonisation of oils for cylinder lubrication," by J. W. Donaldson.
- Jan. 22. SOCIETY OF CHEMICAL INDUSTRY, *Birmingham and Midland Section.* Annual Dinner.
- Jan. 22. SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY, *Birmingham and Midland Sections.* Chemists' Dinner. The Queen's Hotel, Birmingham, at 7 p.m. The guests will include the President of the Institute of Chemistry, Prof. G. G. Henderson, and the President of the Society of Chemical Industry, Mr. F. H. Carr, C.B.E.
- Jan. 24. INSTITUTE OF CHEMISTRY, *Leeds Area Local Section.* "The training of the fuel chemist," by Prof. J. W. Cobb.
- Jan. 25. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 4.30 p.m. "The sugar resources of the British Empire," by B. H. Morgan.
- Jan. 26. SOCIETY OF CHEMICAL INDUSTRY, *South Wales Section.* University College, Singleton Park, Swansea. "Quantitative spectrographic analysis," by Capt. J. R. Green.

CORRESPONDENCE

PHARMACISTS AND CHEMICAL ANALYSIS

SIR,—May I use the hospitality of your columns to draw attention to certain curious statements which have been made (apparently in all seriousness) by a pharmacist, which may be of interest and amusement to your readers. "Chemical analysis as a science has been framed and developed by pharmacists, and it remains to this very day the main part of a pharmacist's training and occupation. . . . Ever since analysis has been practised it has been the pharmacist's chief occupation, and it is a job only for pharmacists"

Yours etc.,
R. F. HUNTER

SPACE FORMULÆ

SIR,—You have several times asked for information about space formulæ. By the time you have read to the end of this letter, I think you will realise more about the subject; you can hardly know much about it, otherwise you would not have written so light-heartedly about it; a fluent pen hardly compensates for lack of knowledge.

Suppose you want a space formula on the lines of the usual pictures of crystals; these are all drawn on a conventional plan; you assume you are looking slightly down on to the crystal. If you look slightly down on to a circle it looks like an ellipse. In the cubic system,

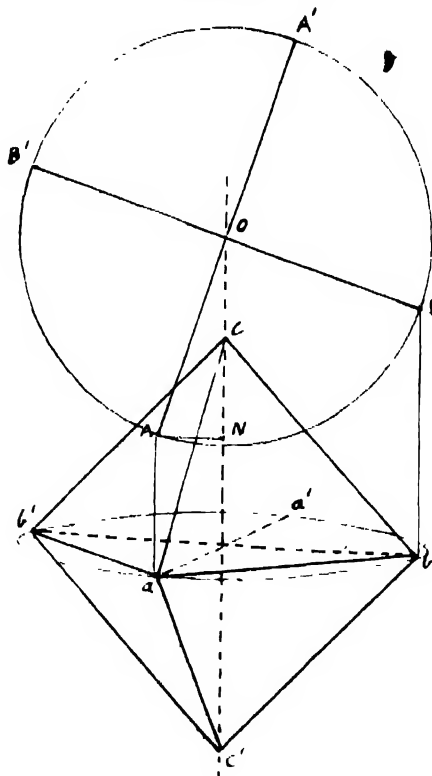


Fig. 1

which is the easiest to begin with, and to which the tetrahedral carbon atoms belong, you must draw a circle in which two axes are diameters and draw a vertical line to represent the third vertical axis (Fig. 1); if

CC' represents the vertical axis, the ellipse will give the appearance of the circle, and the two axes AA' and BB' will become aa' and bb' in the ellipse. The small diameter of the ellipse is one-sixth of the diameter of the circle, and every vertical chord of the ellipse is one-sixth of the corresponding vertical chord of the circle. This gives you the correct ellipse for the conventional angle for the elevation of the eye $9^\circ 28'$. The conventional

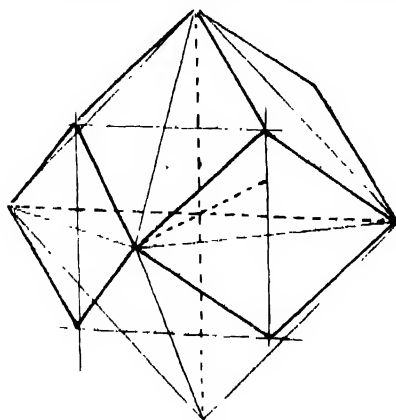
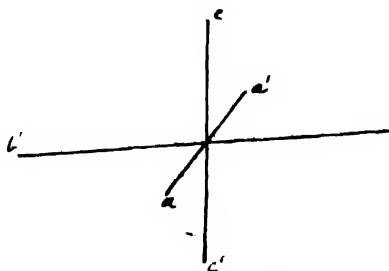


FIG. 2

position of the two axes AA' and BB' is that shown in the diagram, and is such that AN is one-third of ON . The vertical axis is not foreshortened, and is therefore equal to the diameter of the circle. By joining the ends of the axes you get a projection of the octohedron. If you bisect the edges of the octohedron and draw lines through the points of bisection parallel to the axes you will get points which give you the rhombic dodecahedron (Fig. 2). In other ways you may draw the cube and all other forms of the cubic crystal. Similarly by drawing the axes of copper sulphate which belongs to the triclinic system, you can get proper pictures of its crystals (Figs. 3 and 4). Now let us choose a simple organic compound like acetic acid; you want two tetrahedra representing the two carbon atoms connected by the apex of each tetrahedron. Draw your vertical axis CC' , your circle, and your ellipse. Draw an equilateral

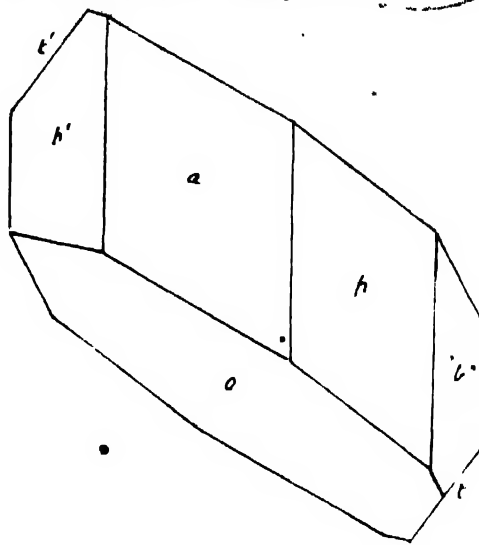


Axes of copper sulphate

FIG. 3

triangle in your circle ABC , its projection in the ellipse will give you its appearance in the drawing (Fig. 5). To get the height of this tetrahedron bisect AB in D and CB in E . Join CD and EA , cutting each other in F , the centre of the circle. If h is the height of a tetrahedron standing on its base $h^2 + FD^2 = CD^2$. On

CD describe a semi-circle, and with D as centre and DF as radius describe a circle cutting the semi-circle in G .



Copper sulphate

FIG. 4

CG is the height of the tetrahedron; set off this length on the axis of CC' , making $OM = CG$ and complete the

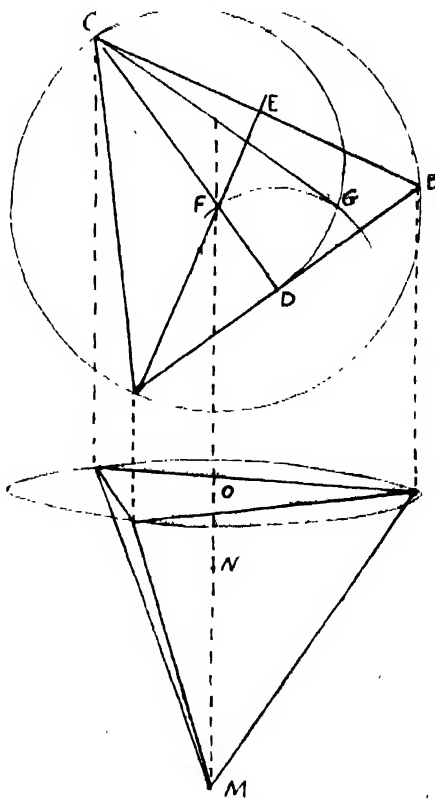
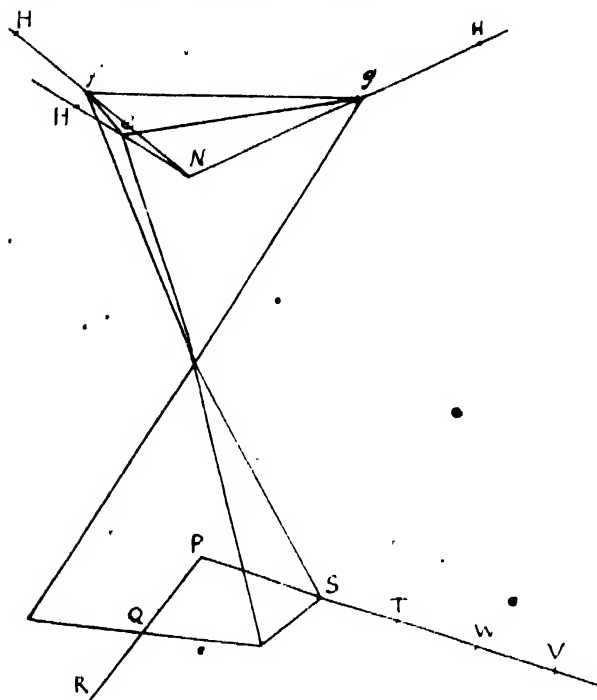


FIG. 5

drawing of your tetrahedron. By calculation or geometry you can find the point N such that N is equidistant from

the corners of the tetrahedron; this is where the nucleus of the carbon atom is situated and ON is a quarter of OM. Draw another tetrahedron at the bottom, as in Fig. 6; if you assume the bottom atom is free to rotate



R and T, oxygen V, hydrogen

FIG. 6

about the CC' axis, it is immaterial how you arrange the corners; if you assume any constant position for them, draw them accordingly; it will not be very easy for anyone to prove you are wrong. To place the centres of the hydrogen atoms joined on to the top carbon atom, draw lines Ne, Nf and Ng. You can assume the volume of a hydrogen atom is a quarter that of the carbon atom if you like, no one can prove it is not so. In that case

if H represents the hydrogen nucleus $\frac{Hc}{Ne} = \frac{1}{\sqrt[3]{4}}$ and so

on for the other two corners. When you come to the COOH part of the picture, you can get your carbon atom nucleus, and assume that the one oxygen atom is symmetrically placed, i.e., its centre is along the line PQR. You have to assume the size of the oxygen atom and draw it in accordance with your assumption; personally, I assume that it is not a sphere in this particular compound, but is more the shape of a bolster; it does not matter, no one can prove it yet. I put its centre at R, where $\frac{QR}{PQ} = \frac{1}{\sqrt[3]{4}}$. As to the hydroxyl

group, I put the centre of the oxygen atom at T, where $\frac{ST}{SP} = \frac{1}{\sqrt[3]{4}}$, and I put the centre of the hydrogen atom at V, where VW is equal to ST. If you accept the principle of close-packing, a few minor adjustments must be made, but they are so small as to be hardly noticeable on drawings of this size. Sir, take a piece

of paper and a wet towel and sit down to a little geometry. Draw yourself a projection of a molecule of camphor or iodoform, and see how many assumptions you have to make, and how long it takes you to make them, and whether the result is worth the trouble. You may learn a little geometry in the process; anyway, you will learn not to write any more editorials asking chemists to supply you with space formulae.

Yours, etc.,

E. MURGATROYD

PERSONAL AND OTHER ITEMS

Sir Harry McGowan, Lieut.-Col. Pollitt, and Mr. B. E. Todhunter have been added to the Board of International Combustion, Limited.

Dr. P. Hartley has been awarded the William Julius Mickle Fellowship of the University of London for 1927 in respect of the work he has carried out for the past five years on problems of serology and immunity.

We regret that in our extract from the New Year Honours List we omitted the name of Dr. H. T. Tizard, F.R.S., the Principal Assistant Secretary to the Department of Scientific and Industrial Research, who becomes a C.B.

Dr. George McOwan, M.A., B.Sc., Ph.D., lecturer in chemistry in the United College of St. Salvator and St. Leonard, University of St. Andrew, has been appointed reader in chemistry at Raffles College, Singapore.

Mr. A. E. Marshall, consulting chemical engineer, who was recently elected president of the Association of Chemical Equipment Makers in the United States, was born in Liverpool, England. For a time he was a plant superintendent with the United Alkali Co., Ltd., and later joined the Thermal Syndicate, going to New York in 1912 as manager for the Thermal Syndicate of New York. Since 1921 he has been engaged in consulting work.

The American Petroleum Institute has granted \$4,000 to Johns Hopkins University for use in research, with the object of establishing scientific methods for the identification of sulphur compounds in petroleum. The work will be carried on by Dr. Parry Borgstrom.

The British Thomson-Houston Company has presented two electric motors to the Coal Treatment Laboratory in the University of Birmingham.

Mr. A. Oldroyd, managing director of the Dewsbury branch of the Yorkshire Dyeware & Chemical Manufacturing Co., Ltd., has died, aged 73.

We regret to learn of the death, at the age of 74, of Dr. E. H. Rennie, for over forty years Professor of Chemistry in the University of Adelaide. He contributed papers on the chemistry of various natural products to the JOURNAL of the Chemical Society.

The late Mr. F. N. Layman, manufacturing chemist, left £63,062, with net personalty £62,542.

The death is announced of Mr. F. Whowell, general manager of the Bleachers' Association, Ltd.

Dr. F. J. Moore, former professor of organic chemistry in the Massachusetts Institute of Technology, has died, aged 59 years.

Technical Data

M. Ch. Marie, General Secretary of the International Committee responsible for the publication of the "Annual Tables of Constants and Numerical Data," announces the publication of a volume entitled "Numerical Data for Engineering—Metallurgy," extracted from Vol. V of the "Annual Tables." The volume, which is by M. L. Descroix, and contains a preface by Sir Robert Hadfield, Bart., F.R.S., includes all the data relating to engineering and metallurgy for the years 1917–1922 inclusive. The price of the volume is, paper backed, 105 francs, bound 126 francs, but to members of the Society of Chemical Industry the price is reduced to 78.75 francs and 94.50 francs, respectively.

A similar volume, also extracted from Vol. V of the "Annual Tables," and entitled "Numerical Data for Electricity, Magnetism, Electrochemistry," by M. G. Malapert, Dr. A. Buffat, Dr. G. I. Higson, and Dr. K. Gordon, has also been published. The price, paper backed 56 francs, bound 77 francs, is reduced, for members of the Society of Chemical Industry, to 42 francs and 57.75 francs, respectively.

Research Association of British Paint, Colour and Varnish Manufacturers

Arrangements have been made to purchase a property at Teddington, near to the National Physical Laboratories, to be used as the research station and laboratories. It is hoped that the premises will be ready for occupation by the end of March. A Technical Advisory Committee was appointed at a meeting of the Council held on January 4 to consider and draw up the preliminary programme of research. A second member of the technical staff has been appointed, viz., Dr. J. O. Cutter, Ph.D.

Recent Publications of the Department of Scientific and Industrial Research

Building Research Technical Paper, No. 4 (H.M. Stationery Office, price 6d.), discusses methods for determining the free lime in hydraulic cement. The resistance of cement to sea water, fire and other agencies depends largely upon its content of free lime, and the description of reliable methods of estimation will be welcome to those who have to deal with hydraulic cement.

Success in the kiln seasoning of wood depends upon a knowledge of the movement of moisture in the wood, a subject which is dealt with in the second Technical Paper of the Forest Products Research Laboratory. The experimental results obtained illustrate the factors which require consideration in the application of artificial seasoning.

Institute of Metals

At the annual general meeting of the Institute of Metals, to be held in London on March 9 and 10, 17 papers are expected to be submitted. In the evening of March 9 the annual dinner of the Institute will take place at the Trocadero Restaurant. Following the dinner—at which there will be a curtailed toast list—a dance will be held. This dinner dance is the first function of the kind to be arranged by the Institute.

The annual autumn meeting of the Institute of Metals will be held at Derby in September. Arrangements for

the meeting are being made under the direction of Sir Henry Fowler, K.B.E., LL.D., of Derby. Sir Henry, who is Chief Mechanical Engineer of the London Midland & Scottish Railway Company, has just been appointed a Vice-President of the Institute.

The past year witnessed a steady growth in the membership of the Institute of Metals in spite of Great Britain's industrial troubles. The membership on December 31, 1926, was 1,801, as compared with 1,692 a year previously. If this rate of increase is but slightly raised during 1927 the membership should reach the 2,000 mark before the Institute celebrates its twentieth anniversary next year. The next election to membership is due to take place on January 19, followed by another on February 23. Particulars of the Institute, incorporated in a newly-issued booklet, can be obtained by intending applicants for membership from the Secretary, Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, London, S.W.1.

Beet Sugar Industry

The Anglo-Scottish Beet Sugar Corporation factory at Poppleton, York, one of six factories now under the control of the corporation, was officially opened on January 7 by Lady Invernairn. The factory is said to be capable of dealing with 10,000 tons of beet daily.

A contract for the erection of a beet sugar factory at King's Lynn, to deal with 1200 tons of beet per day of 24 hours, has been placed with Fawcett, Preston & Co., Ltd., sugar machinery manufacturing engineers, of Liverpool. This factory, which will be ready for the 1927 beet crop, will be operated by a company to be formed by the Anglo-Dutch Group. It will be the 15th beet sugar factory in Great Britain.

Research in Pure Chemistry at Mellon Institute

According to Dr. Edward R. Weidlein, director, Mellon Institute of Industrial Research, University of Pittsburgh, there has been established in the Institute a definite department of research in pure chemistry, with Dr. Leonard H. Cretcher as the head. As a senior fellow of the Institute, Dr. Cretcher (A.B., Michigan, 1912; Ph.D., Yale, 1916) has been in charge of the institution's fundamental chemical studies since 1922, and has published jointly with several assistants and other members of the Institute a number of papers on the results of their organo-chemical researches.

As head of the new department, Dr. Cretcher will have supervision over all the Institute's investigations in pure chemistry, and will also serve as an adviser to industrial fellows who are carrying on research on problems in synthetic organic chemistry. Dr. Weidlein says in his announcement of the departmental plans that Dr. Cretcher's activities will be operated as an integral part of the Institute, and will be sustained by institutional subsidy. Dr. William L. Nelson (B.S., Trinity, 1920; Ph.D., Pittsburgh, 1926), who has been named as the first fellow in the department, was a member of the staff of the department of chemistry of the University of Pittsburgh during the period 1922–6.

Dr. Weidlein states that while Mellon Institute is primarily an industrial experiment station, it has always recognised the need of fundamental scientific

research as a background and source of stimulus for investigation on behalf of industry. During the past five years the Institute has been giving a constantly increasing amount of attention to the encouragement and support of research in pure chemistry, and has been progressively successful in arranging for funds to devote to the prosecution of investigations not suggested by industry, but planned within the Institute, and aimed towards the study of more basic problems than those usually investigated for direct industrial purposes. In the Institute's new department of research in pure chemistry this interest and work will be nurtured and given opportunity to expand.

American Electrochemical Society

The Spring Meeting of 1927, which marks the twenty-fifth anniversary of the Society's organization, will be held at the Benjamin Franklin Hotel, Philadelphia, on April 28, 29 and 30. Elaborate preparations are in hand to make this anniversary meeting an exceptional one. A symposium, presided over by Dr. H. S. Taylor, will be held on "The electrochemistry of concentrated solutions," and great interest is also being shown in the symposium on "The gaseous reduction of ores," papers having been promised on the reduction of iron, nickel, tungsten, molybdenum, zinc and tin ores.

An unusual opportunity to visit reduction and refining plants will be afforded by the "North-western Trip" of the Society in the coming autumn, when a visit will be arranged to numerous metallurgical plants in the Pacific North-west.

Research in Cotton

Speaking recently at the Manchester Athenaeum, Dr. J. C. Withers, describing some of the recent work at the Shirley Institute, said the Institute now possessed a method of ascertaining the source of raw cotton of varying origin. They had gained valuable experience in testing mechanical and other damage to raw cotton, and had developed a new standard yarn tester. A successful examination had been made of the thermal properties of a fabric, and in consequence the development of new methods of manufacture was foreshadowed.

United States Chemical Industry in Conference

Plans are being made in the United States for a conference of leaders of the chemical industry under the auspices of the Chemical Trades Advisory Committee of the U.S. Department of Commerce.

Alkali Cyanide in Furnace Gases

Following its investigations of alkali-cyanide concentration in blast-furnace gases, the U.S. Bureau of Mines has concluded that it seems unlikely that the operation of the blast furnace would be adversely affected by the withdrawal of a small part of the gas for the recovery of cyanides. If one-tenth of gas at a certain plane in the furnace studied by the U.S. Bureau of Mines were withdrawn, it is estimated that the daily recovery of crude cyanide would be 1,040 lb., which, at 10 cents a pound, would be worth \$104.

The Sesamum Crop of British India

From information received from reports of states which comprise, on an average, 79.5% of the total area under sesamum in India, the total acreage estimated at present is 3,157,000, as against 3,193,000 acres at the same time

last year. Present condition of the crop is, on the whole, fair.

Indigo Crop of British India

From information received from provinces which contain about 85% of the total area under indigo in India, the total acreage is estimated at 100,400, or 25% below the area of last year. The total yield of dye is estimated at 20,100 cwt., as against 28,200 cwt. last year, or a decrease of 29%.

Nickel in Canada

The nickel content of nickel compounds sold from Canadian plants during the first half of 1926 totalled 34,519,896 lbs., valued at \$7,702,754, as compared with a total of 34,810,990 lbs., worth \$7,792,145 reported during the first half of 1925. Nickel is exported from Canada as refined metal or as the oxide, and some is shipped as nickel-copper matte for refining elsewhere.

Restricted Imports of Chemical Plant into Russia

It is reported that the Soviet Industrial Planning Authority has decided to reduce the programme of imports of chemical plant by 30%. The chemical trusts view the decision with concern, however, as they believe that the result will be to hamper certain sections, particularly the rubber and match industries, very greatly.

European Glue Syndicate

It is reported from Geneva that the European producers of glue have formed a syndicate, with the object of reducing competition. It is not known how far the syndicate will be representative as it appears that some large manufacturers, particularly in Holland, are not included in it.

Nitrogen Fixation in Germany

The Klockner concern has made an agreement with the Kuli Industrie A.-G. relating to supplies of fixed nitrogen for the manufacture of a new compound fertiliser. The Claude process will be used, if satisfactory arrangements can be made with the patentees, and either the existing factory will be enlarged or a new one will be built.

The Action of Organic Compounds on Alcoholic Fermentation

In a recent paper (*G. Chim. Ind.*, Nov., 1926), Prof. Mameli, of Parma, describes the results of a long series of investigations into the action of organic compounds on alcoholic fermentation. Many groups were examined, and it was found that phenoxyacetic acids and their sodium salts, cumarones, and diketobenzoisoxazines, greatly stimulated alcoholic fermentation when added in very small concentrations, but when used in higher concentrations, depressed the rate. As phenoxyacetic acids and cumarones not only stimulate enzymic activity, but are able to raise the body temperature without causing symptoms of local intolerance, properties which are both associated with biocatalytic agents such as hormones and vitamins, further work is to be carried out to ascertain whether these compounds can act as vitamins.

The Copper Combine

It is understood that at the conference at Brussels of European members of the International Copper Combine, the British Metal Corporation, one of the most important copper firms, announced its intention to leave the combine, owing principally to the price policy of the combine.

REVIEWS

THE ESSENTIAL OILS. By HORACE FINNEMORE, B.Sc.
Pp. xv+880. London: Ernest Benn, Ltd., 1926.
Price: 70s. net.

Treatises on essential oils are often subdivided into three sections, the first being descriptive of individual oils, while the others deal respectively with the chemistry of the component substances and the general analytical methods used in this branch of organic chemistry. Mr. Finnemore has combined these three aspects of the subject, his arrangement of the material being based upon the botanical system of Engler and Gilg. The chemistry of the individual substances, together with the methods used in their diagnosis and isolation, are consequently discussed in a sequence which may appear somewhat unusual to the chemical reader. This method of treatment, however, allows of a welcome curtailment of the enormous mass of data which must necessarily be handled in a work of this kind. In the opinion of the reviewer, the author has rightly refrained, in a work of one volume, from entering into the detailed chemistry of individual substances, the references to original papers being sufficient in most cases to permit of the ready acquisition of further information. The analytical details are also given in a clear, concise and satisfactory manner. The test given on p. 573, however, is not necessarily indicative of the presence of *l*- (or *d*-) α -phellandrene in eucalyptus or other oils, unless the pure α -nitrosite—having m.p. 121–122°, and $[\alpha]_D \pm 140^\circ$ to $\pm 150^\circ$ in chloroform after five minutes—can be isolated by fractional crystallisation from the crude product of the reaction.

In all, the work contains accounts of about 2000 essential oils. The descriptions of the more important oils contain details of cultivation, subsequent treatment, physical and chemical characteristics, analysis and uses; statistics are also freely quoted in illustrating their economic value. Analyses of material from various localities are often given, and the author discusses more fully than usual the interesting question of the geographical distribution of various important genera and species. Especially to be commended is the stress laid upon the urgent desirability of developing the production of valuable essential oils in the British Empire, with its almost unlimited diversities of climate and other conditions. An indication of such latent possibilities is afforded, for example, by successful attempts to cultivate in Northern Rhodesia three species of *Eucalyptus* which afford prolific yields of geraniol, citral and cineole, respectively. Mr. Finnemore's summary may be supplemented by adding the striking fact that certain species of this remarkable genus are capable of flourishing in the open as far north as Scotland. The economic possibilities in this one genus, comprising some 300 species, each with its characteristic leaf-oil, are enormous: nevertheless, these possibilities have received little more public recognition in Australia than in Great Britain. That the backward condition of the British essential oil industries is not due to lack of initiative and vigour among British men of science is evidenced by the important advances in this field of enquiry which have accrued during recent years from investigations carried

out not only in Great Britain, but notably also in Australia and in India. It is a pleasing feature of the book under notice that Mr. Finnemore has drawn particular attention to these "steady and valuable researches," which in some instances are of equal interest and importance to pure and applied organic chemistry: a case in point is provided by the recognition, in India, of *d*-piperitone in a Himalayan grass oil (p. 145) almost immediately after the characterisation, in Australia, of *l*-piperitone from a series of *Eucalyptus* oils (p. 570). It is an additional satisfaction to find in Mr. Finnemore's treatise an able summary of the important but inadequately recognised work of H. G. Smith and R. T. Baker on the essential oils of the eucalypts and Australian pines.

The plan of this book demands a thoroughly comprehensive index, and in this respect there is undoubtedly room for improvement. Although satisfactory for the direct indication of individual oils, the present index often affords little guidance to the occurrence of particular substances; indeed, in some instances one reference only is given to a component which is mentioned repeatedly in the text. As a further example, the five references to piperitone ignore the important occurrence of *d*-piperitone in the oil of *Andropogon Jwarancusa*. The references to analytical methods are likewise scanty; such entries as "Acetylation," "Saponification," "Aldehydes, determination of," etc. are absent, although the text contains descriptions of standard methods which should be indexed under these headings. An author index would be an additional aid to chemical investigators in this field.

Taken in its entirety, Mr. Finnemore's book provides a noteworthy and valuable contribution to the literature of essential oils. It may be recommended with confidence to chemists, botanists, manufacturers, oil distillers and others who require a handy and up-to-date account of this increasingly important subject. The book is printed in a large and clear type, and its appearance reflects credit on the printers and publishers. It may be suggested, however, that the decidedly high price of the volume might have been reduced appreciably by adopting a less expensive format, in particular by omitting the plates, which, although interesting, are not indispensable.

JOHN READ

CHEMISTRY OF THE OIL INDUSTRIES. By J. E. SOUTHCOMBE, M.Sc., Second edition, revised and enlarged
Pp. xiv + 224. London: Constable & Co., Ltd., 1926. Price: 12s. 6d. net.

The object of this work, as indicated by the author in the Preface, is to form a bridge between the elementary text-books of pure chemistry and the numerous technical treatises and monographs of a specialised character. The author has, on the whole, been successful in his aim, for after a useful introductory chapter dealing with the relevant organic chemistry, he passes on, following a chapter dealing with the theory of the colloidal state, to give in broad outline a general account of the mineral oil industry, the sources and modes of preparation of the fatty oils, their composition and properties and the various industrial operations in which they are largely concerned.

Considering, however, that the book is now in its second and revised edition, it is to be regretted that the author has not kept more abreast of the times with some of the subject matter. As an instance, no reference is made to the now well-established hypochlorite method of refining petroleum, the author contenting himself with a description of the older and costlier sulphuric acid and soda method. The statement (p. 216) that "progress in refining during the last decade has been primarily on the engineering side" is one not likely to pass unchallenged by those connected with the chemical side of the petroleum industry.

The account of the production of edible oils (p. 172) is very loosely worded, and badly arranged: one would not recommend the use of alkaline earths and carbonates for removing free fatty acids, nor would one propose to remove volatile matter by boiling the oils with water. The account of the recovery and distillation of glycerin is too meagre, whilst to the now important operation of hydrogenating fatty oils the author devotes only four lines of print (p. 217).

A number of minor errors have crept into the text: cerotic acid should be written $C_{25}H_{51}COOH$ its parent hydrocarbon being hexacosane, $C_{26}H_{54}$, and not pentacosane (p. 25), "trydecyl" should be written tridecyl (p. 25), "pseudo-umene" should be pseudo-cumene (p. 50); one notices also "phytostearol" for phytosterol, "*Cocos*" *nucifera* for *Cocos nucifera*, *Brassica* "*Napus*" for *Brassica Napus* (p. 77), and "Hexo-bromide" instead of Hexabromide (p. 130). H. M. LANGTON

AMBRONN-FESTSCHRIFT KOLLOIDCHEMISCHEN BEIHEFTE. Edited by A. FREY AND W. OSTWALD. Pp. 376. Dresden: Theodor Steinkopff, 1926. Price: 18 m.

The "Festschrift" is a pious and useful institution. Contributors obey the opening injunction of the 14th chapter of Ecclesiastics and enjoy the advantage, which is shared by the reader, of seeing papers dealing with one particular line of research collected in a stately volume. The one under review is largely devoted to the investigation of the structure of disperse systems by polarised light and by X-rays. Summaries of Ambronn's fundamental investigations in this field are given by A. Frey and by C. Steinbrink. A number of papers by E. A. Hauser and H. Mark (stretched india rubber), E. Ott (crystallised albumin), J. R. Katz (synthetic rubber), and Katz and O. Gerngross (tendons) describe X-ray investigations of the structure of colloidal and organised material. K. Hess gives very fine illustrations of the astonishing crystals—fully developed and sometimes macroscopic—of cellulose acetate, which he obtains by slow concentration of solutions in tetrachlorethane. The complex mercury derivatives of sulphosalicylic acid, investigated by Wo. Ostwald and M. Mertens, exhibit a number of remarkable properties, the most striking of which is accidental double refraction, enormous in amount and all the more conspicuous, as the sols of these substances are quite colourless. On the addition of certain dyes they become dichroic (S. Berkman and H. Zocher).

Space forbids the mention of more than one among the remaining contributions, that of H. Siedentopf on anastigmatic condensers for dark ground illumination, which will appeal to students of the beautiful and austere subject of geometrical optics.

The whole volume, as did the Zsigmondy-Festschrift, again gives evidence of great activity, which seems to be in no way hampered by the increasing complexity and costliness of the apparatus required for modern methods of research. E. HATSCHKE

GUM ARABIC, WITH SPECIAL REFERENCE TO ITS PRODUCTION IN THE SUDAN. By H. S. BLUNT, M.A. Pp. 15. London: Oxford University Press and Humphrey Milford, 1926. Price: 10s. 6d. net.

This handsomely produced volume contains only some 40 pages of text divided into thirteen chapters, as follows: Gum, general description; History of the trade; The tree (botanical etc.); Kordofan Province, Exploitation; Markets; Freights and freightage; Royalty; Chemical properties and uses; Water supply of Kordofan Province; Um Ruaba experimental Government plantation; Origin of Gum; Forest Policy. It will be seen that the arrangement of chapters does not follow a very logical sequence. The book concludes with a bibliography, a glossary, a rainfall map of Kordofan Province, and a series of plates of nearly fifty picturesque photographs, some of which are relevant to the subject.

The first chapter consists of half a page, from which it can be inferred that the general description of gum is noteworthy chiefly for its brevity. The only other chapter calling for comment is that entitled chemical properties and uses. This amounts to just over three pages, a rather high proportion being taken up by useless and irrelevant information of a non-scientific and non-technical character, whilst the actual chemical and physical portion is so elementary as to be almost useless. Although a fairly long list of corrigenda is printed, it is not complete, as is shown by "galacose" for "galactose" on page 29. PERCY MAY

ZERKLEINERUNGS-VORRICHTUNGEN UND MAHLANLAGEN. By CARL NASKE. Pp. x + 375. CHEMISCHE TECHNOLOGIE IN EINZELDARSTELLUNGEN, edited by Prof. A. BINZ. Fourth enlarged edition. Leipzig: Otto Spamer, 1926. Price: bound, 36 r.m.; paper, 33 r.m.

The first two hundred pages of this work is devoted to machines employed in size reduction, beginning with coarse crushing machinery of the jaw and gyratory types, passing to fine grinding by descriptions of crushing rolls, impact, hammer and edge runner mills, as well as stamp, ring roller, ball and tube mills, and concluding with a section on wet grinding.

As most of the machines described are of continental manufacture, the book shows the developments in this class of machinery in Europe, and especially in Germany. One failed to notice in this section any mention of the disc crusher either of the vertical or horizontal type, and one might also suggest that as colloids and colloidal solutions are playing an increasingly important part

in many industries, the author may with advantage enlarge the scanty reference to this subject in subsequent editions.

The grouping of particles of the same size forms the subject matter of the next chapter, in which machines are described for effecting this either by the passage of the material over screens or by air separation. Here again the author might consider the expansion of this chapter to include some of the other means of grading. The final portion of the book deals with the transport of materials in bulk to the factory, the different machines employed to move them inside the works, the various methods of removing dust, and concludes with a large section describing layouts of crushing, grinding, sifting and transport units in cement, gas and other works.

The book is well printed and illustrated, but the paper edition, for a book of this value and price, is not sufficiently well bound to enable it to withstand reasonable usage. Cutting of the pages, too, imposes an unnecessary task.

THE CALENDER EFFECT AND THE SHRINKING EFFECT OF UNVULCANISED RUBBER. Dr. W. DE VISSER. Translated from the original Dutch by E. S. ALLSOP. Pp. viii + 152. London: Crosby, Lockwood & Son, 1926. Price: 15s. net.

The anisotropic character frequently exhibited by sheeted rubber has long been a source of trouble to the rubber manufacturer; more recently, however, it has also attracted attention on account of its bearing on the mechanical structure of rubber. The author gives an account of a comprehensive investigation of the subject made mainly in the Rubber Institute laboratory at Delft; a section, however, more physical in character was completed at University College, London. Phenomena associated with this anisotropism include a difference of mechanical properties in different directions, a tendency to recovery, double refraction, exalted specific gravity and rapid hardening. Methods found to be essential to trustworthy results and the influence of various factors are recorded. The nature of this physical condition, which is shown not to be peculiar to natural rubber, but to be shared by other elastic gels such as synthetic rubber and casein, is discussed and referred to a probable partial oriented "crystallisation" of the material.

The volume is attractive in form and type. Misprints are few, and "Casilloa" (p. 128), *Crasiliensis* (p. 147), and a reference to the "rubber particles in gutta percha latex" are not likely to mislead. Unfortunately, reading is frequently rendered difficult by quaint English, a selection of the unusual expressions being "reproductive" and "reproductiveness" for "reproducible" and "reproducibility" (p. 11), "invaluable" for "valueless" (p. 36), "notch" for "projection" (pp. 78 and 90), "oversight" for "record" (p. 142), and "arduous dissolubility" (p. 126). The book, however, is a decided scientific contribution to the literature of a subject which forms the meeting-place for some of the latest structural theories of rubber with the unwritten lore of the practical "rubber man."

D. F. TWISS

REPORT

Report of the Fuel Research Board for the Year 1925, with Report of the Director of Fuel Research. Department of Scientific and Industrial Research. Pp. 79. H.M. Stationery Office, 1927. Price 1s. 3d.

In the report of the Fuel Research Board steady progress is recorded in the work of the Physical and Chemical Survey of the National Coal Resources, under which three new committees have been added to the list. It is pointed out that the importance of methods of sampling and analysis of coal is being increasingly realised. A final report on methods of analysis, embodying those recommended in 1923, with minor amendments, is being prepared, and progress is being made by the sub-committee dealing with the difficult question of sampling. Investigations have been continued into the use of vertical retorts and into the enrichment of the gas by injecting oil during carbonisation. It has been found possible to double the normal rate of throughput, using certain coals. The work on low-temperature carbonisation was continued, employing continuous vertical metal retorts, with the object of obtaining good domestic coke and a maximum of oil-producing tar. A hopeful view is taken of the retort elaborated, but steady work for a long period is required to enable its commercial value to be judged. A description of these retorts is given in both sections of the report.

An increase in the staff has made it possible to carry out further systematic work on the effect of variations in the carbonisation temperature on the gas, tar and coke produced, and laboratory work is being carried out on the nature of the gas and tar, on the reactivity of coke, and on other problems. The constituents of the tar and its possible use as a source of various chemicals are being investigated at the Chemical Research Laboratory at Teddington.

The work on the bacteriological production of power alcohol from cellulosic materials was continued at the Royal Cordite Factory and, as a by-product of this investigation, a binder for briquettes has been prepared from straw and other vegetable materials. It is considered that the method may produce a cheap and effective binder, and if successful may have a very important bearing on the problem of low-temperature carbonisation and the manufacture of "artificial" fuel from coal-dust.

The Director of Fuel Research deals, in his Report, with the Physical and Chemical Survey of the National Coal Resources, with the work done in connexion with the gas industry, low-temperature carbonisation, coal purification, steam-raising, power alcohol, domestic heating, and laboratory and small-scale work. The work on the enrichment of coal gas and on increasing the throughput of vertical retorts is described more fully here. The experimental setting of horizontal retorts was erected during the year and provided with all necessary accessories. Under the heading of low-temperature carbonisation an account is given of the investigations with cast-iron vertical retorts with external heating, and much interesting information is given about the different types of retorts utilised. As difficulties arise, owing to the deterioration of the retorts, the

question of the most suitable metal to withstand higher temperatures is being investigated with the co-operation of the British Cast-Iron Research Association and Prof. H. C. H. Carpenter. It is concluded that, given a suitable metal for the retorts, there is no difficulty in producing a lump coke for domestic use from a suitable blend of coal when charged in reasonably small sizes. Should it be possible to prepare binding material from straw and other vegetable matter, it would be possible to use other types of retorts which produce good tar yields but coke of small sizes, which could then be briquetted into lumps suitable for all purposes. Reference is made to the important tests of low-temperature carbonisation plants which the Government has authorised the Department to carry out. Valuable work is in progress on "low-temperature" tars, mainly from the point of view of the conversion, in the cheapest and best way, of the tar into motor spirit, fuel oil and, if possible, all the other products yielded in quantity by mineral oils. The elucidation of the constituents of the tar with a view to the identification of ingredients of value other than as fuel comes within the province of the Chemical Research Laboratory at Teddington, but no hard and fast division of work is made. Work is being carried out on the distillation of tar and the miscibility of crude low-temperature tar with petroleum fuel oil, including tests of the Lessing process for the removal of the pitch in the tars. Arrangements for installing the experimental coal-washing plant are in hand. Interesting work has been conducted on steam-raising and on the use of motor spirit obtained from coal in a special internal-combustion engine.

In the work on the production of alcohol from cellulose materials, attention is being concentrated on the direct fermentation of hemicelluloses and pentosans, and further progress has been made.

Experiments on problems of domestic heating are now carried out at the new Building Research Station near Watford.

A special section deals shortly with the large amount of laboratory and other analytical work carried out at the Fuel Research Station. Useful results have been obtained on the hydrogenation of coal, using a small pressure bomb. A small continuous plant for the hydrogenation of coal is to be installed, and arrangements have been made by which the British Bergius Syndicate keeps the Department informed of all the experimental work on the Bergius process which is being carried out on British coals. Investigations are being continued on the analysis of coal and coal gas, on the temperature of the initial decomposition of coal, the reactivity of coke, the carbonisation of coal in the form of fine particles (as in the McEwen-Runge process), adsorptive agents for the recovery of benzene, calorimetry, CO and CO₂ recorders, and the X ray analysis of coal.

Amongst the miscellaneous work described is an important investigation, which is being continued, on the spontaneous combustion of coal on ships.

Appendix III contains a summary of progress made by the Physical and Chemical Survey of the National Coal Resources, covering a very large amount of important work, and Appendix IV reproduces a valuable memorandum prepared by Dr. Lander in his capacity as Assessor to the Royal Commission on the Coal Industry (1925).

COMPANY NEWS

CASTNER KELLNER ALKALI CO., LTD.

A net profit of £210,928 is reported for the year to September 30, 1926, making available, with £28,008 brought forward, £238,936, compared with a profit of £296,557 for the previous year. A final dividend has been declared of 14%, making 22% (same), leaving £18,936 to be carried forward.

BRITISH CYANIDES CO., LTD.

The annual general meeting was held on January 4, Mr. C. F. Rowsell, chairman, presiding. In the past, satisfactory results had been obtained by the conversion of sulphocyanide, obtained from the gasworks, by the company's process into ferrocyanide and similar chemicals, but since the war there had been a heavy drop in the price of the chemicals produced, resulting not only in a considerable loss to the company, but rendering its business as a whole unprofitable. The research department had been working continuously to find new uses for the raw material which the company was bound under contract to take from the gasworks, and discovered that a chemical known as thiocarbamide could be produced. About this time the Board had to decide whether to close down the business or continue to manufacture at a loss, and it was decided that as sulphocyanide would be required in large quantities for the new chemical and its development, it would be in the interests of the company to adopt the latter course. Accordingly a scheme was submitted, and subsequently approved, for providing new capital by reducing the £1 shares to 2s. It was then proposed to increase the capital to its original amount of £450,000 by the creation of 3,312,746 new ordinary shares of 2s. each, each shareholder being entitled to subscribe for two new ordinary shares of 2s. each. The position of the preference shareholders was that they were asked to sacrifice the cumulative dividend, which had not been paid up to the present time, and that their dividend should not again become cumulative until after the end of 1928. They would also be given the option of converting their shares into ordinary shares at the rate of five ordinary shares for one preference share for three years. Mr. Kenneth M. Chance, the managing director, said that the most important factor in the situation of the company was that for the development of their new industries they must control a cheap supply of thiocarbamide, for which cheap sulphocyanide was required. Therefore the contracts with the gasworks must be maintained, and the surplus disposed of. This could only be done by making it into prussiate of soda and selling it as such. The manufacture of moulding powders by the Beetle Products Co. had already reached the commercial stage, the demand, especially before Christmas, being heavy. As regards the cotton side of the industry, the fact that such firms as the Bradford Dyers' Association and Bleachers' Association were co-operating with the company in developing that particular business on a commercial scale should be sufficient evidence that there was a great future for that side of the industry.

ALLEN LIVERSIDGE AND CO., LTD.

An interim dividend has been declared on the ordinary shares at the rate of 10% per annum (5% actual), less tax, being the same as last year's interim.

COMMERCIAL GAS CO., LTD.

A Parliamentary Bill has been deposited by this company for next session, which proposes to reduce the basic price of gas from 1s. per therm to 11.4d. per therm, at which price the standard rate of dividend is proposed to be fixed at 5 per cent. on the ordinary stock issued, all of which is to rank equally for dividend, and at the rate of 6 per cent. on any ordinary stock issued after the passing of this Act. The surplus profits, after payment of these dividends, are to be divided as to three-fourths to the consumers and one-fourth to the ordinary stockholders and employees in two equal shares.

MIDLAND BANK, LTD.

The net profit for the year to December 31, 1926, was £2,535,730, which, with £813,166 brought forward, makes £3,348,896 for appropriation as follows:—To interim dividend for the half-year to June 30 last, paid July 15, and dividend for the half-year to December 31 last, payable on February 1 next, each at the rate of 18% per annum less income tax, £1,823,874; to bank premises redemption fund, £500,000 (£600,000 for 1925); to officers' pension fund, £200,000 (£150,000); leaving £825,022 to be carried forward (£813,166).

LYDENBURG PLATINUM AREAS, LTD.

The first ordinary general meeting was held on December 30 last, Mr. J. A. Agnew (chairman) presiding. After describing the work done at the various properties, the chairman stated that during October 1463 tons of ore were treated at the plant at Maandagshoek, and that up to date 4800 tons had been milled in this plant for an estimated total recovery of 1260 oz. of platinum and associated metals, of which 970 oz. were recovered in the form of metallies and 290 oz. in concentrates, the metals recovered being valued at about £24,224. It has now been decided to double the capacity of this plant, which will then be capable of dealing with a minimum of 100 tons of ore per day; taking platinum at £20 per ounce, and making ample allowance for the treatment of concentrates etc., the estimated profit should be between £10,000 and £12,000 monthly. On the completion of the pilot plant erected on the Dwarsriver property, it was decided to neglect for the time being the treatment of the oxidised ore on the norite reef, which presented many difficulties, and to combine gravity and flotation concentration methods in this plant for the treatment of sulphide ore which lay below the oxides. The plant commenced operating at the end of May and continued until October, 5,180 tons of ore being crushed and treated, the average value being 1.631 dwts. platinoids per ton from which 0.87 dwts., or 53.3%, was recovered. In conclusion, the chairman stated that the balance of £45,000 in hand shown in the balance sheet had been absorbed in further development work, including additions to the Maandagshoek plant. There was a small overdraft from the bankers, and when this had been extinguished by the returns now coming forward from Maandagshoek, and when the Maandagshoek plant is running on the enlarged scale, it was proposed to take up again the development of certain of the ore deposits other than the dunites. He looked forward to concrete and satisfactory results during the current year.

BRITISH METAL CORPORATION, LTD.

At an extraordinary general meeting held on December 23, the resolutions rearranging the capital passed at the extraordinary general meeting on December 8 were confirmed as special resolutions (cf. CHEM. AND IND., December 10 and 17, 1926, pp. 937 and 963).

BRITISH SUGAR MANUFACTURERS, LTD.

The adjourned first ordinary general meeting of this company, formed in 1925 to construct and operate a beet sugar factory in Norfolk, was held on December 31, 1926, Mr. H. E. Carter presiding. A loss of £24,187 was reported for the period ended March 31, 1926, and with the addition of loan and debenture interest, £3,584, and a depreciation allowance of £11,269, the deficit was raised to £39,400. In common with all other countries, the tonnage of beet per acre in this country, especially in the fenland, had been much lower than anticipated. Up to the present the company had put through an untared weight of about 50,000 tons of beetroot, and had produced about 4,700 tons of white granulated sugar and about 2,000 tons of molasses, and they would probably receive sufficient beet to bring them to 55,000 tons untared, thus being about 15,000 tons short of their earlier estimates. The directors anticipated an improvement during the current year, an increased number of applications having already been received from growers.

TURNER AND NEWALL, LTD.

The accounts for the year to September 30, 1926, of this company of asbestos manufacturers show a net profit, after providing for depreciation and taxation, of £287,080, plus £19,127 brought in, compared with £287,936 for 1925. A final dividend of 1s. 6d. per share has been declared, making 2s. per share, less tax (same), and £15,162 has been carried forward.

LIVERPOOL NITRATE CO., LTD.

The accounts for the year ended June 30, 1926, show a profit of £14,598, which with £26,943 brought forward, makes £41,541. After deducting £21,000 for the interim dividend of 1s. 6d. paid last May, a balance remains of £20,541, which it is proposed to carry forward.

BRITISH BURMAH PETROLEUM CO., LTD.

The sixteenth ordinary general meeting was held on December 17, the Hon. L. Holland, chairman, presiding. The total gross production of this and their allied Rangoon Oil Company during the year ended July, 1926, was 646,407 barrels, being 61,175 barrels less than for the previous year. The total working profit for the year was £349,520, compared with £312,270, to which has been added a refund of £5,349 in respect of Dominion income-tax and £6,449 brought forward from 1925. After meeting all charges, the net profit was £83,230, against £53,149. A dividend of 7½d. a share, free of income-tax, was declared. The chairman emphasised the need of keeping sufficient funds available for securing further sources of crude oil supplies, in view of the ever-diminishing supply.

REEVES AND SONS, LTD.

An interim dividend of 2½%, less tax, has been declared on the ordinary shares, payable on January 20.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3¾d. per lb. ex wharf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3¾d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2¾d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
 Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—2s. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 2d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 per ton. Scarce. Grey, £17 5s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£8 5s.—£10 per ton and upwards, according to grade and locality. Very scarce and fair demand.
 Iron Liquor.—1s. 6d. per gal. 32° Tw.; 1s. 2d. per gal. 24° Tw.
 Red Liquor.—10d.—11d. 16° Tw. per gal.
 Wood Creosote.—2s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 10d.—4s. per gal., 60% O.P. Solvent, 4s. per gal., 40% O.P. Both scarce and in fair demand.
 Wood Tar.—£4—£5 per ton and upwards, according to grade.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals, 6½d.—7d. per lb. Crude 60's, 1s. 8d.—1s. 10½d. per gal.
 Acid Cresylic, 99/100.—2s. 2d.—2s. 3d. per gal. Steady. 97/99.—2s.—2s. 6d. per gal. Pale, 95%, 1s. 10d.—2s. 4d. per gal. Dark, 1s. 9d.—2s. 3d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 3½d.—1s. 4½d. per gal., ex works in tank wagons; Standard motor, 1s. 11½d.—2s. 2½d. per gal., ex works in tank wagons; Pure, 2s. 2½d.—2s. 5½d. per gal., ex works in tank wagons.
 Toluene.—90%, 2s. to 2s. 6d. per gal. Firm. Pure, 2s. 3d.—2s. 8d. per gal.
 Xylol.—2s. 3d.—2s. 8d. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9½d. per gal.
 Naphtha.—Crude, 10d.—1s. 1d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, about 1s. 11d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton, Whizzed or hot pressed, £9 per ton.
 Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—112s. 6d.—130s. per ton, f.o.b. according to district. Scarce and more enquiry. Prices nominal.
 Pyridine.—90/140.—9s. 6d.—17s. per gal. Nominal. 90/180.—7s. 6d. per gal. Heavy.—7s.—10s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.*
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—9½d. per lb., naked at works.
 Aniline Salts.—9½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d.—4½d. per lb. Quiet.
 m-Cresol 98/100%.—2s. 8½d. per lb. Quiet.
 p-Cresol 32/34° C.—2s. 8½d. per lb. Quiet.
 •Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—9d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 11d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4d.—2s. 6d. per lb. Firm.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity.
 Acid, Boric B.P.—Cryst. £40 per ton. Powder £44 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 3½d.—1s. 4½d. per lb. Less 5%. Weak market.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4½d.—1s. 6d. per lb. Firm and good enquiry. Technical 11½d.—1s. per lb. Good enquiry.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 0½d. per lb. Less 5%.
 Amidol.—9s. 6d. per lb. d/d.
 Acetanilide.—1s. 7d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £30 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Aspirin.—2s. 4d. per lb. Good demand.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzophenanthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carriage paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium.—1s. 9d.—1s. 11d. per lb. Sodium.—2s.—2s. 2d. per lb. All spot.
 Calcium Lactate.—1s. 4d.—1s. 6d. per lb.
 Chloral Hydrate.—3s. 3d.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 1½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—6s. 6d.—7s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 8d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green. 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £33 per ton net.
 Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%; Heavy Pure 2s.—2s. 3d. per lb., according to quantity.
 Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 12s.—14s. per lb., according to quantity. Liquid (95%), 12s. per lb. Detached cryst., 15s. per lb.
 Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig. 6s.—6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 2d.—4s. 3d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 4s. 11d.—5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonol.—15s. 6d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. 9d.—4s. per lb.
 Phenazone.—5s. 9d.—6s. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 82s. per cwt., less 2½% for ton lots. Dearer.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6½d. per lb. spot.
 Quinine Sulphate.—2s. per oz.—1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s.—4s. 3d. per lb. spot.
 Saccharin.—55s. per lb. Quiet.
 Salol.—3s.—3s. 3d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s. 1d.—2s. 2d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carriage paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—80s.—85s. per cwt. net, according to quantity.
 Sod. Salicylate.—Powder, 1s. 10d.—1s. 11d. per lb.; Crystal, 1s. 11d.—2s. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton, according to quantity, 1-cwt. kegs included.
 Sulphonol.—10s. 6d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
 Thymol, Purif.—11s.—12s. per lb., according to quantity.
 Natural.—17s. 6d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
 Anubine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—11s. per lb.
 Citronellol.—15s. per lb.
 Citral.—9s. 6d. per lb.
 Ethyl Cinnamate.—10s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa). 11s. per lb.
 Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Shui Oil*) 12s. per lb. (*ex Bois de Rose*) 16s. per lb.
 Linalyl Acetate.—(*ex Shui Oil*) 14s. 6d. per lb. (*ex Bois de Rose*) 18s. 6d. per lb.
 Methyl Anthranilate.—9s. per lb.
 Methyl Benzoate.—4s. 6d. per lb.
 Musk Ketone.—36s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—11s. per lb.
 Rhodinol.—28s. 6d. per lb. Safrinol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—17s. 3d.—19s. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—31s. 6d. per lb. Bourbon Geranium.—12s. per lb.
 Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb. Cassia, 80/85%, 8s. 6d. per lb. Cinnamon, Leaf.—5½d. per oz. Citronella.—Java 85/90%, 2s. 4d. per lb., Ceylon, Pure, 1s. 11d. per lb. Clove, pure—6s. 3d. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 19s. per lb. Lemon.—9s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—9s. 9d. per lb. Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—10s. per lb. Peppermint.—Wayne County, 25s. 6d. per lb. Japanese, 9s. 6d. per lb. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

THE Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Mar. 7th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Jan. 20th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Allis-Chalmers Manuf. Co. Commminuting-mills. 32,842. Dec. 29. (U.S., 15.4.26.)
 Bargeboer. Regulating liquid level in evaporating-vessels. 32,908. Dec. 30. (Ger., 6.11.26.)

Dunsmore. Hydro-extractors etc. 32,922. Dec. 30.
 I.-G. Farbenind. Recovery of reaction products from gases. 32,947. Dec. 30. (Ger., 30.12.25.)
 Kuhn. Liquid separator. 32,800. Dec. 28.
 Loesche. Grinding-mills. 32,837. Dec. 29.
 Pahl. Filter sieves. 32,898. Dec. 29.
 Pasquiers. Drying-apparatus. 32,793. Dec. 28. (Fr., 28.12.25.)

II.—Complete Specifications

32,363 (1925). Baker Perkins, Ltd., and Pointon. Hydro-extractors. (263,303.)
 819 (1926). Lucas. Furnaces. (263,312.)
 6015 (1926). Fesca. Centrifugal separators. (263,348.)
 9516 (1926). Robertson (Power Specialty Co.). Furnaces. (263,369.)
 21,713 (1926). Svensson and Norling. Drums for centrifugal separating-apparatus. (263,443.)
 22,149 (1926). Mellvaine. Apparatus for determining the moisture content of masses of particles. (263,450.)
 *26,776 (1926). I.-G. Farbenind. Process for the detection of silicic acid gel. (263,483.)

III.—Applications

Asiatic Petroleum Co., Ltd., and Joyce. Oxidising heavy petroleum oils etc. 32,959. Dec. 30.
 Boscik, Hodler, and Maschinenfabr. Augsburg-Nürnberg. Carbonising-machines. 32,861. Dec. 29. (Ger., 30.12.25.)
 Evans (Kohlenveredlung A.-G.). Distillation of carbonaceous substances etc. 33,092. Dec. 31.
 Guertner. Distilling etc. coal. 32,862. Dec. 29.
 La Rillisiere. Cracking mineral oil etc. 33,066. Dec. 31.
 Tully and Yeo. Manufacture of gas for heating etc. 33,077. Dec. 31.

III.—Complete Specifications

27,972 (1925). Carr, Toogood, and Dempster & Sons, Ltd. Retort furnaces. (263,269.)
 11,078 (1926). Maze. *See* III.
 19,215 (1926). Norton. Washers for coal and the like. (263,422.)

III.—Application

Combustion Utilities Corp. Purification of tar oils. 32,978. Dec. 30. (U.S., 22.9.26.)

III.—Complete Specification

11,078 (1926). Maze. Purification and hydrogenation of liquid hydrocarbons. (263,381.)

IV.—Applications

Harris, Thomas, Wylam, and Scottish Dyes, Ltd. Dyes etc. 32,888. Dec. 29. Dyes etc. 33,064. Dec. 31.
 Hereward, Thomas, and Scottish Dyes, Ltd. Dyes etc. 32,887. Dec. 29.
 I.-G. Farbenind. Manufacture of thiomorpholines of the anthraquinone series. 32,839. Dec. 29. (Ger., 29.12.25.)
 Manufacture of alkynaphthalenes. 32,840. Dec. 29. (Ger., 29.12.25.)
 Manufacture of benzanthrone derivatives. 32,841. Dec. 29. (Ger., 30.12.25.)
 Manufacture of dyestuffs. 32,956. Dec. 30. (Ger., 30.12.25.)
 Kritchewsky and Prutman. 32,851. *See* VI.

IV.—Complete Specifications

9726 (1926). Carpmal (I.-G. Farbenind.). Manufacture of 1:4-diarylamino-5:8-dioxyanthraquinones. (263,370.)
 10,559 (1926). Carpmal (I.-G. Farbenind.). Reduction of aromatic nitro compounds. (263,376.)
 *32,301 (1926). I.-G. Farbenind. Manufacture of vat dyestuffs of the anthraquinone series. (263,494.)

V.—Complete Specification

25,081 (1926). Grunert. Producing artificial silk filaments. (263,462.)

VI.—Application

Calvert. Treatment of vegetable fibres. 33,005. Dec. 31.
Kritchovsky and Prutsman. Chemicals for colouring fabrics. 32,851. Dec. 29. (U.S., 5.5.26.)

VI.—Complete Specifications

23,475 (1925). Bedford. Dyeing artificial silk. (263,222.)
25,192 (1925). Tootal Broadhurst Lee Co., Ltd., and Foulds. Production of pattern effects on acetyl silk fabric. (263,248.)
26,576 (1925). British Celanese, Ltd., and Ellis. Dyeing, printing, and stencilling cellulose acetate. (263,260.)
28,282 (1926). Brit. Celanese, Ltd., and Ellis. Dyeing or colouring yarns, fabrics, etc. (263,473.)

VII.—Application

Clayton, Gibbs, and Salt Union, Ltd. Preparation etc. of sodium chloride compositions. 32,999. Dec. 31.

VII.—Complete Specifications

31,777 (1926). Soc. Anon. Le Salvoxy. Apparatus for the production of oxygen. (262,318.)
6,914 (1926). Brit. Celanese, Ltd. (Amer. Cellulose & Chem. Manuf. Co.). Printing fabrics and articles made of or containing cellulose esters or ethers. (263,355.)
*26,776 (1926). I.-G. Farbenind. See I.

VIII.—Applications

Bichereux. Manufacture of raw plate glass. 32,847-8. Dec. 29. (Ger., 30.12.25.)

VIII.—Complete Specification

16,557 (1926). Haddan (Corning Glass Works). Manufacture of glass or quartz transparent to ultra-violet light. (263,410.)

IX.—Complete Specifications

23,445 (1925). Lanhoffer. Preparation of raw materials for cement. (263,221.)
253 (1926). Thompson and McGivern. Bitumen emulsion. (263,308.)

X. Applications

A.-G. Brown, Boveri, et Cie. Electric smelting-furnaces. 33,070. Dec. 31. (Ger., 2.1.26.)
Beeston. Annealing-furnaces. 33,007. Dec. 31.
British Thomson-Houston Co., Ltd. Refining metals. 32,942. Dec. 30. (U.S., 31.12.25.)
Krupp Grusonwerk A.-G. Treatment of zinciferous flying dust. 32,876. Dec. 29. (Ger., 4.2.26.)

X.—Complete Specifications

9098 (1926). Greenawalt. Sintering apparatus. (263,363.)
15,090 (1926). Croy. Aluminium solder. (263,402.)

XI.—Applications

A.-G. Brown, Boveri, et Cie. 33,070. See X.
British Thomson-Houston Co., Ltd. Electric furnaces. 32,943. Dec. 30. (U.S., 31.12.25.)
Comp. Franc. pour l'Exploit. des Proc. Thomson-Houston. Electrodes for electric batteries. 32,829. Dec. 29. (Fr., 17.5.26.) Elements for electric batteries. 32,936. Dec. 30. (Fr., 2.7.26.)
Lucas, Ltd., and Young. Coating grids for electric accumulators. 32,806. Dec. 28.

XI.—Complete Specifications

6978 (1926). Shearman. Apparatus for the electrification of gases. (263,356.)
10,401 (1926). Turnauer. Electric batteries. (263,374.)

XII.—Complete Specification

2780 (1926). Barbet. See XVIII.

XIII.—Applications

McMinn. Auto-corrosive paint. 32,934. Dec. 30.
Quittner. Manufacture of elastic and waterproof coatings. 32,857. Dec. 29. (Austria, 30.12.25.)

XIII.—Complete Specification

13,529 (1926). Papeteries Navarre. Making solutions of resins. (263,393.)

XIV.—Applications

Cockerill. Apparatus for estimating amount of india-rubber in latex. 33,024. Dec. 31.
Grasselli Chemical Co. Vulcanisation of rubber etc. 32,895. Dec. 29. (U.S., 12.2.26.)
Staudinger. Manufacture of hydro-cyclo-caoutchouc. 32,957. Dec. 30. (Switz., 31.12.25.)
Williamson. Treatment of rubber. 32,918. Dec. 30.

XVI.—Application

Bennett. Treating seeds. 32,802. Dec. 28. (Australia, 26.3.26.)

XVI.—Complete Specification

2780 (1926). Barbet. See XVIII.

XVIII.—Application

Hansena A.-G., and Nathan. Filtration of beer wort etc. 32,795. Dec. 28.

XVIII.—Complete Specification

2780 (1926). Barbet. Treatment of residual liquors from the distillation of fermented liquids to obtain dry fertilisers and glycerin. (263,322.)

XX.—Applications

Chem. Fabr. Pott & Co. Condensation products of aromatic sulphonic acids. 33,071. Dec. 31.
Grasselli Chemical Co. Aldehyde amine condensation products. 32,896 and 32,897. Dec. 29. (U.S., 13.3.25.)
Grube and Osten. Production of highly-bactericidal non-organotropic substances. 32,929. Dec. 30.
Pope. Manufacture of ketones. 33,048. Dec. 31.

XX.—Complete Specifications

18,395 (1925). Caspari. Manufacture of oxygenated products from hydrocarbons or oxidisable derivatives of hydrocarbons. (263,201.)
559 (1926). Gammay. Production of camphene from pinene hydrochloride. (263,311.)
4308 (1926). Klaversteijn. Extraction of tartaric salts. (263,340.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Steam-driven briquette presses (A.X. 4071); Chemicals, raw materials for tanning, leather, textile, rubber, glass, paint and varnish industries, confectionery machinery, rubber manufacturing machinery (Commercial Bureau, Australia House, Strand, London, W.C., Ref. 414); *Austria*: Mica, micranite, oil insulation cloth and tapes, oil insulation silk (5); *Belgium*: Mechanical rubbers, packing (6); *British India*: Patent medicines, caustic soda (1); Asbestos sheets, wire woven glass (Madras & Southern Mahratta Railway Co., Ltd., 25, Buckingham Palace Road, London, S.W.1); saponified cresol, bismuth carbonate, bismuth salicylate, bismuth subnitrate, iodoform, iodine and potassium iodide (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1); *Egypt*: Asphalt (B.X. 3126); *Mexico*: Ink (B.X. 3127); *New Zealand*: Paper, drugs (3); *Poland*: Bronze wire, aluminium links, copper sulphate (A.X.

1019); *Rumania*: Non-ferrous metals, leather belting, lead, copper, zinc (12); *South Africa*: Cast-iron tanks (A.X. 4069); Wrought-iron pipes (A.X. 4061); *Salvador*: Galvanised iron corrugated sheets (18); *Sweden*: Chloride of lime, Glauber's salt, caustic potash, caustic soda, gypsum, rosin, china clay, potato starch (16).

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during December, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 552, of which 446 were from merchants or importers. To these should be added 11 cases outstanding on November 30 making a total for the month of 563. These were dealt with as follows: Granted 444 (of which 427 were dealt with within seven days of receipt). Referred to British makers of similar products 51 (of which 46 were dealt with within seven days of receipt). Referred to Reparation supplies available 3 (all of which were dealt with within two days of receipt). Outstanding on December 31, 1926 62. Of the total of 563 applications received, 178 or 85 per cent were dealt with within seven days of receipt.

Prohibited Exports

The Home Office has issued a list of goods the export of which from the United Kingdom is prohibited save under licence. Amongst these are to be found: Cocaine and salts thereof, and any substance containing not less than 0.1% of cocaine; depth charges and component parts thereof; diamorphine and salts thereof, and any substance containing not less than 0.1% of diamorphine; ecgonine and salts thereof, and any substance containing not less than 0.1% of ecgonine; explosives, with certain exceptions; heroin, morphine and salts thereof and any substance containing not less than 0.2% of morphine and opium (raw opium and medicinal opium). The exportation of opium prepared for smoking is absolutely prohibited.

Trade Notes

Thomas Broadbent & Sons, Ltd., of Huddersfield, have opened an office at 65, Bath Street, Glasgow, under the management of Mr. Eden Field.

The Pulsometer Engineering Co., Ltd., has received an order from the London and North Eastern Railway Co. for the supply and erection of four "Pulsometer" double-unit turbine centrifugal pumps, two delivering 800 gals. of water per min. against a total head equivalent to a pressure of 850 lb. per sq. in., and two delivering 600 gals. per min. against the same head. In addition, two return water pumps delivering 3000 gals. per min. against a total head of 14 ft., meters, pipes, valves, etc. are included in the contract. A similar plant was supplied to the Great Western Railway.

Fine Chemicals

One of the publications for which one looks early in the new year is the "Catalogue of B.D.H. Fine Chemical Products," issued by The British Drug Houses, Ltd. The new issue now to hand contains a remarkable list of chemical products of every kind, and should form part of the library of every laboratory. The catalogue opens

with a list of organic and inorganic chemicals, which covers no less than 76 pages; then follow lists of liquids of known refractive index; of analytical reagents which conform to the standards of purity given in "The B.D.H. Book of A.R. Standards"; of solutions and chemicals for volumetric determinations, both of general and special nature; of indicators for the determination of p_H , including the B.D.H. Capillator, Comparator, soil-testing outfit, universal indicator, and so on; of stains, mounting media and other requisites for microscopic work; of aniline dyes; and of minerals. The catalogue covers products so diverse as reagents for blood testing, Ridsdale's analysed samples for students in metallurgical analysis, "Sira" adhesive wax and crystals for wireless; but the most comprehensive assembly of pure chemicals for research and analytical work of every kind is attraction enough.

PUBLICATIONS RECEIVED

SÄUREWIRKUNG UND WASSERSTOFFIONEN-KONZENTRATION IN DER REINEN UND ANGEWANDTEN KOLLOIDCHEMIE. Discussion held by the Kolloidgeellschaft in Düsseldorf from September 23 to 26, 1926. Reprinted from the Kolloid-Zeitschrift, Vol. XI, Part 3. Pp. 162-288. Dresden und Leipzig: T. Steinkopff, 1926. Price 6 m.

BETTER PIT IN APPLES. A Review of the Problem. By A. J. M. Smith, M.A., Ph.D. Food Investigation Special Report No. 28. Department of Scientific and Industrial Research. Pp. iv + 21. H.M. Stationery Office, 1926. Price 1s. net.

ART DE L'INGÉNIEUR ET MÉTALLURGIE. RESISTANCE DES MATÉRIAUX ET DONNÉES NUMÉRIQUES DIVERSES. Edited by L. Descroix. Extract of Vol. V of Tables Annuelles de Constantes et Données Numériques. Pp. x + 1660-1999. Paris: Gauthier-Villars et Cie.; Chicago: University of Chicago Press; Cambridge: The Cambridge University Press, 1926. Price: paper, 105 fr.; bound, 126 fr.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE. BUREAU OF STANDARDS. Washington: Government Printing Office, 1926.—United States Government Master Specification: No. 334a for Clay. Fire. Circular No. 298. Price 5 c. No. 335a for Refractories. Fire Clay. Plastic. Circular No. 297. Price 5 c. No. 7b for Turpentine (Gum Spirits of Turpentine and Steam-Distilled Wood Turpentine). Circular No. 86. Price 5 c. The Analysis of Dental Gold Alloys, by W. H. Swanger. Scientific Paper No. 532. Price 10 c. Effect of Concentrated Loads on the Length of Measuring Tapes. By L. V. Judson. Scientific Paper No. 534. Price 10 c. Classification of Iron and Steel Scrap. Report of National Committee on Metals Utilization. Simplified Practice Recommendation No. 58. Price 10 c. Annual Report of Director of the Bureau of Standards for the Fiscal Year ended June 30, 1926. Miscellaneous Publication No. 75. Price 5 c. Use of Glue in Coated Paper. By G. K. Hamill, V. H. Gottschalk, and G. W. Bicking. Technologic Paper No. 323. Price 15 c.

REPORT OF THE FUEL RESEARCH BOARD FOR THE YEAR 1925. Department of Scientific and Industrial Research. With Report of the Director of Fuel Research. Pp. vi + 79. H.M. Stationery Office, 1926. Price 1s. 3d. net.

A TEXT-BOOK OF PHARMACY FOR PHARMACEUTICAL STUDENTS AND APPRENTICES. By A. O. Bentley, Ph.C., with a section on some Biological Aspects of Pharmacy, by H. S. Holden, D.Sc., F.L.S. Pp. x + 540. London: Baillière, Tindall & Cox, 1926. Price 15s. net.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY

CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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No. 3

EDITORIAL

Fuel Research

THERE are many points of interest in Dr. E. W. Smith's paper on "Some aspects of the fuel problem," which we publish in this week's issue. In the first place we are comforted by his observations that there is no shortage of research work and research workers in fuel, that there is no deficiency in the number of periodicals relating to fuel, and that there are plenty of trained men for research. There are a dozen organisations dealing with fuel research, including the Institution of Gas Engineers, the Coke Oven Managers' Association, and the Fuel Section of the Society of Chemical Industry, which three have formed a joint committee; there are fuel departments in the Universities of Leeds, Sheffield, Manchester, Birmingham, and the Imperial College of Science, and Dr. Smith proposes that a Federal Fuel Council should be formed of representatives of these eleven organisations and five fuel departments. There is already a tendency to closer co-operation between these bodies, and Sir Alfred Mond is arranging a fusion between the Institution of Fuel Technology and the Institution of Fuel Economy Engineers. For details of Sir Alfred Mond's views on some of the aspects of the fuel problems we must refer our readers to Dr. Smith's paper. Apart from the economic and industrial aspects of fuel there is the very important question of hygiene and the pollution of the atmosphere. That much remains to be done is shown by the recent report of the Advisory Committee on Atmospheric Pollution issued by the Meteorological Office of the Air Ministry. It appears from this report that Newcastle-on-Tyne is raised to the bad eminence of an air which contains more solid matter than that of any other city in the United Kingdom. The solid matter is measured in metric tons per hundred square kilometres and the figures of some towns are very great. Newcastle has 37,000 tons of solid per hundred square kilometres, Burnley 34,000, Rochdale 26,000, Liverpool 25,000, Wakefield 22,000. London varies very much,

some parts having 17,000 tons, others about 10,000 tons, while the suburbs have less. Birmingham enjoys 13,000 tons, Glasgow 10,000, Edinburgh 5000, and Leeds 3000. As the Society is to hold its Annual Meeting this year in Edinburgh, it is pleasant to find that this beautiful and historic city is also clean and clear.

The Electro-deposition of Rubber

The study of the electrical charges at the surfaces of colloidal aggregates has been applied to technical cataphoresis by the Electro Osmose Co. in recent years. More recently, however, anaphoresis has become a practical issue. The negative charge upon finely dispersed rubber particles causes them to migrate to the positive pole or anode in an electrical field, so that a film of rubber may be produced thereupon. The practical difficulties associated with the formation of a tough, coherent film have been largely solved by extended research, and the various anode rubber companies in this country and on the continent, with which are associated the Dunlop Rubber Co. and the Goodrich Co. of America, are actively preparing for full technical exploitation of the process. Not only may natural rubber suspensions—rubber latex

be employed in the deposition bath, but also artificial emulsions. In both instances, sulphur, compounding ingredients, and vulcanisation accelerators may be dispersed in the emulsion of rubber so that the film deposited may be subsequently vulcanised. Anodes constructed in metal or porous porcelain may be employed, in the latter case the electrical circuit being completed through the agency of electrolytes. After controlled deposition of the film of rubber, the coated anode may be removed, dried, and the rubber vulcanised *in situ*. Later, if desirable, the anode mould may be stripped. It is clear that the process allows of the manufacture of rubber-coated metallic apparatus for the chemical industry—tanks, pipes, and so on—as well as metallic wires covered with a perfect, strong, insulating sheath of rubber. In addition, by the use of suitable

anode moulds passing continuously through the process of deposition, drying, vulcanising and stripping, such articles as inner tubes, gloves, tobacco pouches, and sheet rubber goods may be made. Further, fabrics waterproofed by rubber deposition may find important applications in the motor industry. We have never swerved from our conviction that fundamental research, the practical application of which may or may not be envisaged by the investigators, is essential to the progress of the chemical and allied industries, but it is refreshing occasionally to remind ourselves, with the aid of examples chosen from recent developments, of the earning power of research.

The Earning Power of Research

We hope we shall not be charged with debasing the pure gold of true research if, borrowing a title from a worthy American contemporary, we refer to some recent instances which show that the manufacturer often sees such a return upon his investment in research as to make its active prosecution a very definitely justifiable speculation. Not only does the enlightened industrialist realise the true value of scientific research, but the general public, through the agency of such lectures as have recently been broadcast by Professor W. L. Bragg, is being initiated into the mysteries and consequences of this advancing form of human activity. There must be few chemical manufacturers to-day who fail to realise that the work of such men as Deville, Tellier, Ramsay and Young, and Le Châtelier laid the foundations of the synthetic ammonia industry long before Haber commenced his work. The manufacture of thousands of tons a year of synthetic acetaldehyde and acetic acid would have been impossible without the academic investigations of Lagermark, Eltekow, and Kutschew, whilst no margarine maker could have dreamt of hydrogenated oils when Sabatier was reporting experiments on the action of finely divided metals upon gases containing not a millilitre of hydrogen. Did Ramsay and Travers ever contemplate helium-filled airships or neon-filled electric bulbs when they were scoring delights and living laborious days in search of the rare gases? The appearance in a Swiss contemporary of a further paper on muskone, the perfuming constituent of natural musk, has given us an up-to-date instance of the earning power of research and of the value of co-operation between industrial and academic chemists. As a result of many years of intensive research, carried through in the laboratories of several continental universities and of an important Swiss firm manufacturing synthetic perfuming materials—researches which have involved the expenditure of tens of thousands of pounds—synthetic muskone has been placed upon the market. For many years artificial musks such as those of Baur have been used in large quantities, but these compounds of the synthetic chemist have never replaced natural musk, the essential component of which, muskone, was well known to be entirely different from the artificial musks, tri-nitro butyl toluene and the like. The study of natural muskone, which is only obtained in about one per cent. yields from the scarce and expensive animal musk, and of civetone, which can be won more cheaply and in greater quantity from civet, inspired synthetical experiments into the

making of multi-carbon ring ketones, as an outcome of which synthetic muskone and civetone have been produced in the factory. Muskone, *cyclo-pentadecanone*, appears fortunately to be the sole perfuming constituent of natural musk, so that the synthetic product should have to overcome no such prejudices as stood in the path of synthetic indigotin or vanillin, which, although representing the essential constituents of natural indigo and vanilla beans respectively, were—and often still are—held to be deficient substitutes for the products of *Deus* Nature. If synthetic muskone brings as rich a reward to its creators as did indigotin and vanillin to theirs, the earning power of research will prove once more to be no mere high-sounding slogan of a simple souled, commercially inept chemist.

The Centenary of Aluminium

This year of grace marks the completion of one hundred years since Wohler isolated aluminium in metallic form. At least it is generally accepted that the honour belongs to Wöhler, although evidence has been put forward in support of Oersted, who is reported to have obtained metallic aluminium some years previously, in 1824. It is not for us, however, to adjudicate upon claims of priority, nor does it concern us very much, as aluminium was not produced in quantity until 1854 when Sainte-Claire Deville made the metal by reducing aluminium sodium chloride with metallic sodium. In 1859 a factory was established in Battersea, London, and later small quantities were made in Warrington. Commercial manufacture, however, can only be said to have begun in 1886, when Cowles introduced his process, in which alumina was reduced by carbon in the presence of copper in an electric arc furnace. The sodium reduction process gained a new lease of life when the price of sodium was reduced on the advent of the Castner process, but all these processes had to yield finally before the application of what was then a new process to metallurgy—the use of electricity for the reduction of metals, as exemplified by the Hall and Heroult processes for the electrolytic manufacture of the pure metal. It is interesting to observe the development of production since the early days of Deville's process, when aluminium cost £18 a pound. During the period 1885 to 1900, the total world production was about 10 million pounds, and during the period 1901 to 1910, the output rose to 300 million pounds. Since then the production has increased enormously, the world output in 1926 being some 170 million pounds: 230 million pounds in Europe, 240 million pounds in the States and Canada. Although aluminium is one of the commonest elements in the earth's crust, it is one of the most recent metals to attain great industrial importance. As a material of construction, it has gained its place, and even greater developments may be expected from the use of its alloys, which so conveniently combine strength and lightness. Metallurgically, it is of great interest, and much investigation still remains to be carried out. Its uses are endless, and the chemical industry, which utilises so much plant made of the versatile metal, does not bear the least debt to the pioneers who made its manufacture commercially feasible on so large a scale.

SOME ASPECTS OF THE FUEL PROBLEM*

By E. W. SMITH, D.Sc., F.I.C.

The Samuel Commission, followed by the Coal Strike, has further stimulated the interest that was developing in connexion with the study of fuel problems. It is undoubtedly a fact that "the man in the street" has to-day a much clearer conception of the importance of the subject of fuel than at any previous time.

It can be said that there is only one fuel problem, and that is how to produce fuel at a lower cost, for industry and otherwise. All other problems are subsidiary, though important and complementary to this main problem.

It is really the subsidiary problems on which I propose to touch this evening. Broadly speaking, these subsidiary problems can be divided into three groups: Technical, Economic and Hygienic. Another system of sectionalisation might be Coal Raising, Coal Preparation and Coal Utilisation.

From a technical point of view, and indeed from every other point of view, it is fundamental to the whole fuel problem that there is required all through the fuel industry, in all its branches, a much higher standard of technical knowledge. It is not sufficient that boys and men shall merely have a "good education," or that they shall have a scientific training, or that they shall have a practical experience. Study and education in fuel should be taken seriously, and not treated as an "extra" subject, tacked on to an otherwise general education. The subject of fuel is broad enough and deep enough to justify its presence in the curriculum of all technical schools, colleges and universities. It is the most fundamental subject of our industrial and domestic life. The rudiments and preliminaries are worthy of some treatment even in our elementary schools. It is relatively useless to devote the whole of technical development as regards fuel to research, if those who have to take advantage of the research that is done are not capable of giving such researches the intelligent consideration which should come from minds trained in the subject of fuel.

I therefore differentiate between what is being done in the teaching of fuel subjects, and what is being done in research. There are two distinct lines of development—namely, the training of the fuel technologist, and the utilisation of the fuel technologist in research and control.

It is well known that scientifically trained men can specialise in fuel, and take training courses at some of the modern universities. It is rare to find that there are courses of a co-ordinated nature spread over a period of years in many of our technical schools. It is rarer still to find that fuel is dealt with in any way at our public schools, secondary schools, or the elementary schools. I am fully aware that individual items can be indicated as having a bearing on fuel, such as the subjects of heat and light, but to my mind that is not enough.

There would appear to be no shortage of research work and research workers in fuel. The Fuel Department of the Leeds University specialises in the problems relating to the gas and coking industries. That University would

appear to be the first to raise the subject to the status of a Degree. Sheffield University specialises in the problems relating to the mining and coking industries. Birmingham University is dealing more particularly with petroleum and coal treatment. The Imperial College of Science concentrates on important fundamental problems. The Fuel Research Board is directing valuable work on many subjects relating to fuel, from a survey of the coalfields to carbonisation and hydrogenation. Their work is not confined to the Fuel Research Station, but their men can be found in many of the universities carrying out specialised work under the direction of the Director of Fuel Research. Valuable work is also being carried out of a specialised nature for different industries. The Federation of Iron and Steel Manufacturers has its Fuel Division; the Federation of British Industries also has its Fuel Division. The Association of leading firms in Lancashire and Cheshire has its research organisation.

The work that is being done in all these important directions is available in the main to the community at large. The results can be found published in the Transactions of various institutions, in the reports of some organisations, and in the technical Press. There is no deficiency in the number of periodicals relating to fuel.

There would appear to be any number of trained men for research. One of the problems of the immediate future would seem to be the creation of a more positive directive power, having for its primary object a greater co-ordination of research, research workers, and the technology of fuel.

The Society of Chemical Industry has always had its doors open to fuel subjects. It has always been recognised that without fuel there would be no chemical industry. Chemical industry, as understood to-day, may cover every conceivable national industry, because if any industry is to be run under the best commercial conditions, it has a chemical side to it which must not be neglected.

During recent times, when the difficulties connected with coal have become accentuated, all interested in the subject have given thought, from time to time, to improved means of organising public interest; getting improved co-ordination amongst producers and users, a greater pooling of results of research work, and many other topics connected with fuel. This has borne fruit in the inauguration of a number of technical institutions.

Some of us in the Society of Chemical Industry felt that before any elaborate step should be taken in the formation of any new society, it would be necessary to take thought as to the most important primary objectives, and determine what facilities were available for bringing about the desired results. Very careful consideration was given to the advisability or otherwise of forming a new institution. There was never any fundamental objection to a new institution as such, and there is not one to-day, so far as I am aware. It was felt, however, that the Society has an obligation and a duty to its own members. Fuel is as much a chemical subject as any other that can be mentioned amongst the Society's activities. The Society has a membership of about 4800. These members are spread over the British

* Paper read before the Glasgow Section on Dec. 15, 1926. Mr Langlands presiding.

Isles and the Empire. In Great Britain alone it has 11 local sections, highly organised, active, and mainly interested in the subject of fuel. It was, therefore, decided that the Society's contribution to a solution of the fuel problem would be to use its Local Sections and membership in the development of a systematic co-ordination and treatment of fuel topics at its meetings. This has been done by the formation of a Fuel Section which, on behalf of the Council and those members who are more particularly and directly interested in the subject of fuel, arranges conferences on special matters, and papers and lectures for Local Sections when necessary. So far the Committee has been appointed by the Council. It is intended that, later on, each Local Section shall be represented on the Committee. In the meantime, very successful conferences have been held on the subjects of Free-Burning Smokeless Fuel, and Tar, and a congress is being organised in connexion with the carbonising industries.

In order to prevent overlapping, and to encourage co-ordination, a Joint Committee of the Fuel Section of the Society of Chemical Industry, the Institution of Gas Engineers, and the Coke Oven Managers' Association has been formed to run these National Congresses, and the latest development is the close co-operation of this Joint Committee with the English Section of the World Power Conference, which is holding a meeting on the subject of Fuel in the autumn of 1928.

Anyone who has read the inspiring and illuminating Presidential Address of Sir Alfred Mond, delivered the other day at the annual meeting of the Institution of Fuel Technologists, will be struck by the insight into the fuel problem displayed by Sir Alfred. He is also chairman of the National Fuel & Power Committee, set up by the Board of Trade, which has for its objective: "To consider and advise upon questions connected with the economic use of fuels and their conversion into various forms of energy, having regard to national and industrial requirements in the light of technical developments."

Sir Alfred urged the need for the co-ordination of the work and activities of all institutions interested in fuel. As a start, he was arranging the fusion between two Institutions of which he is president—the Institution of Fuel Technology and the Institution of Fuel Economy Engineers. He hoped that the Fuel and Power Committee, of which he was chairman, would be a big force in bringing about this co-ordination.

There is no doubt that co-ordination amongst institutions, and particularly institutions relating to fuel, is required. It will never be possible, however, for one institution to represent all fuel interests. It is not conceivable that the Institution of Gas Engineers, or the Coke Oven Managers' Association, or even the Society of Chemical Industry, will sink its identity in the Institution of Fuel Technologists, whether each of these Institutions is represented on its Council or not. An Institution has to be one of two things for it to be truly representative. It shall either represent individuals only, or shall represent institutions only, and if it be the latter, then it immediately becomes a Federal Council.

For some time I have felt very strongly that it would be of national advantage if a Federal Fuel Council were to be formed, representative of other Institutions and

Research Organisations. Its chairman could be the chairman for the time being of the National Fuel and Power Committee. Its vice chairman could be the Director of the Fuel Research Board. Each of the following institutions could, with advantage, be represented on this Council:—

- The Institution of Gas Engineers.
- The Coke Oven Managers' Association
- The Institution of Mining Engineers
- The Fuel Section of the Society of Chemical Industry.
- The Institution of Petroleum Technologists
- The Institution of Fuel Technologists.
- The Institution of Fuel Economy Engineers.
- The Institution of Electrical Engineers.
- The Fuel Research Board
- The Fuel Division of the National Federation of Iron and Steel Manufacturers
- The Fuel Division of the Federation of British Industries.
- The Safety in Mines Department
- The Fuel Departments of the following Universities: Leeds, Sheffield, Manchester, Birmingham, and the Imperial College of Science

The primary function of the Federal Fuel Council would be to make joint representation on all matters where joint representation is desirable, and to act in an advisory and co-ordinative capacity on request from sectional interests.

In the meantime the Fuel Section of the Society of Chemical Industry will carry on its work of co-ordination and co-operation in the creation of a 'Fuel Sense' in all industries, and a greater appreciation of the importance and possibilities in the study of fuel by all concerned. It is not desirable that out-and-out bureaucratic methods, through intensive organisation, should be tolerated, but there is a big gap between the chaos that is possible and bureaucratic control, and it is that happy medium, allowing full play to individual initiative and effort, which is the end that is desired.

From the publicity that has been given to the subject in recent years, it would strike a visitor from Mars that the subject of low-temperature carbonisation is one which is of the most fundamental and primary importance to the British fuel industries. On this subject Sir Alfred Mond states that he feels that although the production of oil from coal is not necessarily an economic proposition, it should be pursued in order that the country could be in the position of economic independence of outside oil supply. This appeared to him to be a matter of ever-increasing importance with the increase of the mechanisation of modern warfare, and the greater the quantity of oil obtainable in this country the greater would be our stability.

Whilst agreeing with Sir Alfred in every respect on this matter, it is necessary to point out that the conditions he lays down entail Government control and Government subsidy. There is no doubt that there is every justification for the development of even uneconomic processes if it can be demonstrated that enough fuel oil can be obtained at reasonably short notice from home sources of raw materials. I would suggest, however, that the matter be placed on a par with the

production of toluene during the war. All the details can be worked out, a full-scale plant can be operated, and preparation made for extensive production in case of eventualities, such operations to be put into force immediately the necessity arises. In the meantime, oils can be, and are being, produced in large quantities from the normal processes of carbonisation. Such processes as the Bergius process can be fully developed whether economic or not, but I submit that this is not a subject which the main fuel interests can develop, but one which specialised men shall undertake on behalf of the State.

Another matter of primary importance to industrialists, with which Sir Alfred dealt, was his point of view that research should not be paid for out of profits, but should be regarded as capital expenditure. If industrialists could be brought to the same point of view, a radical change would immediately take place in their attitude towards research. It is a great deal easier to bring about development out of capital than out of revenue. It places a much greater responsibility on the research workers—a responsibility which is salutary and beneficial in every respect. Research needs to be organised on business lines like any other activity in industry, and this does not need to interfere in any way with the efficiency, independence, and individuality of the research workers. It presupposes the right attitude of mind in a chairman of directors, and a breadth of view which is not over-frequently met with.

Lastly, one of the problems, and not the least important in connexion with fuel, is that of its hygienic utilisation. Pure water is an essential of life. Pure food is largely ensured by the State, but the most important of all—*pure air and unadulterated sunlight*—are treated as matters of secondary importance. One does not need to be a fanatic on this subject to realise, after but little study, that if the use of coal in a raw state were to be forbidden, then the productivity of the individual worker would be considerably increased with the same effort expended, which increase would correspond in national wealth to something commensurate with the amount of the Budget. Consequently, one of the most important fuel problems is to develop means for the utilisation of coal which are non-smoke producing. A great deal has been done, but much remains to be achieved. This is a matter which requires the co-operation of the public, and this co-operation cannot be attained without much propaganda and education. Concentrated effort is needed on the part of all industrialists on this problem. The aim should be the elimination of the direct use of raw coal for all purposes in which there is a danger of the production of smoke.

I think I have said enough in a very general way to indicate some of the directions—on broad lines—in which progress can be made. The Local Sections of the Society of Chemical Industry have a great responsibility in this matter. They can be the local centres for the dissemination of knowledge, the nuclei for the creation of co-ordination and co-operation, and the inspiration for a higher civic duty in the alleviation of those evils which are created through the inefficient use of the nation's most valuable asset.

IMPROVEMENTS IN AND IN CONNEXION WITH DIAPHRAGMS TO BE USED IN ELECTRIC BATTERIES*

By M. WILDERMAN, Ph.D., B.Sc.

All chemical reactions in an accumulator take place at the surface of contact of the sulphuric acid with the solid sponge lead and lead peroxide, as well as with the solid PbSO_4 which separates on the electrodes. The acid in contact is the first to take part in the reaction, becoming more dilute during discharge and more concentrated during charge, than the acid which is more removed from the electrodes. Diffusion then supplies the H_2SO_4 from the more concentrated acid between the electrodes, to the less concentrated acid at the surface of contact with the electrodes, and diffusion again conducts the H_2SO_4 away from the electrodes during charge to the layers of the acid which are more removed from the same. Diffusion being, however, a very slow process, it cannot supply or remove the H_2SO_4 to or from the electrodes with the same speed as it is removed by the current from the solution, or is increased at the surface of the electrodes. Thus the acid in contact within the electrodes is diluted considerably during discharge, or is enriched unduly quickly during charge, and this takes place all the more the greater the current densities used. On account of this, during discharge the voltage and with it the ampere-hr. and watt-hr. capacity drop considerably, on account of the fall in the concentration of the acid in contact with the electrodes, and this drop is greater the higher the current densities. There is only one way to increase and improve the voltage, the A.H. and W.H. capacity for different current densities, the speed of recovery, etc., during discharge, and this is to increase the concentration of the acid at the surface of the electrode by introducing an automatic mixing and circulation of the electrolyte between the electrodes. For this a hydrostatic and an increased electro-osmotic pressure are purposely created between the electrodes by means of a diaphragm of special construction and porosity.* The invention also comprises the use of non-compressible separating frames, together with the said diaphragms, with various features and details of construction and arrangement of the accumulator for obtaining the object in view.

To carry the invention into effect, a number of conditions must be complied with:

1. A diaphragm, not a perforated sheet, must be used as a separator, in order that a hydrostatic and an electro-osmotic pressure be created between the electrodes.

2. It is necessary that the separators be constructed in such a way that the solution between the electrodes is unequally distributed between the two electrodes and the separator. The number of molecules of H_2SO_4 which are taken away from the solution during discharge at each electrode, or sent into the solution during charge is the same. If the amount of the solution between the diaphragm and one electrode is greater than the amount of the solution between the diaphragm and the other electrode, the concentration during discharge remains greater at the first electrode than at the second, and a

* Patents No. 100,577, 1922 and No. 245,252, 1924

hydrostatic pressure is thus created from the one side of the diaphragm to the other.

The best conditions of this subdivision of the electrolyte between the two electrodes depend on the variation of the volts, with the variation of concentration of the acid at each electrode, which with the lead accumulator is greater for the positive electrode. For this reason, more solution should be arranged at the positive side of the diaphragm than at the negative side. On the other hand, it is also essential to leave at the negative side of the diaphragm the necessary free space between the diaphragms and the negative electrode to enable such a circulation of the solution between the diaphragm and the electrode.

3. Since the spaces between the separator and the electrodes are very small (1 mm. and less), the separators must be so constructed and be of such properties that the subdivision made should remain constant. For this purpose the separators must be supplied with a non-compressible frame of special construction, capable of effectively counteracting the bending and buckling of the electrodes, and the porous diaphragm itself must be placed in such a position within the frame, so that, whether the frame and the diaphragm form one piece or not, the solution is distributed between the electrodes as may be desired. The frame and the diaphragm themselves must remain unaffected by the electrolyte or by the gases evolved in the battery, and must not be compressed by the electrodes during discharge.

4. The diaphragm must have a great speed of percolation in order that the small value of the hydrostatic pressure and of the electro-osmotic pressure shall suffice to produce an effective circulation of the electrolyte from one side of the diaphragm to the other, which alone is capable of mixing the whole solution between the electrodes with the thin layers of the solution at the surfaces.

The speed of percolation entirely depends upon great porosity and a sufficient radius of the capillaries in the diaphragm. Careful investigations extending over long periods and made with numerous samples have shown that the speed of percolation through an ebonite diaphragm made of a powder (grain 0.9 mm.) and of a porosity of about 50%, is about 40,000 to 100,000 times as great as that of the wooden diaphragms of the same thickness, and about 5000 times as great as that of an earthenware diaphragm used in the Leclanché cells, and about 1000 times as great as that of the threaded rubber separator after this has been in water or acid solution for a few days.

Let us now see how this affects the problem of making the hydrostatic and the electro-osmotic pressure effective for producing a circulation and mixing of the solution between the electrodes. Take, for example, an accumulator for 60 A.H., consisting of 5 positive and 6 negative electrodes, each 13 cm. high and 14 cm. wide.

The total surface of the 10 diaphragms in such a battery will be 1820 cm.² Since the specific gravity of the acid used must be 1.25--1.3, the over-pressure of the acid from the positive side of the diaphragm to the negative side will be equal at most to about 3 mm. water at the top and 3 cm. water at the bottom of the diaphragm.

The speed of percolation through a treated wooden diaphragm 0.9 mm. thick and of about 20 cm. surface was found to be, under a pressure of 107 cm. water, equal to 0.14 c.c. per minute.

It follows from this that under the hydrostatic pressure given above only about 9--10 c.c. of the solution can pass per hour through the surface of the 1820 sq. cm. of the 10 wooden diaphragms, or about 0.0001 c.c. per minute through a surface 1 cm. square. This is so little that we can hardly even call it a sweating of the solution from one side of the diaphragm to the other. No circulation takes place here. On the other hand, by using an ebonite separator having a speed of percolation which is 40,000 or 50,000 times greater than that of a wooden separator, about 400,000 c.c. of the acid will pass per hour or 6660 c.c. per minute under the very same conditions of pressure (3 mm. water pressure on the top and 3 cm. water pressure at the bottom of the diaphragm) from the positive side of the separator to the negative side. Since the total amount of the solution, that which is between the electrodes (2.5 mm. apart), and that within the 10 diaphragms of 50% porosity is about 312 c.c., it follows that the total amount of the solution between the electrodes will pass through the 10 ebonite diaphragms about 20 times per minute. Under such circumstances there can be no doubt that in this case a *true circulation and mixing* of the solution between the electrodes through the diaphragm takes place.

The circulation created in the above manner automatically adjusts itself to the needs of the battery; the higher the current densities the quicker the acid weakens in the unit of time at the surface of contact with the electrodes, the greater also becomes the difference in the concentration of the solution on both sides of the separator, and with it the greater the value of the hydrostatic and the electro-osmotic pressures, and the greater the speed of percolation and mixing of the solution.

The above is fully illustrated by the following results obtained with two 60 amp.-hr. batteries of exactly the same capacity, one with treated wooden separators, one with Wilderman porous ebonite separators (referred to hereafter as "Wilderman separators"). Discharges were made with 6, 30 and 45 amperes between the same equi-potential lines. The two batteries were first fully charged until the total volts, 2.60 to 2.65 per cell, and the single potentials (plus cadmium and minus cadmium readings) were the same, while the acid concentration and its temperature were kept equal; they were then left to stand in open circuit for about 12--18 hours, all the values mentioned remaining equal for both cells, the concentration of the acid and its temperature being adjusted if necessary. The two cells were then discharged separately or in series, until each of them reached the same 1.8 volts, the normal limit of discharge.

Discharge with 6 amperes

After the batteries were fully charged they gave during charge: -

	Ex. Wooden Separators	Wilderman Separators
Total volts	2.60	2.60
Negative cadmium	-0.12	-0.13
Positive cadmium	+2.46	+2.46

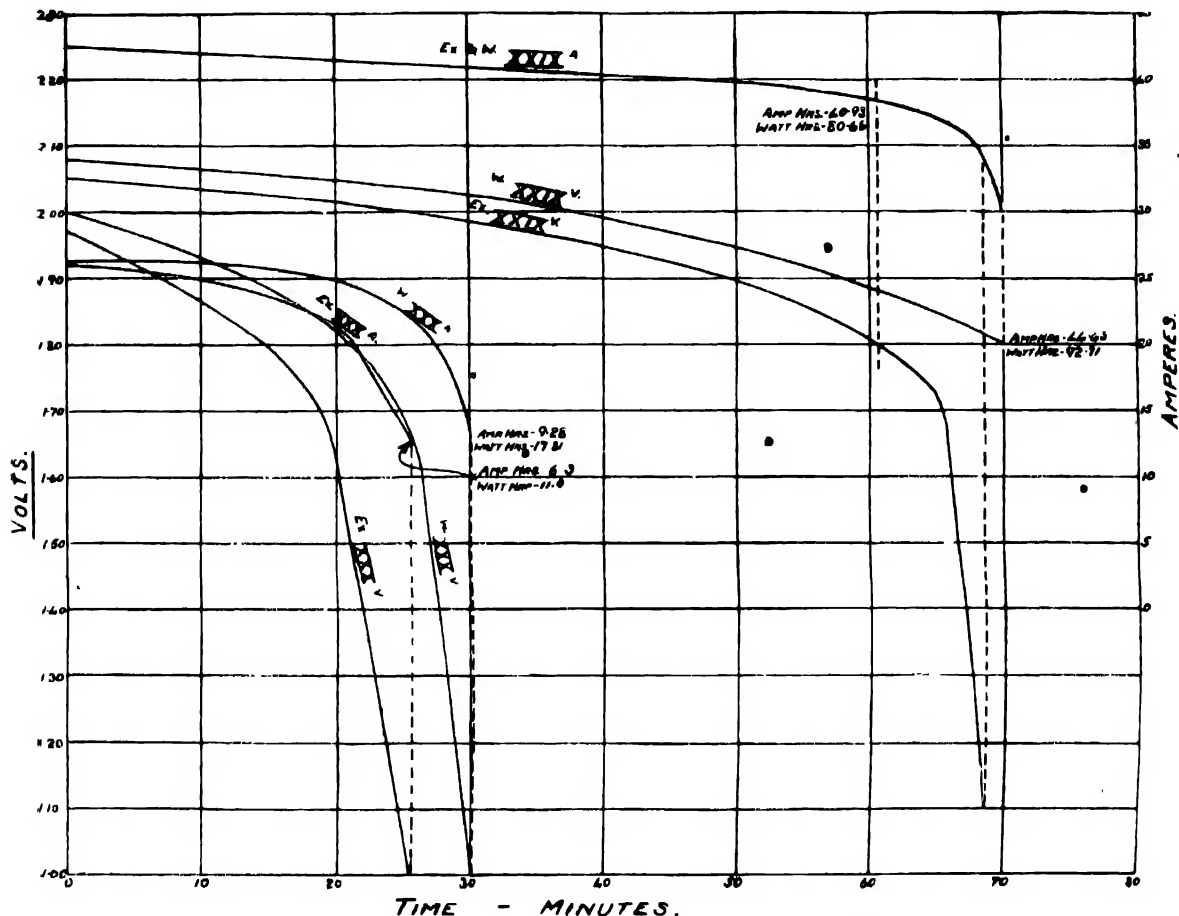
The acid was adjusted at the end of charge while still "gassing" and the batteries left to stand 12 hours on open circuit.

On open circuit immediately before discharge, the following data resulted:—

	Ex Wooden Separators	Wilderman Separators
Total volts	2.06	2.22
Negative cadmium	0.06	0.06
Positive cadmium	2.26	2.28
Acid sp. gr.	1.20	1.285
Acid temperature	18.2° C	18.2° C

Discharges with 45 amperes

From diagram XXIX a discharge with 45 amperes may be seen. The abscissa gives the time in minutes; the ordinate on the right the amperes and the ordinate on the left the volts. The curves on the diagram show the value of the amperes and the volts obtained with the two batteries during discharge. The top curve Ex and W XXIX' gives the amperes during the discharge of the two batteries in series, one with treated wooden



The two batteries down to 1.8 volts, obtained

then separately discharged the following results were

	Ex Wooden Separators	Wilderman Separators
Initial volts	2.14	2.16
Time to reach 1.8 volts	10.96 hrs	11.61 hrs
Average amperes	6.40	6.0
Ampere-hours	56.84	69.7
Watt hours	135.10	143.36

Discharge of about 30 amperes, carried through mentioned above, gave:

	Ex Wooden Separators	Wilderman Separators
Initial volts	2.02	2.05
Time taken to reach 1.8 volts	52.5 min.	59.0 min
Average amperes	28.95	30.7
Ampere-hours	25.23	30.55
Watt hours	49.54	60.82

A great number of similar results were obtained with discharges of different amperes.

separators, denoted by Ex., the other with Wilderman separators denoted by W. The amperes started with 42.5 and gradually dropped as the volts of the two batteries dropped. The amperes and the volts of the two batteries were read at the same time. The second curve from the top W XXIX' gives the corresponding volts of the battery with the Wilderman separators. The third curve from the top Ex XXIX' gives the corresponding volts of the battery with the wooden separators.

It is thus seen that it took 61 minutes for the battery with the wooden separators, and 70 minutes for the battery with the Wilderman separators to reach on discharge 1.8 volts, and during these times 46.63 amp.-hr. and 92.7 watt-hr. were taken out from the battery with the W separators, and 40.93 amp.-hr. and 80.66 watt-hr. from the battery with the wooden separators. After

60-7 minutes the voltage of the battery with the wooden separators fell to 1.12 volts, while the voltage of the battery with the W separators was still 1.82 volts.

The batteries were allowed to stand *in open circuit*, the battery with wooden separators 10.6 hours, with the W separators 9.8 hours to recuperate, until they both reached the same voltage (2.11 volts), and then separately discharged, starting with the same amperes the wooden separators 25.9 amperes and the W separators 26.32 amperes. Curve WXXX¹ gives the amperes with the W separators and curve WXXX² the corresponding volts. Curve ExXXX¹ gives the amperes with the wooden separators, and ExXXX² the corresponding volts. We find that although more ampere and watt-hours were taken out from the battery with the W separators during the first discharge, yet after recuperation it again gave higher volts and amperes and watt-hours (9.28 amp. hr. and 17.81 watt hr.) than the battery with the wooden separators (which

battery of 60 amp.-hr., cover more than the whole field of current densities which can possibly be used in accumulators for comparatively long periods of time, such as for lighting or power. Higher currents such as 100-300 amperes for a 60-ampere hour battery are only used for very short periods, fractions of a minute, as in the starting of a motor car. In such cases the time is too short for the circulation of the solution to become effective, and the rapid drop in the concentration of the acid in contact with the electrodes is unavoidable. Nevertheless, the circulation is of great importance also here, as it enables a much quicker recovery of the battery.

When quick discharges with higher currents are made, it is the resistance introduced by the separators which becomes of importance, the diminution of the volts during discharge due to the resistance being directly proportional to the same, and to the current of discharge used. The following table gives the resistances introduced by the different kinds of separators for a section

No.	Wilderman separator put dry into the acid of 1.275 sp. gr.			New Ex wooden treated separators put damp into acid of 1.275 sp. gr.			New threaded rubber separators put dry into acid of 1.275 sp. gr.			New Honduras Cedar wooden separators non-treated put dry into acid of 1.275 sp. gr.			
	Ohms after 5 mins. immers.	Ohms after 2 hours immers.	Ohms after 4 1/2 days immers.	Ohms after 5 mins. immers.	Ohms after 6 hours immers.	Ohms after 7 days immers.	Ohms after 5 mins. immers.	Ohms after 12 hours immers.	Ohms after 9 days immers.	Ohms after 5 mins. immers.	Ohms after 3 days immers.	Ohms after 26 days immers.	Ohms after 32 days immers.
1	0.0181	0.0161	0.0138	0.0526	0.0435	0.0228	0.1240	0.0538	0.0376	0.4037	0.1302	0.0478	0.0449
2	0.0205	0.0192	0.0176	0.0526	0.0420	0.0227	0.0180	0.0400	0.0320	0.1114	0.2108	0.0871	0.0786
3	0.0218	0.0218	0.0188	0.2270	0.1300	0.0582	0.0600	0.0487	0.0300	0.4080	0.2160	0.0825	0.0705
4	0.0166	0.0166	0.0152	0.0927	0.0561	0.0387	0.0500	0.0180	0.0280	0.3920	0.1492	0.1120	0.1125
5	0.0192	0.0192	0.0148	0.0741	0.0533	0.0317	0.0770	0.0310	0.0370				
6	0.0192	0.0192	0.0202	0.1120	0.0774	0.0110							
7	0.0237	0.0192	0.0150	0.0100		0.0302							
8	0.0305	0.0175	0.0162	0.0610		0.0613							
9	0.0224	0.0192	0.0152	0.0817		0.0716							
10	0.0166	0.0151	0.0147	0.1820		0.1030							
Average resistance introduced for 11.7 cm. ²													
The above corrected for temperature etc. 17° C.													
Average resistance introduced by the 10 separators													
The above corrected for temperature etc. 17° C.													
Resistance introduced for 11.7 cm. ² expressed in mm. thickness of solution between the electrodes at 17° C.													
Total resistance of the solution between the electrodes 2 1/2 mm. apart expressed in mm. solution													
	1.27	1.18	1.017	6.711	4.115	1.327	1.827	3.02	2.220	21.37	10.6	4.968	4.40
	3.57	3.08	2.517	9.211	6.915	5.822	7.327	5.52	4.720	26.87	13.1	7.165	6.90

only gave 6.3 amp.-hr. and 11.9 watt-hr.), the voltage being allowed in both cases to drop to 1.00 volts. In the battery with the wooden separators the volts dropped to 1.00 after 25 1/2 minutes while for the same time the volts of the battery with the W separators was still 1.66. This proves that the speed of recuperation is also much quicker and more complete with the W separators than with the wooden separators.

It will be noticed that although we had the same capacity, the same volts, the same single potentials, the same concentration and temperature of acid during charge and in open circuit after many hours' standing, yet the battery with the Wilderman separators showed higher voltage as soon as the discharge was started, and during discharge. This is evidently due to the acid circulating between the electrodes in the Wilderman separators and not doing so with the wooden separator.

The influence of the resistance introduced by the separators upon the volts when smaller current densities are used is small, as will be seen later on. The current densities used in this test, namely, 6-45 amperes for a

of 11.7 cm.² of the separator. The measurements were made with a battery acid of 1.275 sp. gr., using the well-known method of Kohlrausch. To get the resistance introduced by the ten separators of the 60 amp.-hr. one-cell battery, it is necessary to divide the value of the resistances obtained for 11.7 cm.² by 150 for the wooden separators and by 130 for the Wilderman and threaded rubber separators thus taking into account the actual surfaces of the diaphragm in each case.

The data given in the above table gives the resistances obtained with different separators when they are new. While the Wilderman separators remain unattacked by the acid and the gases evolved in the battery, this is not so with the wooden and threaded rubber separators. In the above table, the resistances introduced by the different separators are also expressed in mm. thickness of solution. There is also given the total increased resistance of the solution between the electrodes due to the introduction of the different separators, for a battery having the electrodes 2 1/2 mm. apart, expressed in mm. thickness of solution. The values given in the

above table are at 17° C. (62-60 F.). The differences between the resistances introduced by the different separators become more and more prominent the lower the temperature. They are considerably greater at -10° C. (14° F.) than in the above table.

From the above table it follows:—

1. After 5 minutes the Wilderman separators put dry into the acid give resistances which are 4-5 times less than those of the treated wooden separators used wet, about 18 times less than the non-treated wooden separators, and about 3-4 times less than the threaded rubber separators also used dry.

2. The resistances of the Wilderman separators were after 4½ days' immersion in acid 2.8 times less than those of the wooden separators, 4 times less than those of the non-treated wooden separators, and 2.2 times less than those of the threaded rubber separators after these had been in acid for many days until they reached their permanent minimum resistance. The resistances of the treated wooden separators vary considerably one from another, owing to the fact that the wooden separators, being of a cellular construction, do not represent a true porous body. For this reason the different electrodes in the same battery using wooden separators work with different current densities.

3. The non-treated cedar wooden separators are much worse than the treated wooden separators; they require a very long time to reach their minimum resistance, and this resistance, when reached, is about 40% higher than that of the treated wooden separators. On the other hand, the treated wooden separators must always be used damp even to give their results.

Upon the resistances introduced by the different kinds of separators depend two important functions of the battery:

(A) The variation of the volts of the same battery with temperature.

(B) The volts obtained with the same battery using different separators during discharge. These two factors may be determined from the data given in the above table and the equations given below.

Let us first determine the variation in the volts of a three-cell battery between 17° C. and -10° C. when different discharges are made. This is given by the following equation:—

$$V_{17^{\circ}\text{C.}} - V_{-10^{\circ}\text{C.}} = An(R_{-10^{\circ}\text{C.}} - R_{17^{\circ}\text{C.}})$$

Where $V_{17^{\circ}\text{C.}}$ = voltage of the battery at 17° C.

$V_{-10^{\circ}\text{C.}}$ = " " " " -10° C.

A = amperes of discharge

n = number of cells in the battery

$R_{-10^{\circ}\text{C.}}$ is the resistance introduced by the given separator at -10° C.

$R_{17^{\circ}\text{C.}}$ is the resistance introduced by the given separator at 17° C.

The data given in the above table for the resistance introduced by the different kinds of separators at 17° C. are taken here to be greater by about 50% at about -10° C.

Increase in the volts on passing from 17° C. to -10° C.

	Discharges.			
	10 amps.	100 amps.	200 amps.	300 amps.
Wilderman separator	0.00187 v.	0.01875 v.	0.0375 v.	0.0562 v.
Ex. treated wooden separator	0.00487 v.	0.04875 v.	0.0975 v.	0.1462 v.
Threaded rubber separator	0.00380 v.	0.0380 v.	0.0760 v.	0.1140 v.
Non-treated wooden separator	0.00765 v.	0.0765 v.	0.1530 v.	0.2295 v.

(b) Next we determine the difference in the volt. obtained with two three-cell batteries of equal capacity at 17° C. using two different kinds of separators after they reached their minimum resistance (say Ex. wooden and Wilderman separators). This is given by the equation.

$$E'' - E' = A.n.(R'' - R')$$

Where E'' = voltage received using the Wilderman separators.

E' = voltage received using the wooden or other separator.

A = amperes of discharge.

n = number of cells in the battery.

R' = resistance introduced by the wooden or other separator.

R'' = resistance introduced by the Wilderman separator.

	Discharges at 17° C.			
	10 amps.	100 amps.	200 amps.	300 amps.
Volts Wilderman are higher than the volts treated wooden separator by	0.00627 v.	0.0627 v.	0.1254 v.	0.1881 v.
Volts Wilderman are higher than the volts threaded rubber separator by	0.00105 v.	0.0105 v.	0.0810 v.	0.1215 v.
Volts Wilderman are higher than the volts non-treated cedar wood separator by	0.01182 v.	0.1182 v.	0.2364 v.	0.3546 v.

The differences in the volts given in this table considerably increase with the fall in temperature.

Further advantages of the Wilderman separators

1. The Wilderman separators are preferably made of ebonite of a special composition. Ebonite, being very suitable for moulding at comparatively low temperatures, is an ideal material for the making of a precision separator of a complicated construction necessary for the creation of an automatic circulation of the solution. This cannot be done in other materials such as wood etc. None of the present separators used have the essential features requisite for an effective circulation, they have neither the requisite speed of percolation, nor the requisite construction for the production of such a circulation, nor yet are they suitable for such a construction. They are provided with frames of non-porous ebonite of such a design and construction so as to keep the electrodes securely apart, allowing at the same time the gases to escape. The porous ebonite diaphragms are placed within the frame, regulating the amount of the solution on each side of the diaphragm as desired.

2. The Wilderman separators are made with non-compressible ebonite frames so devised to sufficiently counteract the bending and buckling of the electrodes both in the vertical and horizontal direction. This maintains the constant conditions for the correct distributions of the acid between the electrodes, thus securing the requisite effective circulation between the electrodes, and considerably prolonging their life. No other separator does this. The wooden separators are easily compressed to a third of their thickness, and when compressed do not return to their original volume; therefore a battery with wooden separators never has constant conditions. Both the wooden separators and the threaded rubber separator are easily bent in any direction by the electrodes, and therefore do not contribute to prolong the life of the electrode. If several prolonged over-charges and discharges with high current

densities be made, it will be found that the electrodes and separators with the Wilderman separators remain straight and the active material of the electrodes still firm, while with the treated wooden separators the electrodes get badly buckled and bent and the separators damaged.

3. An important feature of the Wilderman separators is that they can be stored and used dry, and immediately they are immersed in acid they give very small resistance. On account of this the batteries can be built up dry. When a new battery is required for use all that is necessary is the addition of the acid. The wooden treated separators cannot be used in this way as they always have to be kept damp.

4. The diaphragms of the Wilderman separators, as well as the frames, have the longest life of any separator in existence, being capable of withstanding the action of the acid (and alkali) and the gases evolved in the accumulator. For this reason the resistances remain constant and uniform, and the current densities remain uniform throughout the electrodes. On the contrary, the wooden diaphragms becoming unequally compressed in the battery change their resistances unequally through the surface and cause the electrodes to work with unequal current densities, while the threaded rubber separators cannot stand the action of the acid and gases of the battery for long periods, the rubber covering representing a badly vulcanised soft rubber substance.

5. As explained above, the volts of the battery are higher the stronger the acid used, with the ebonite separators an acid of higher concentration compatible with the electrodes can be used, a greater amount of acid can thus be stored for the reaction, and the volts of the battery kept higher during discharge. This is impossible with the wooden or the threaded rubber separators, which already suffer much when acid of the present strength is used.

6. The Wilderman separator can be made of any size, shape, or form, such as tubes, cylinders, porous vessels or the like, as may be required for other electric batteries. This cannot be done in wood or any other material at present used for diaphragms.

PULP AND PAPER IN CANADA

Pulp and paper mills continue to increase in number in Canada. Announcement has been made of a new mill, with an output of 200 tons paper, to be erected at Cochrane, Ontario, as part of the expansion policy of the Abitibi Pulp and Paper Company, which operates the paper mill at Iroquois Falls, Ontario, with a daily output of 550 tons of newsprint.

Early in the year the erection of a large pulp and paper mill will commence near Deschenes, P.Q., on the Ottawa River, a few miles above the capital city. Those interested are well-known large timber limit proprietors of the Ottawa valley, possessing extensive areas of pulpwood.

The Fort William Paper Co. is considering plans to increase the capacity of the newsprint mill from 150 tons to 400 tons daily, and to increase the sulphite plant capacity. The extensions will cost about \$12,500,000, and be spread over two years.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

LIST OF MEMBERS ELECTED

January 14, 1927

- Abrahams, Montague G., 7, King Street, Smithfield, London, E.C. Preserved Food Packer.
- Alitti, Dr. Aurelio, c/o Messrs. Molteni & Co., Via Mossotti, 4, Florence 27, Italy. Technical Director.
- Askensay, Dr. Paul, Kaiserallee 44, Karlsruhe i. B., Germany. Professor.
- Blair, James, The Clayton Aniline Co., Ltd., 40, Southwark Street, London, S.E. 1. Manager.
- Brown, Arthur George, Calico Printers' Association, Research Dept., St. James's Buildings, Oxford Street, Manchester. Librarian.
- Chappel, Edgar J., c/o The British Drug Houses, Ltd., Graham Street, City Road, London, N.1. Chemist.
- Christopher, Harold, Walkden Works, Verney Road, 8, Bermondsey, London, S.E. Works Chemist.
- Day, Roland B., 25, Broadway, New York City, N.Y., U.S.A. Petroleum Technologist.
- De Moulpied, Alfred T., Messrs. Saderno, Ltd., Imperial House, 17, Kingsway, London, W.C.2. Director.
- Dickson, William, "Ivythorpe," Thornhill Road, Streetly, nr. Birmingham. Research Chemist.
- Drinnan, John, 58, Wilton Street, Glasgow, N.W. Chemist.
- Hamilton, John C., c/o The Know Mill Printing Co., Ltd., Know Mill, Entwistle, nr. Bolton. Manager.
- Harrison, Reginald H., 28, Fellows Road, Hampstead, London, N.W.3. Student.
- Hess, Bernard, Messrs. Adolph Hess & Bro., Ltd., Kirkstall Road, Leeds. Director.
- Honeyman, William, York Street Flax Spinning Co., Ltd., Belfast. Research Chemist.
- Hornby, Henry J., Dursley, Burnham Road, Leigh-on-Sea, Essex. Director.
- Horton, Harold V., 54, Mansfield Road, Ilford, Essex. Chemist.
- Ireland, William E., 29, Park Avenue, Widnes. Works Manager.
- Kemney, Arthur W., Messrs. E. I. Du Pont De Nemours & Co., Experimental Station, Wilmington, Del., U.S.A. Chemist.
- MacLeod, George T., c/o Messrs. R. & J. Garroway, 694, Duke Street, Glasgow, E. Chemist.
- Marshall, Herbert, 5, Graham Road, Dolgarrog, N. Wales. Works Chemist.
- Micklethwaite, Miss Frances M. G., The Edge, Chalfont St. Giles, Bucks.
- Miller, Cecil J., c/o Messrs. Morris Little & Son, Ltd., 3, Hatton Yard, London, E.C.1. Research Chemist.
- Mond, The Rt. Hon. Sir Alfred, M.P., P.C., 37, Lowndes Square, London, S.W.1.
- Morland, Humphrey, Messrs. Clark, Son & Morland, Glastonbury.
- Nitardy, F. W., 17, Columbia Heights, Brooklyn, N.Y., U.S.A. Manufacturing Pharmacist.
- Paterson, Henry A., 24, Manor Road, Rugby. Technical Assistant.
- Patterson, Austin M., Antioch College, Yellow Springs, Ohio, U.S.A. Professor.
- Petley, Bertrand T., Messrs. Steel Bros. & Co., Ltd., 6, Fenchurch Avenue, London, E.C.3. Chairman.
- Phillips, Lewis H., c/o The Crystalate Manufacturing Co., Ltd., Golden Green, Tonbridge, Kent. Chemist.
- Rao, M. G. Srinivasa, Central College, Bangalore, S. India. Professor.

Saville, Frederick H., Shield Works, Royds Street, Stockport Road, Manchester. Company Director.
 Shadbolt, Frederick S., 17, Thorold Road, Bowes Park, London, N.22. Works Manager.
 Stirling, Miss Elizabeth B., c/o Messrs. J. Robertson & Sons, Preserve Manufacturers, Ltd., Golden Shred Works, Catford, London, S.E.6. Chemist.
 Summers, Percy F., Fuel & Metallurgy Dept., The University, Leeds. Lecturer.
 Taylor, Benjamin, 62, Castle Street, Coseley, Staffs. Manager.
 Taylor, Charles W., The Anglo-Egyptian Oil Fields, Ltd., The Refinery, Suez, Egypt. Petroleum Chemist.
 Taylor, Miss Sarah, 25, High Street, Epsom, Surrey. Science Mistress.
 Vicharana, Yen S., 51, Barkston Gardens, London, S.W.5. Student.
 Weeks, Frederick W., Know Mill Printing Co., Ltd., Bevis Green, Walmersley, Bury, Lancs. Manager.

BIRMINGHAM AND MIDLAND SECTION

Mr. J. C. Mann presided over the meeting held at the University of Birmingham on January 11, when Mr. C. E. Wood, M.Sc., read a paper entitled "A study of the rotatory dispersion of certain derivatives of hydroxy acids."

An historical introduction dealing with the work of Gaye on the rotatory dispersion of the lactates was followed by a description of the author's investigations on normal and isomeric esters of *l*-lactic acid. The prevailing type of dispersion observed in these esters was discussed, together with data regarding the effects of increasing the carbon chain on molecular rotatory power. The effect of branching of the carbon chain was compared both in the positive and negative regions of rotation.

The optical properties of several series of compounds were described with the object of emphasising the differing effects of the alkyl, cyclohexyl, and phenyl groupings when directly attached to the asymmetric centre. A diagram on which were represented the dispersion curves of a typical member of each of these series showed how the positive rotations of the lactates changed progressively through the cyclo-hexahydro-mandelates to the strongly negative rotation of the mandelates.

A comprehensive account of the dispersion of esters containing two centres of optical asymmetry was given, and this included a discussion of the occurrence, causes, and classification of complex and anomalous rotatory dispersion. Experimental results for three esters, *d* sec. butyl *d*-lactate, *d* sec. butyl *l*-lactate and *d* sec. butyl *l*-mandelate, were quoted as being simple cases of compounds containing two centres of optical asymmetry. In the first ester, where the rotations of the two asymmetric complexes are of the same sign, the rotation dispersion remains complex, similar in character to the other isomeric butyl lactates; and in the second ester, where the rotations of asymmetric centres are of opposite sign, anomaly results. In the last ester, however, although there are two complexes of opposite sign and dispersion, no anomaly occurs. It followed, therefore, that one of the factors in the condition for anomaly is that the partial rotations of the two asymmetric centres are of comparable magnitude.

The paper concluded with a brief summary of the

effects of acetylation and benzoylation of the hydroxyl group in diethyl tartrate. Further, by reference to other compounds, it was pointed out that simple derivatives of tartaric acid exhibit all three fundamental types of rotatory dispersion.

CHEMICAL ENGINEERING GROUP

On January 14 the Chemical Engineering Group held a meeting under the chairmanship of Mr. F. H. Rodgers, at Burlington House, at which Mr. J. A. Hall read a paper entitled "Thermo-Electric and Resistance Pyrometry in Industry." This paper continued the subject of temperature measurement begun by Prof. J. W. Hinchley when addressing a joint meeting of the Birmingham Section and the Group at Birmingham last month, and as considerable interest has been aroused it is hoped that further papers will be forthcoming.

The author briefly considered the thermodynamic scale, and then proceeded to discuss the resistance thermometer, mentioning the lack of coincidence with the gas scale and giving the Callender correction. Three methods were discussed of eliminating the resistance of the leads, namely (a) the compensating lead method; (b) the employment of four leads arranged in the form of current and potential leads, to each end of the thermometer bulb; and (c) that used for lower temperatures, in which copper leads are carried right up to the bulb of the thermometer: methods (a) and (c) being of industrial importance. After considering the recording instruments for this type of pyrometer, and pointing out that there is rather a big lag in industrial instruments of this type, owing to the mechanical protection required for the resistance, the author showed diagrams illustrating the apparatus used to determine the sulphur point and discussed the various precautions which had to be taken.

The second portion of the paper dealt with thermocouples. The author expressed a preference for the rare metal couples, although the E.M.F. might be much smaller than could be obtained with base metal couples, since with the former more homogeneous alloys could be obtained, thus eliminating potential sources of error. The base metal couples, too, it was pointed out, whilst more liable to give readings which vary with varying immersions due to non-homogeneity, deteriorated more rapidly, necessitating heavy couples for a long life, but these allow of the reduction of the external resistance, and the larger E.M.F. permits more robust measuring instruments to be employed.

The necessity of periodic calibration of pyrometers was emphasised and diagrams were shown of a method of taking the salt point, and of the variation of E.M.F. with temperature for a number of different substances. The principal features of instruments used in conjunction with these couples were described as well as the methods of protecting the couples. Under this heading it was pointed out that since platinum is readily contaminated by metals at high temperatures it is inadvisable to insert the couple in this case directly into the sheath.

The paper produced an excellent discussion in which the subject was approached from the aspect both of manufacturers and the users. The following gentlemen took part in the discussion: Messrs. Davidson, Dunglison and Foster, Professor J. W. Hinchley and Drs.

Sodean and Watson. In proposing a vote of thanks to the author the chairman complimented English manufacturers on the advances which they had made in the making of accurate instruments of this nature.

MANCHESTER SECTION

Mr. L. Guy Radcliffe, M.Sc.Tech., presided over the meeting held on January 7, when four papers were read and discussed. Some forty persons were present.

A paper entitled "Standardisation in chemical analysis" was read by Prof. W. H. Roberts, of Liverpool. Prof. Roberts said there was much divergence of opinion in regard to standardisation in chemical analysis. He did not, personally, believe in standardisation as a fixed general principle, but only in cases where a particular process was dealing with something indefinite such as the "Reichert-Wollny" process for the determination of butter fat. A process of that description should be absolutely standardised, and everyone should work on the same lines. It was not possible to standardise either the accuracy or the temperament of the workers who were using a process. It was also very difficult to get anybody to carry out a standard process literally as laid down, sooner or later a man would vary the process to suit himself, and even slight differences would create great variations in the final results. Several processes had been more or less standardised, for which standard apparatus had been set up. One in particular was the method of determining the strength of alcoholic liquid by means of the "Sikes" hydrometer, yet there were probably very few "Sikes" hydrometers outside the laboratories of analysts which were accurate.

It was practically impossible to adopt any standard method for any particular substance. For standard processes there must be standard apparatus, and that apparatus must be very carefully and accurately checked, and in most laboratories this was not the case. Standard processes as laid down by text books did not conduce to concordant results on the part of different workers, while if all tests and all analyses were done by standard methods then the thinking part of the chemical profession would very rapidly deteriorate. Many people held that standard methods were necessary for the analysis of foodstuffs. A method had been set up for the estimation of "woody" fibre in foodstuffs, and a certain analyst had prepared a large quantity of a particular foodstuff, samples of which were sent round to various other people in order that the percentage of fibre might be determined by the same process. There were marked variations in the results. As a matter of fact, it was not in the process itself that the differences occurred, but in the sampling and in the preparation of the sample. It was almost impossible to prepare a sample of, say, 14 or 15 lb. which was uniform throughout.

In his opinion it was the duty of every analyst to work out his own processes; to test everything for himself and not to rely implicitly upon anybody's statement in a text book. Discrimination must also be exercised in the matter of tests. Years ago the test for alum in flour, and similar substances, was by the addition of tincture of logwood, when an immediate blue coloration was produced. This was a very nice

test indeed, until someone commenced to use calcium superphosphate in baking powder. It was suddenly discovered that superphosphate of lime also gave the blue coloration under certain conditions, after prosecutions had been instituted under the Food and Drugs Acts with respect to flours which were not adulterated with alum at all. There were far too many traps for the unwary in standard methods of analysis.

The next paper on "Normal amyl benzene and some of its derivatives, Part 2," was by L. G. Radcliffe, M.Sc.Tech., F.I.C., and R. L. F. Robert, M.Sc.Tech., A.I.C. In this paper the authors stated they had repeated, improved, and extended the work described by one of them and N. Simpkin in a previous communication. As before, the starting material was normal butyl alcohol which, using Fittig's reaction and purified benzyl chloride, gave a considerable quantity of normal amyl benzene. The yield of normal amyl benzene had been materially improved by the use of mechanical stirring of the reaction mixture instead of shaking, and the whole process, instead of occupying several days, was complete in 6 or 8 hours. Purified amyl benzene was used to prepare the normal amyl benzene barium sulphonate and from this the potassium salt was prepared by treatment with potassium carbonate. In another method the potassium salt was obtained by adding the potassium carbonate directly to the neutralised sulphonic acid, filtering, and evaporating the filtrate in the usual way. By this modification the time of preparation was considerably shortened and the yields were quantitative. The potassium salt, warmed with phosphorus pentachloride, gave the sulphonic chloride, and from this the sulphonamide was made by treatment with powdered ammonium carbonate, and oxidised by Pinner's method to *p*-sulphamino-benzoic acid melting at 278-280°, thus confirming the *para* structure for the original sulphonic acid. From the normal amyl benzene-*p*-sulphonic acid a *p*-hydroxy compound was made by fusing the potassium amyl benzene sulphonate with excess of caustic potash at 240° C in a special apparatus kindly lent to the authors by Prof. A. Lapworth. The resulting *p*-hydroxy-*n*-amyl benzene yielded a benzoyl compound melting at 52° and a tetra-bromide melting at 93°. The following three alkyl derivatives were made from this amyl-*p*-hydroxybenzene compound by the usual method: *p*-methoxy-*n*-amyl benzene; the ethoxy compound, and the butyl ether.

The estimation of mixtures of the isomeric toluidines was described by Dr. H. H. Evers and Mr. N. Strafford, M.Sc. The authors stated that in all of the many methods advanced for the estimation of *para*-toluidine in samples of *ortho*-toluidine, the influence of the *meta*-isomer—which was invariably present in small amount in technical toluidines—was overlooked. For this reason alone the accuracy of some of the methods was rendered doubtful. All the methods reviewed in the paper were found to be of limited value, whilst it was claimed that the methods proposed by the present authors permitted of an accurate determination of both *meta* and *para* isomers. The estimation of *m*-toluidine depended upon the fact that on titration with standard bromate this isomer absorbed 3 atoms of bromine per molecule, whilst each of the others absorbed only 2

atoms per molecule, hence the proportion of *meta* could readily be calculated. For the determination of *p*-toluidine a thermo-analytical method had been evolved. Since *o*-toluidine remained liquid even at

20° C, a direct setting point method could not conveniently be applied when dealing with samples of low *para* content; the difficulty had been overcome by artificially raising the setting point by the addition of pure *para*-toluidine in known amount. From the elevation of the setting point of the mixture thus prepared over that of the pure *ortho-para* mixture containing the same proportion of *para* as added to the original sample, the *para* content of the latter could readily be calculated from the data given in the paper. In such mixtures replacement of a portion of the *ortho*- by *meta*-toluidine had no effect on the setting point obtained. In other words, the ternary mixture had the same setting point as the binary one of same *para* content, and hence for such mixtures the method was specific for estimation of the *para* isomer.

The fourth paper read (under arrangement with the Chemical Society) dealt with the influence of the sulphur atom on the reactivity of adjacent atoms or groups, and indicated a qualitative comparison of the reactivities of chlorine and hydroxyl in the α , β , γ , and δ positions to a sulphur atom. The authors of the paper were Dr. G. M. Bennett and Mr. A. L. Hock.

A joint meeting with the Manchester Section of the Institution of the Rubber Industry was held on January 13. Mr. C. Paine, the Chairman of the Manchester Section of the Institution of Rubber Industry, presided, and Mr. L. Guy Radcliffe, M.Sc.Tech., F.I.C., Chairman of the Manchester Section of the Society of Chemical Industry, was also present.

A paper entitled "Rubber solvents" was read by Dr. D. F. Twiss.

Dr. Twiss said that there could be no single ideal solvent because many factors were concerned which were often associated with the particular conditions of use. In addition to solvent power for rubber, other features desirable in a solvent were: (1) Chemical stability in itself; towards rubber, oxygen, moisture, and sulphur chloride. This, in a wide sense, also covered any extreme fire risk. (2) A restricted range of distillation; the solvent must neither be too volatile nor too resistant to vaporisation. (3) Odour not extremely unpleasant. (4) Absence of serious physiological effect.

Certain chemical features of solvents were of significance as affecting their use with rubber. Solvents with a tendency to develop acidity were undesirable. Oxidative tendencies were also undesirable as they might induce parallel oxidation in the dissolved rubber. This was one reason for the lapse of turpentine from popularity.

Cold vulcanisation by means of sulphur chloride generally called for a solvent for the latter which must also be a solvent for rubber; it must, however, not be olefinic or ethylenic in character. Also for this purpose benzene (or other coal tar solvents) and petroleum naphtha need to be carefully purified, and should be able to withstand the Admiralty sulphuric acid test.

NOTTINGHAM SECTION

The fourth meeting of the Session was held with the co-operation of the Fuel Section on January 12 at University College, when J. G. King, Ph.D., F.I.C. (Chief Chemist, H.M. Fuel Research Station), gave a lecture on "The production of liquid fuels from coal." Dr. E. B. R. Prideaux presided.

Dr. King said the production of oil from coal is a problem which is receiving considerable attention in both scientific and economic circles at the present time. From the "world" point of view it is becoming increasingly evident that the peak of oil production from natural sources will be reached in a limited number of years. The consumption of crude oil is increasing annually, thus, to take one example:—the number of oil-burning ships which are now being built is more than 50% of the total even in this country, this consumption taking place to the exclusion of coal.

A recent survey has shown that we in this country can look for no natural source of fuel oil. The Scottish shale beds are almost worked out, and the English shale beds, the chief of which stretches from Norfolk to Somerset, are characterised by a high sulphur content which renders the ultimate product of low commercial value. Our natural resources from a home point of view lie therefore almost entirely in coal, and the problem reduces to—What is the best means of converting coal economically into a stable liquid form which will replace petroleum products?

At the moment there are three main methods under serious consideration with the view to solving this problem, but it is by no means certain which of these, if any, will ultimately be commercially successful.

Dr. King then outlined the three main lines of research: (1) Low-temperature carbonisation; (2) the hydrogenation of coal by the Bergius process; (3) the reduction of carbon monoxide for the catalytic production of liquid fuels.

The primary object of low-temperature carbonisation is the production of smokeless fuel, and the secondary object the production of a tar from which liquid fuel oils can be obtained. Many plants and processes have been put forward; but whilst many have achieved at least partial technical success, none, as yet, has proved successful commercially, and if this process has a future it seems likely that its applications will not be restricted to any one type of plant, since all coals are not equally suited to one particular process.

Dr. King then described in detail the work carried out at the Government Fuel Research Station. In the experimental plant it was found that the period of maximum evolution of tar and gas coincide up to 550° C. The results in general indicate that there is a critical point, which will, however, show some variation with the type of coal and the process of carbonisation.

Not only do the yields of tar vary with temperature of carbonisation, but also the constitution of the tar. At temperatures above 550° there is an accelerated increase in the amounts of phenols and unsaturated oils, whilst the saturated oils show a corresponding decrease.

Again, at the lower temperatures of carbonisation, solid paraffins may be isolated from the oils, whereas at temperatures above 600° no solid paraffins can be obtained.

Grude tar is not miscible with petroleum, and the only method by which the tar can be converted into fuel oils is by distillation. The available products being motor spirit, crude fuel oil, tar acids and pitch.

If, instead of burning 50,000,000 tons of household coal per annum, it is converted into smokeless fuel, this quantity of coal would yield 800,000,000 gals. of crude tar, 550,000,000 gals. of tar oils, and 150,000,000 gals. of motor spirit. In 1924 we imported 1,042,000,000 gals. of fuel and burning oils and 422,000,000 gals. of motor spirit; hence, even if the coal used in industry were also carbonised, the process would not supply the demand for motor spirit. The lecturer deplored the fact that we did not follow the continental practice in recovering as much benzol as possible from coal gas.

Dr. King went on to describe the Bergius process for the hydrogenation of coal. This process offers a much larger quantity of liquid product per ton of coal, but the commercial success at present appears more doubtful than that of low-temperature carbonisation. Briefly, the process of hydrogenation of coal consists of the introduction of hydrogen into the coal substance and into the products of decomposition in such a manner that a high proportion forms liquid products of as fully saturated a nature as possible. The conditions necessary are a pressure of about 200 atmos., a temperature of about 450° C, and a high gaseous concentration of hydrogen.

There are several economic factors which operate against the economic success of the Bergius process; thus, for example, the production of hydrogen at a very cheap rate is essential if the process is to be a commercial success. Thus, a ton of dry, ash free coal requires about 35,000 cu. ft. of hydrogen, i.e., 10% of its weight.

Dr. King then briefly surveyed the progress that had been made relative to the catalytic reduction of carbon monoxide. He pointed out that a considerable advance had been made by Fisher and Tropsch in determining a catalyst and conditions under which liquid hydrocarbons with little or no admixture of oxygenated compounds were formed.

The lecture was well illustrated by numerous slides, and a good discussion followed, in which Messrs. Bowen, Wilkinson, Whittaker, Bramley, Prideaux, and others took part.

CALENDAR OF FORTHCOMING EVENTS

- Jan. 22. SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY. *Birmingham and Midland Sections*. Chemists' Dinner. The Queen's Hotel, Birmingham, at 7 p.m. The guests will include the President of the Institute of Chemistry, Prof. G. G. Henderson, the President of the Society of Chemical Industry, Mr. F. H. Carr, C.B.E., and the Chairman of the Chemical Employers' Federation, Mr. K. Wilson.
- Jan. 24. INSTITUTE OF CHEMISTRY, *Leeds Area Local Section*. "The training of the fuel chemist," by Prof. J. W. Cobb.

- Jan. 24. BIRKBECK COLLEGE (UNIVERSITY OF LONDON) CHEMICAL SOCIETY, Breems Buildings, Fetter Lane, E.C.4, at 5.45 p.m. The Distinguished Visitor's Address on "Physical chemistry and the phenomena of life," by Prof. F. G. Donnan.
- Jan. 25. MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY, at 5.30 p.m. "Some recent advances in the physics of the solid state," by Prof. W. L. Bragg.
- Jan. 25. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 4.30 p.m. "The sugar resources of the British Empire," by B. H. Morgan.
- Jan. 25. ROYAL PHOTOGRAPHIC SOCIETY, *Scientific and Technical Group*. 35, Russell Square, W.C.1, at 7 p.m. Exhibition and demonstration of apparatus used in the testing of photographic products etc.
- Jan. 26. GLASGOW UNIVERSITY ALCHEMISTS' CLUB. Meeting at 7.30 p.m. "Electrosynthesis," by Sir James Walker.
- Jan. 26. INSTITUTE OF CHEMISTRY, *Belfast and District Section*. Queen's University, Belfast, at 7.30 p.m. "Hydrogen-ion concentration in plants," by Prof. Small.
- Jan. 26. FARADAY SOCIETY, Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. (1) "Behaviour of the quinhydrone electrode in solutions of neutral copper sulphate," by J. B. O'Sullivan. (2) "The actinic absorption of chlorine gas with respect to the hydrogen chlorine reaction," by W. Taylor. (3) "The residual effect in the actinic absorption of chlorine," by W. Taylor and A. Elliott. (4) "Vapour pressure and heat of dilution of aqueous solutions. Part II," by W. R. Harrison and E. P. Perman. (5) "Electrostatic capacity of aluminium and tantalum anode films," by N. A. de Bruyne and R. W. W. Sanderson. (6) "On the velocity of chemical reaction in the silent electric discharge," by G. A. Elliott, S. S. Joshi, and R. W. Lunt. (7) "The activation of hydrogen in the electric discharge," by G. A. Elliott. (8) "The Soret effect," by C. C. Tanner; and (9) "An improved method of measuring vapour pressure by air bubbling," by H. I. Downes and E. P. Perman.
- Jan. 26. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Ordinary Meeting). "British and American practice in hot and cold working of metals," by F. W. Spencer.
- Jan. 26. SOCIETY OF CHEMICAL INDUSTRY, *South Wales Section*. University College, Singleton Park, Swansea, at 7.30 p.m. "Quantitative spectrographic analysis," by Capt. J. R. Green.
- Jan. 28. INSTITUTION OF ENGINEERING INSPECTION, Palace Chambers, Westminster, S.W.1. "The manufacture and uses of arsenical copper," by I. Taverner.
- Jan. 28. MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY, *Chemical Section*. Meeting at 7 p.m. "The biochemistry of cork formation." Discussion to be opened by Dr. E. Rhodes.
- Jan. 29. WEST OF SCOTLAND IRON AND STEEL INSTITUTE. "Steel commercially considered," by Sir W. Larke.
- Jan. 31. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Cantor Lecture III). "Recent progress in optics," by L. C. Martin.

NOTES FROM OXFORD

Specially contributed

Wine without Water

Oxford has been educationally *en fête* during the week past, having received over 300 members of the Science Masters' Association within its ever hospitable weather-beaten walls, which may easily—to judge from appearances near Magdalen bridge—soon be restored beyond all recognition. Fortunately, the University retains not a few of its time-honoured traditions, though it may be doing its best to reduce our sons to one dead level of uniformity—for all now glory, it seems, in looking untidy alike and the mark of the beast called a gentleman is ceasing to be manners, the hat of respectability being cast aside.

To heal themselves, the wandering school physicians underwent a varied course of treatment, beginning with an exceptionally well-delivered address by their President, General Hartley. The meeting was opened not with prayer, but by closing the windows to prevent the entry of "fresh fog" from outside. Members then smoked themselves in solidly. Thus were fulfilled the words of one of the greatest of Oxford graduates:—"There are not now many European gentlemen, even in the highest classes, who have a pure and right love of fresh air. They would put the filth of tobacco even into the fresh breeze of a May morning." The architect member of the Association has a great opportunity before him to build a lecture room in which stink chambers for smokers are duly provided. The Presidential address was a highly technical disquisition upon the Electrolytic Dissociation Hypothesis. All the old early chestnuts were dished up and finally covered with Debye and Hückel sauce with a special Balliol flavour. Very appropriately, the Editor of *Nature* was called upon to move the vote of thanks. He did so with consummate tact, showing his appreciation of the situation by quoting the story of the Bishop on a week-end visit, who came down to breakfast early and found only the young daughter of the house in evidence. Of course, he talked nicely with her, and learnt that she knew the Lord's Prayer and the Commandments. On asking her, however, if she knew the Creed (or was it the Catechism?), the reply came—"Damn it, I'm only seven." He thus hit off not only his own inability, but presumably that also of the major part of the audience to appreciate the issues raised. Water had received no mention, nor was the least reference made to the unfortunate effect salts have upon acids—unfortunate in that they enhance their acidulous character. In Uesania, we know, from recent official confessions, water is at last being noticed. This is only as it should be—in a dry land. There is less call to honour it in the damp valley of the Thames. Oxford, fortunately, still has links with the past. It remains a centre of religious observance, it is possible to drink a quart of ale from a mug in Magdalen—the feat was performed not long since by a chemist—and port is still current in the Colleges. May the University preserve such traditions and long prosper under them. What matters it whether or no those who arrogate to themselves the name of chemist take water seriously or not.

Dry Catalysis

Boys at home for the holidays would chortle in their joy if they knew what penance their science-masters did during the recent Oxford jaunt by attending at lectures. Of those we sampled, that on Catalysis was the most instructive. We got no further in arriving at a definition of this all-embracing term. Even at Oxford, where words are analysed and made up into dictionaries, clear agreement as to the limitations of a word is not considered necessary. The vision, however, will long remain in our eyes of a gentleman speaking in more or less audible tones—usually less—and at the same time executing a slow, measured *pas seul* behind the lecture-table the while imitating the juggler who throws up a set of balls and keeps them revolving, but doing so with a piece of chalk, using this also in occasional darts at the blackboard to make faint scrawls thereon. When witnessing Prof. Hill's demonstrations, later in the week, of the multiplicity of co-ordinated muscular and nervous actions involved in dancing and in the recovery of balance by a cat falling from a window, we thought back with pity upon that lecturer at Oxford. Also, when we listened there at night to the word-perfect manner in which the Public Orator at Marconi House made his announcements, we thought how good for lecturers it would be if the example set by such a masterly speaker could be turned on at intervals, just as a tuning fork is sounded to start singing; if we are to learn languages by wireless, why not lecturing? Some means of catalysing speakers into clearness of diction and coherency of expression is obviously needed. As to the lecture, the argument was of the limited order usual with counsel in the Chancery Courts. Whatever work lay behind the discourse, we heard nothing of it—how it was done, which after all is the main thing, interpretation in these days being "to haste." Still, in proposing the vote of thanks the venerable Leed took shelter behind no early Bishop's apron, but professed himself rapturously satisfied: he is known, however, to be not merely mellifluous, but soft-hearted. As on the previous evening, the desire seemed to be to have nothing to do with vulgar water. In fact, it was a "dry" discourse. "Loving cups," say mugs of ale, would have been more than welcome. Why does not the Association go the whole hog and logically make the lectures into *Kneipes*? The introduction of the degraded form of fire-worship now customary in the Halls of Science is more than a half-way step. At least those who do not take part in the ritual would find the means of purging their throats from its nauseous effects, though eyes and nose would still suffer from the acrid fumes. Now that we have visited Oxford, we no longer have the slightest belief in the possibility of homogeneous interactions—to use the jargon of the tribe—ever taking place within its confines. Everywhere we went, whether in cellardom or leoprine haunts, in all the physical laboratories, we found the most delicate operations being consistently smoked over and thoroughly nucleated as a consequence, we imagine. We were reminded of an afternoon on a sunny lawn in Dundee at the British Association meeting there: how Lord Kelvin chortled when the recently proclaimed transmutation of copper into lithium was made clear to him in terms of cigarette ash. There is no longer any dis-

cipline in our laboratories and most students now systematically narcotise themselves. Nor is this surprising. We happened through Sedberg in a motor-car recently on a Sunday morning, and saw several masters from the school with their wives walking through the streets after church: one, quite a dignitary, in University gown and mortar-board, was smoking a short pipe. With such un-Victorian example before them, boys may well do anything that suits their fancy. Youth is now but a parasite of a pipe. Doubtless this will soon make its appearance in the Bights at the Boat Race if our young men do not grow too tired to work even at play. We are hereby brought back to water and Oxford. It seemed almost providential, after engaging in "dry catalysis" in the morning, that we were able, in the evening, to dilute our port with water to listen to an eloquent wireless discourse by Sir Alexander Houston, whose every word was perfectly enunciated, upon the history of the New River Company and the inestimable boon of clean water which London owed to Sir Hugh Middleton. It is well that the masses can enjoy both water and clear speech by wireless: let us pray that it does not take to smoke.

CORRESPONDENCE

THE TESTING OF DISINFECTANTS

Sir, Mr. Quinton Moore's interesting note on the "Testing of disinfectants by the Rideal-Walker method," in your issue of December 31, would have been better entitled as one on the testing of *some* disinfectants.

I fear he has overlooked the investigations conducted by my late friend, R. C. Woodcock, and myself many years ago, as noted at foot of this letter*. Incidentally, it may be remarked that these investigations proved beyond doubt that this test is only of value for determination of the comparative germicidal values of those prepared from certain coal-tar derivatives (within the conditions of the test).

Disinfectants vary so much in chemical constitution and action that no one test is available for determining their relative values, and they could only be comparatively valued if their properties were dependent upon one and the same chemical entity.

If reliance were left upon the Rideal-Walker method it would be found that such substances as borax, chromic acid, hydrogen dioxide, benzoic acid and hundreds of other well-recognised preservatives, antiseptic and disinfectant preparations would be condemned as practically useless.

Yours faithfully,

C. T. KINGZETT

* "Bacterial testing of certain disinfectants as affected by varying conditions," by C. T. Kingzett and R. C. Woodcock (communicated to the Brit. Pharm. Conf. at Cambridge in 1916; see *That in Journ.*, July 30, 1916), and "The bacterial testing of disinfectants: a practical criticism," by the same authors (*J. Soc. Public Analysts*, May, 1913).

PERSONAL AND OTHER ITEMS

At a board meeting of the United Alkali Company, on January 18, Mr. Holbrook Gaskell (one of the existing directors) was appointed a managing director, and the following gentlemen were appointed additional directors of the company:—Sir Alfred Mond, Sir Harry McGowan, Mr. J. G. Nicholson, and Lieut.-Colonel G. P. Pollitt.

Mr. N. A. Anfilogoff, general manager of the London and Thames Haven Oil Wharves, Ltd., has been appointed a Justice of the Peace for Essex.

The Home Secretary has appointed Dr. J. C. Bridge, one of the medical inspectors of the Factory Department, to the post of Senior Medical Inspector of Factories, which was vacated by the resignation of Sir Thomas Legge.

The progress medal of the Royal Photographic Society has been awarded to Mr. George Eastman, of the Eastman Kodak Company, in recognition of his inventions, researches, publications and other works which have resulted in an important advance in the development of photography.

Mr. Thorp Whitaker, a director of the Bradford Dyers' Association, has retired from his position as managing buyer of the Association, but will remain in a consultative capacity as a director. Mr. Whitaker, who has completed fifty years' service in the dyeing industry, was chemist to Edward Ripley and Son, Ltd., before he became a director of the Association. He received the O.B.E. for his work in assisting the Board of Trade in buying and distributing colours during the war.

Prof. A. W. Porter has resigned from the honorary secretaryship of the Institute of Physics, and Prof. A. O. Rankine has been appointed to succeed him.

University College, London, which is endeavouring to raise £500,000 in celebration of its centenary, is making a special appeal for £100,000 to endow five "City of London" chairs in various subjects, including geology and pharmacology. It is pointed out that "work on the production, standardisation, and properties of new drugs for medical purposes is an essential function of the Chair of Pharmacology. Such work is of vital importance to all firms dealing in drugs. Great Britain is falling behind Germany and the United States in this branch of industry, and consequently British markets are being flooded by drugs which have been tested and proved abroad."

The death is announced of Lord Bearsted (formerly Sir Marcus Samuel), a pioneer in the use of petroleum and the founder of the Shell Company, which rendered great service to the country during the war by supplying, at the shortest notice, a petroleum distillate rich in toluene for the manufacture of T.N.T. Lord Bearsted was a generous public benefactor, and gave £10,000 in 1924 to Sheffield University to encourage research in metallurgy.

We regret to have to announce the death, after a brief illness, of Mr. F. J. Stoakley, who had been chief assistant to the Professor of Chemistry at Cambridge for many years. The passing of such a genial and attractive personality will be regretted by all those who have passed through the School of Chemistry at Cambridge.

The Theory of Strong Electrolytes

The Faraday Society is arranging a general discussion on "The theory of strong electrolytes," to be held at Oxford on April 22-23. On the first day "Ionic mobility" will be discussed, and on the second day "The activity of strong electrolytes." Well-known European and British workers will be present at the discussion.

Institution of Fuel Technology

The registration of the Institution of Fuel Technology as a company limited by guarantee is announced. Its President is Sir Alfred Mond, and the Vice-Presidents include Lord Aberconway, Prof. H. B. Dixon, Sir Robert Hadfield, Sir William R. Smith, Lord Weir, and Mr. D. Milne Watson.

International Rubber Exhibition

The International Exhibition of Rubber and other Tropical Products will be held in the Grand Palais, Champs Elysées, Paris, from January 21 to February 6. Although unofficially organised under the direction of Mr. H. G. Montgomery, a number of governments are taking part in the exhibition, in addition to numerous producing and manufacturing organisations and firms in various countries. Lord Colwyn is President and Sir Wyndham Dunstan Vice-President of the exhibition, which is held under the patronage of M. Gaston Doumergue, President of the Republic.

In connexion with the exhibition a series of conferences is to be held. M. Painlevé is the Hon. President of these conferences, and will open the proceedings on January 24, at 10 a.m. Sir Wyndham Dunstan and Prof. Perrot will preside at the following daily meetings at which numerous papers by experts on the production and use of rubber, new methods for the treatment of rubber latex and its direct employment for manufacture and new uses for rubber, will be read. In the following week mornings will be devoted to cotton, palm oil, and other tropical products. The exhibition will be opened on Friday, January 21, by M. Perrier, the Minister for the Colonies, and the President of the Republic will visit the exhibition on Saturday, January 22, when the Lord Mayor of London is expected to pay a visit.

European Steel Cartel

It is reported from Paris that the Iron and Steel Cartel will be joined by Austria, Czechoslovakia and Hungary. According to the *Excelsior*, negotiations are being carried on with English interests, who ask for a quota of 9½ million tons, the same as that of Germany, whereas the Cartel offers only 8 million tons.

Anglo-French Industrial Conference

It is reported that the recent conference between representatives of the Federation of British Industries and of the corresponding German Federation will probably be followed by a similar conference between the British Federation and representatives of French industry. An invitation has been sent to French business leaders to come to London to discuss subjects of common interest, and if the invitation is accepted the meeting, according to the *Manchester Guardian*, will probably be held in March.

Beet Sugar Industry

During the campaign which is now drawing to a close, the Cantley, Kelham, Ely, and Ipswich beet sugar factories have produced sugar from 550,000 tons of beets grown on 65,000 acres. This is about half the total acreage of sugar beet grown in Great Britain. The Anglo-Dutch group, which operates the above factories, is now contracting with farmers for a new factory at King's Lynn, to be ready in the autumn.

Forest Research in Canada

At a recent meeting of the members of the Canadian Pulp & Paper Association in Montreal, arrangements were agreed upon for the erection of a forest research laboratory, the site of which will be on the McGill University grounds. A special holding company will be formed with power to enter into a contract for a 40-year lease of the land at a nominal rental. The projected building will cost about \$350,000, and be of fireproof construction. Accommodation will be afforded in the basement of the building for the semi-commercial pulp and paper apparatus, appliances and machinery, as well as that for artificial silk manufacture. The first floor will be devoted, almost entirely, to the executive offices of the Canadian Pulp & Paper Association, the Division of Pulp and Paper of the Forest Products Laboratories, and the Department of Industrial and Cellulose Chemistry of McGill University. The upper floors will be occupied by the library and the various research laboratories of these organisations. The cost of the upkeep and maintenance of the building will be borne in equal proportions by the three parties who will share its occupancy—the University, the Forestry Branch of the Canadian Department of Interior, and the Pulp & Paper Association. The erection of the building will commence at an early date, and it is anticipated to be ready for occupancy within a year. The entire cost of construction will be borne by the Canadian Pulp & Paper Association.

Canadian Mining Industries

The Victoria Syndicate, of London, England, a subsidiary of the Mond Nickel Company, has developed a new mine, the Drum Lummon, in the Pend d'Oreille section of Nelson Mining Division, B.C. also a body of zinc ore in the old Hudson Bay Mine on Sheep Creek, B.C. It has also taken 500,000 shares in the Ruth-Hope Mine, at Sandon, B.C., where a large amount of ore is being developed in the Silversmith Vein. The same syndicate has entered into an agreement with the owners of the Sherritt mine in Northern Manitoba, in the vicinity of the Flin Flon Mine, which is under control of Harry P. Whitney and others of New York, for the further development of this mine.

New German Fertiliser

The German Dye Trust announces that it is placing on the market a fertiliser containing nitrogen, phosphoric acid and potash, "combined by a new chemical process," for which special advantages are claimed. According to *The Times*, this announcement is a move in a struggle between the Trust, the four big potash concerns, and a section of the "heavy" industry.

Alcohol in Canada

The annual financial statement of the Canadian Industrial Alcohol Company, Ltd., Montreal, for the year ending September 30, 1926, shows net profits, after depreciation etc., at \$2,109,851 as compared with \$1,359,026. Dividends of \$1,024,000 were declared, leaving a surplus of \$1,085,851, bringing the total profit and loss balance to \$2,717,340.

COMPANY NEWS

IMPERIAL CHEMICAL INDUSTRIES, LTD.

The directors of Imperial Chemical Industries, Ltd., announce that allotment letters have been posted in respect of transfers "in order" received at the registered offices of Brunner, Mond & Co., Ltd., Nobel Industries, Ltd., the United Alkali Company, Ltd., and the British Dyestuffs Corporation, Ltd., up to December 31. Further batches of allotment letters will be posted at approximately weekly intervals.

The acceptances to date of the offer to exchange shares has been entirely satisfactory, shareholders representing over 80% of the ordinary shares in each company having agreed, and the acceptances from the other classes of shareholders being equally satisfactory.

In response to numerous requests from shareholders abroad and others who are prevented from completing the necessary formalities immediately, the directors of Imperial Chemical Industries, Ltd., have decided to keep the offer open for a reasonable time beyond January 15, named in the circulars to the shareholders.

ILFORD, LTD.

The directors have decided to call a meeting of shareholders to authorise an increase of the capital from £500,000 to £640,000 by the creation of 140,000 new ordinary shares of £1 each, ranking for dividend, and in all other respects *pari passu* with the existing ordinary shares. It is further proposed to capitalise £62,000 of the reserve fund, and to distribute as a bonus one new ordinary share of £1 in respect of every five ordinary shares held.

BRITISH SUGAR PROCESSES, LTD.

The rights for the exploitation of the Suchar process of refining sugar have been secured for the United Kingdom, British West Indies, Egypt, China, Japan, Formosa, India, etc. by an English company, "British Suchar Processes, Limited," which has a strong financial backing. The promising results reported by refineries in which the process is installed suggest that it is at last possible to produce a standard refined sugar at the plantation. The process is simple, and is claimed to effect many economies. The cost of refining by this process is said to be well below that of the bone-char process, while the quality of the sugar produced, judging from shipments made from Porto Rico and Louisiana, is equal to the best on the market. Further, a relatively small capital investment is required, and the water and fuel consumption is low. Moreover, it is claimed that the carbon can be simply and completely reactivated after use.

In addition to its use in the raw sugar factory, Suchar is finding an application in the syrup, jam, and confectionery industries, as it enables the manufacturer to produce directly, from raw sugar, syrups which will conform to any specific requirements.

INTERNATIONAL HOLDINGS AND INVESTMENT CO., LTD.

It is announced that the extra interest payable to the 7% participating first mortgage debenture stockholders in respect of their participation in profits for the half-year ended December 31, 1926, is at the rate of £1 5s. 5d. % free of tax (equal to £1 11s. 9d. gross), payable on February 1.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salaminoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free. Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton. Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
 Crimason.—1s. 3d.—1s. 7½d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—2s. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 2d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithophone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r.

London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride.—4d. per lb., carboys extra.

*Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.

Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep.—5s. 3d. per lb.

Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 per ton. Scarce. Grey, £17 5s. per ton. Liquor, 9d. per gal. 32° Tw.

Charcoal.—£8 5s.—£10 per ton and upwards, according to grade and locality. Very scarce and fair demand.

Iron Liquor.—1s. 6d. per gal. 32° Tw.; 1s. 2d. per gal. 24° Tw.

Red Liquor.—10d.—11d. 16° Tw. per gal.

Wood Creosote.—2s. 9d. per gal., unrefined.

Wood Naphtha.—Miscible, 3s. 10d.—4s. per gal., 60% O.P. Solvent, 4s. per gal., 40% O.P. Both scarce and in fair demand.

Wood Tar.—£4—£5 per ton and upwards, according to grade.

Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carboic. Crystals, 6½d. 6½d. per lb. Crude 60's, 1s. 9½d.—2s. per gal.

Acid Cresylic, 99/100.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 1d. per gal. Pale, 95%, 1s. 10d.—2s. per gal. Dark, 1s. 9d.—2s. per gal.

Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.

Benzole.—Crude 65's, 1s. 3½d.—1s. 4½d. per gal., ex works in tank wagons; Standard motor, 1s. 6d.—2s. 4½d. per gal., ex works in tank wagons; Pure, 2s. 2½d.—2s. 5½d. per gal., ex works in tank wagons.

Toluole.—90%, 2s. to 2s. 6d. per gal. Firm. Pure, 2s. 3d.—2s. 8d. per gal.

Xylol.—2s. 3d.—2s. 8d. per gal. Pure, 4s. per gal.

Creosote.—Cresylic 20/24%—10½d. per gal. Standard specification, 6d.—9½d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8d.—9½d. per gal.

Naphtha.—Crude, 10d.—1s. 1d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, about 2s. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s. per ton.

Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet Flaked, £12 10s.—£13 per ton.

Pitch, medium soft.—117s. 6d.—130s. per ton, f.o.b. according to district. Scarce and more enquiry. Prices nominal.

Pyridine.—90/140.—9s. 6d.—17s. per gal. Nominal. 90/180—7s. 6d. per gal. Heavy.—7s.—10s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—8s. per lb.

Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.

Acid H.—3s. 3d. per lb. 100% basis d/d.

Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.

Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—9½d. per lb., naked at works.

Aniline Salts.—9½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.

Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—4d.—4½d. per lb. Quiet.

m-Cresol 98/100%.—2s. 8½d. per lb. Quiet.

p-Cresol 32/34° C.—2s. 8½d. per lb. Quiet.

Dichloraniline.—2s. 3d. per lb.

Dimethylaniline.—2s. per lb. d/d. Drums extra.

Dinitrobenzene.—9d. per lb., naked at works.

Dinitrochlorobenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

a-Naphthol.—2s. per lb. d/d.

β-Naphthol.—11d.—1s. per lb. d/d.

a-Naphthylamine.—1s. 3d. per lb. d/d.

β-Naphthylamine.—3s. per lb. d/d.

p-Nitraniline.—1s. 9d. per lb. d/d.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—7d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb. d/d.

R. Salt.—2s. 4d. per lb. 100% basis d/d.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—9d. per lb., naked at works.

p-Toluidine.—2s. 2d. per lb. ex works, naked.

m-Xylidine Acetate.—2s. 11d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 4d.—2s. 5d. per lb. Firm.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity.

Acid, Boric B.P.—Cryst. £40 per ton. Powder £44 per ton. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 3½d. per lb. Less 5%. Weak market.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots. •

Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. 1s. 4d.—1s. 5d. per lb. Firm and good enquiry. Technical 11½d.—1s. per lb. Good enquiry.

Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.

Acid, Tartaric.—1s. 0½d. per lb. Less 5%.

Amidol.—9s. 6d. per lb. d/d.

Acetanilide.—1s. 7d.—1s. 8d. per lb. for quantity.

Amidopyrin.—11s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.

Aspirin.—2s. 4d. per lb. Good demand.

Atropine Sulphate.—11s. per oz. for English make.

Barbitone.—8s. 9d. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth

Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—

10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—

12s. 6d. per lb., all according to quantity. Bismuth

Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb.

Bismuth Subchloride.—11s. 9d. per lb. Bismuth Sub-

gallate.—9s. 9d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr
paid any station in Great Britain in ton lots.
Bromides.—Ammonium.—2s. 2d.—2s. 4d. per lb. Potas-
sium.—1s. 9d. 2s. per lb. Sodium.—2s.—2s. 3d. per
lb. All spot.
Calcium Lactate.—1s. 4d. —1s. 6d. per lb.
Chloral Hydrate.—3s. 3d.—3s. 6d. per lb., duty paid.
Chloroform. 2s. 3d.—2s. 7½d. per lb., according to quantity.
Creosote Carbonate.—6s. per lb.
Ether meth.—1s. 1d. —1s. 11½d. per lb., according to sp. gr.
and quantity. Ether purif. (Aether B.P. 1914)
2s. 3d.—2s. 4d., according to quantity.
Formaldehyde.—£39 per ton. Ex wharf in barrels.
Gadacol Carbonate.—6s. 6d. 7s. per lb.
Hexamine.—2s. 4d. 2s. 6d. per lb.
Homatropine Hydrobromide.—30s. per oz.
Hydrastine Hydrochlor.—English make offered, 120s. per oz.
Hydrogen Peroxide (12 vols.).—1s. 8d. per gal. f.o.r. makers'
works, naked.
Hydroquinone.—4s. per lb.
Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots.
Potassium 4s. 1d. per lb. Sodium 4s. 4d. per lb.
Iron. Ammon. Citrate B.P.—2s. 1d. —2s. 4d. per lb. Green,
2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d. —2s. 5d. per lb.
Iron Perchloride.—22s. per cwt., 112 lb. lots.
Magnesium Carbonate.—Light Commercial £33 per ton net.
Magnesium Oxide.—Light Commercial £67 10s. per ton, less
2½%; Heavy Commercial £22 per ton, less 2½%;
Heavy Pure 2s. 2s. 3d. per lb., according to quantity.
Menthyl.—A.B.R. recryst., B.P., 18s. 9d. per lb. net.
Synthetic, 10s. 6d.—12s. per lb., according to quantity.
Liquid (95%), 12s. per lb. Detached cryst., 15s.
per lb.
Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig,
6s. 6s. 1d. per lb.; Corrosive sublimate, lump, 4s. 8d. —
4s. 10d. per lb., Powder, 4s. 2d.—4s. 3d. per lb.;
White precip., lump, 4s. 10d.—5s. per lb., Powder,
4s. 11d.—5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d.
per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide,
5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d.
per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.
Methyl Salicylate.—1s. 9d. per lb.
Methyl Sulphonol.—15s. 6d. per lb.
Metol.—11s. per lb. British make.
Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
Paraldehyde.—1s. 4d. per lb.
Phenacetin.—3s. 9d.—4s. per lb.
Phenazone.—5s. 9d.—6s. per lb.
Phenolphthalein.—6s. —6s. 3d. per lb.
Potass. Bitartrate.—99/100% (Cream of Tartar) 83s. per cwt.,
less 2½% for ton lots. Dearer.
Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
•Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
Potass. Iodide.—16s. 8d.—17s. 5d. per lb. according to
quantity.
Potass. Metabisulphite.—6d. per lb., 1 cwt. kegs included.
F.o.r. London.
Potass. Permanganate.—6½d. per lb. spot.
Quinine Sulphate.—2s. per oz.—1s. 8d. —1s. 9d. per oz. in
100 oz. tins.
Rac. cin.—4s.—4s. 3d. per lb. spot.
Saccharin.—55s. per lb. Quiet.
Salol. 3s.—3s. 3d. per lb.
Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C.,
1923.—2s.—2s. 2d. per lb.; U.S.P., 1s. 11d.—2s. 2d.
per lb., according to quantity.
Sod. Ferrocyanide.—4d. per lb., carr. paid.
Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d.
consignee's station in 1-cwt. kegs.
Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—80s.—85s. per cwt.
net, according to quantity.
Sod. Salicylate.—Powder, 1s. 10d.—1s. 11d. per lb.; Crystal,
1s. 11d.—2s. per lb.
Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton,
according to quantity, 1-cwt. kegs included.
Sulphonol.—10s. 6d. per lb.
Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
Thymol, Puriss.—10s. 9d.—11s. 6d. per lb., according to
quantity. Natural. 17s. 6d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
Aubepine (*ex Anethole*).—10s. 6d. per lb.
Amyl Acetate. 2s. per lb. Amyl Butyrate.—5s. 6d. per lb.
Amyl Salicylate.—3s. per lb.
Anethole (M.P. 21/22 °C.).—5s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s.
per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl
Benzoate. 2s. 3d. per lb.
Cinnamic Aldehyde.—Natural, 17s. per lb.
Coumarin.—11s. per lb.
Citronellol.—15s. per lb.
Citral.—9s. 6d. per lb.
Ethyl Cinnamate.—10s. per lb.
Ethyl Phthalate.—3s. per lb.
Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb.
Geraniol.—6s. 6d. 10s. 6d. per lb. Heliotropine.—
4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—
(*ex Shui Oil*) 12s. per lb.—(*ex Bois de Rose*) 16s. per lb.
Lanilyl Acetate.—(*ex Shui Oil*) 14s. 6d. per lb.—(*ex Bois
de Rose*) 18s. per lb.
Methyl Anthranilate.—9s. per lb.
Methyl Benzoate.—4s. 6d. per lb.
Musk Ketone.—36s. per lb.
Musk Xylol.—8s. 6d. per lb.
Nerolin.—3s. 9d. per lb.
Phenyl Ethyl Acetate.—12s. per lb.
Phenyl Ethyl Alcohol.—11s. per lb.
Rhodinol.—28s. 6d. per lb. Saffrol.—1s. 6d. per lb. Terpineol.
—1s. 6d. per lb. Vamlin.—19s. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.
—31s. 6d. per lb. Bourbon Geranium.—12s. per lb.
Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb.
Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf. 5½d.
per oz. Citronella.—Java 85/90%, 2s. 4d. per lb., Ceylon,
Pure, 1s. 11d. per lb. Clove, pure—6s. 3d. per lb.
Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc
38/40%, 19s. per lb. Lemon.—9s. per lb. Lemon-
grass.—4s. 6d. per lb. Orange, Sweet.—9s. 9d. per lb.
Otto of Rose.—Bulgarian, 70s. per oz., Anatolian,
30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—
Wayne County, 24s. 6d. per lb. Japanese, 9s. 6d. per lb.
Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s.
per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at
the Patent Office immediately, and to opposition not later than Mar. 14th.
They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court,
Chancery Lane, London W.C.2, on Jan. 27th. Complete Specifications
marked * are those which are open to public inspection before acceptance.
The remainder are those accepted.

I.—Applications

Ackermann and Langenheim. Conical crushing-mills. 275.
Jan. 5.
Habermann. Centrifugal dryers and separators. 352.
Jan. 5. (Ger., 3.2.26.)
Hatfield. Apparatus for chemical analysis. 214. Jan. 4.

Johnson (I.-G. Farbenind.). Drying gases. 54. Jan. 1.
 Leek. Separation of solids and liquids from suspensions
 etc. 566. Jan. 8.
 Minter. Kilns. 162. Jan. 3.
 O'Neill. Pulveriser. 371. Jan. 6.
 Ver Mehr. Mixing-machines. 357. Jan. 5.

I.—Complete Specifications

23,996 (1925). Slate. Refrigeration. (240,485.)
 591 (1926). Bentley. Rotary kilns and furnaces.
 (263,630.)
 10,850 (1926). Internat. Combustion Engineering Corp.
 Pulverising-mills. (251,295.)
 14,228 (1926). Bentley, Coates, and Riley and Sons, Ltd.
 Colloidal or the like materials. (263,670.)
 18,022 (1926). Chypers. Rotary drying drum. (255,492.)
 18,917 (1926). Brackett and Co., Ltd., and Brackett.
 Screening or filtering apparatus. (263,693.)
 *7418 (1926). Soc. L'Air Liquide. Separation of constituents
 of gaseous mixtures. (263,732.)
 *27,964 (1926). Deutsche Gasglühlicht-Auer-Ges. Cata-
 lysts for gas reactions. (263,758.)
 *31,173 (1926). Albersheim and Konheim. Determining
 the viscosity of fluids. (263,781.)
 *32,223 (1926). Duchemin. See II.
 *32,536 (1926). Excelsior Feuerlöschgeräte A.-G., and
 Treichel. Producing foam. (263,812.)
 *32,556 (1926). Still. See II.
 *32,793 (1926). Pasquiers. Drying. (263,838.)
 *32,947 (1926). I.-G. Farbenind. Recovery of reaction
 products from gases treated with electric arcs. (263,859.)

II.—Applications

Aluminum Co. of America. Caking coke. 448. Jan. 6.
 (U.S., 22,426.)
 Brégaunt. Gas producing apparatus. 495. Jan. 7. (Fr.,
 14,126.)
 Duckham, and Woodhall-Duckham, Ltd. Manufacture of
 coke. 128. Jan. 3.
 Folliet, and Pétrole Synthétique Soc. Anon. Converting
 gas into hydrocarbons of higher carbon content. 70. Jan. 1.
 Gasifier Co. Gasifying liquid fuels. 252. Jan. 4. (U.S.,
 16,926.)
 International Combustion Engineering Corp. Treatment
 of coal. 444. Jan. 6. (U.S., 12,325.)
 Johnson (I.-G. Farbenind.). Production of products from
 coal, tars, etc. 114. Jan. 3. Purification of mixtures of
 oils. 515. Jan. 7.
 McGuinness. Apparatus for heat treatment of shale etc.
 265. Jan. 4.
 Wlassmann. Low-temperature distillation furnace. 435.
 Jan. 6. (Ger., 5,826.)
 Warsop. Treating bitumen. 39. Jan. 1.

II.—Complete Specifications

25,066 (1925). Umpleby. Generation of gaseous fuel.
 (263,561.)
 30,972 (1925). Soc. de Recherches et D'Exploit. Petroli-
 feres. Manufacture of agglomerated adsorbent carbon.
 (244,561.)
 7390 (1926). Shearman. Apparatus for the destructive
 distillation of bones and the like. (263,659.)
 17,089 (1926). Whitehead and Hird. Low-temperature
 carbonisation of coal, lignite, shale, peat, or the like.
 (263,686.)
 17,582 (1926). Szikla and Rozinok. Gasification of fuel.
 (255,857.)
 25,980 (1926). Wolf and Wolf. Dehydration of coal
 sludge. (260,002.)
 *6417 (1926). Litharge Recovery Corp. Separating
 metallic base reaction products from hydrocarbon oils.
 (263,730.)

*31,545 (1926). Urbana Coke Corp. Coking coal.
 (263,785.)
 *32,223 (1926). Duchemin. Gas scrubber. (263,794.)
 *32,325 (1926). Stettiner Chamotte-Fabr. Coking or
 carbonising ovens. (263,801.)
 *32,556 (1926). Still. Gas-fired furnaces, particularly for
 coke and gas-producing furnaces. (263,817.)
 *32,714 (1926). Ammonia. Purifying gas from the distilla-
 tion of coal or coke. (263,830.)
 *32,861 (1926). Hodler, Bosek, and Maschinenfabr.
 Augsburg-Nürnberg. Carbonising-machines. (263,850.)

III. Application

Johnson (I.-G. Farbenind.). 114. See II.

IV.—Applications

British Alizarine Co., Ltd., and Barnard. Manufacture of
 dyestuffs etc. 379. Jan. 6.
 I.-G. Farbenind. Manufacture of dyestuffs of the triaryl-
 methane series. 127. Jan. 3. (Ger., 2,126.)

IV.—Complete Specifications

24,552 (1925). Bentley, and Blyth & Co., Ltd. Manu-
 facture of poly-nitro-amines. (263,552.)
 *32,225 (1926). I.-G. Farbenind. Manufacture of acid
 dyestuffs of the anthraquinone series. (263,795.)
 *32,555 (1926). I.-G. Farbenind. Manufacture of mono-
 azo-dyestuffs capable of being chromed. (263,816.)
 *32,693 (1926). Soc. Chem. Ind. in Basle. Manufacture of
 dyestuffs. (263,826.)
 *32,839 (1926). I.-G. Farbenind. Manufacture of thio-
 morpholines of the anthraquinone series. (263,843.)
 *32,840 (1926). I.-G. Farbenind. Manufacture of alkyl-
 naphthalenes chlorinated in the nucleus. (263,844.)
 *32,841 (1926). I.-G. Farbenind. Manufacture of benzan-
 throne derivatives. (263,845.)
 *32,956 (1926). I.-G. Farbenind. Manufacture of vat-
 dyestuffs of the dibenzanthrone series. (263,861.)
 *127 (1927). I.-G. Farbenind. Manufacture of dyestuffs
 of the triarylmethane series. (263,879.)

V.—Applications

Brandwood and Holt. Production of artificial silk yarns.
 591. Jan. 8.
 Lilienfeld. Manufacture of artificial materials from
 viscose. 331. Jan. 5. (Austria, 5,126.)

V.—Complete Specifications

23,561 (1925). Cross and Engelstad. Manufacture of
 products comprising lignone derivatives. (263,520.)
 6848 (1926). Vereinigte Glanzstoff-Fabr. Production of
 artificial threads from cellulose derivatives. (249,141.)
 16,046 (1926). Bomberg A.-G. See VII.
 *4113 (1926). Pellerin. Cellulose product resembling
 wool. (263,727.)
 *30,224 (1926). British Enka Artificial Silk Co., Ltd.
 Producing acetyl cellulose compounds. (263,771.)
 *32,530 (1926). Brit. Celanese, Ltd. Phosphoric acid
 solutions of cellulose. (263,810.)

VI.—Application

Bloxam (I.-G. Farbenind.). Producing fast dyeings. 330.
 Jan. 5.

VI.—Complete Specification

27,083 (1925). Imray (Soc. Chem. Ind., in Basle). Dyeing
 acetyl-cellulose. (263,579.)

VII.—Applications

Carpmael (I.-G. Farbenind.). 540. See XX.
 Fairweather (Selden Co.). Catalytic oxidation of sulphur
 dioxide. 174. Jan. 4.
 Johnson (I.-G. Farbenind.). Production of anhydrous
 chlorides etc. 514. Jan. 7.
 Lacell, and New Metallurgy, Ltd. Production of chlorides
 from metallic oxides etc. 609. Jan. 8.

Norsk Hydro-Elektrisk Kvaestofakt. Production of granulated nitrate of lime. 223. Jan. 4. (Norway, 14.1.26.)

VII.—Complete Specifications

26,725 (1925). Hill, and Blaydon Manure & Alkali Co. (1877), Ltd. See XVI.

44 (1926). Siegel. Manufacture of sodium fluoride from silico-hydro-fluoric acid. (263,623.)

2420 (1926). Shimadzu. Apparatus for the continuous production of lead oxides in the dry state. (263,644.)

14,272 (1926). Roessler and Hasslacher Chemical Co. Manufacture of alkali monoxides. (253,520.)

15,625 and 15,936 (1926). Suida. Preparation of concentrated acetic acid from pyroligneous acid. (255,043 and 255,047.)

16,046 (1926). Bomberg A.-G. Production of a basic copper sulphate for the manufacture of cellulose solutions. (260,212.)

*31,051 (1926). Möller and Kretz. Preparation of solutions of hydrofluosilicic acid. (263,779.)

*31,052 (1926). Möller and Kretz. Manufacture of readily-soluble salts of hydrofluosilicic acid. (263,780.)

*32,518 (1926). Vohl & Co. Purification of solutions of metal salts. (263,809.)

VIII.—Applications

Ceramic Patent Holdings, Ltd., and Mellor. Glazes for ceramic ware. 227. Jan. 4.

Folliet, and Pétrole Synthétique Soc. Anon. 69. See X. 70. See II.

VIII.—Complete Specifications

32,252 (1925). Sibar Soc. Anon. Verreries de Romont. Production of a sodium aluminium boro-silicate glass. (245,131.)

17,528 (1926). British Thomson-Houston Co., Ltd. Fusing silica. (255,118.)

*29,473 (1926). Quartz & Silice. Manufacture of ceramic ware or materials. (263,765.)

*29,474 (1926). Quartz & Silice. Blowing and moulding articles in silica glass. (263,766.)

*32,847 and 32,848 (1926). Richeroux. Manufacture of raw plate glass. (263,846-7.)

IX.—Application

Warsop. 39. See II.

IX.—Complete Specifications

26,088 (1925). Rice. Porous or cellular cements. (263,571.)

15,292 (1926). Auspitzer. Improving wood. (253,925.)

19,994 (1926). Smidth & Co. Fine grinding of cement. (256,987.)

23,504 (1926). Voisin. Manufacture of spontaneously-pulverised aluminous cements. (259,203.)

*27,948 (1926). Wolman, Peters, and Pfug. Preservation of wood. (263,757.)

*32,239 (1926). Ahlers. Concrete making. (263,797.)

X.—Applications

Aluminium-Ind. A.-G. Manufacture of aluminium. 546. Jan. 7. (Ger., 27.1.26.)

Ashcroft. Treatment of metallurgical slags etc. and recovery of metal products etc. 620. Jan. 8.

Cole. Proofing iron against rust etc. 66. Jan. 1.

Folliet, and Pétrole Synthétique Soc. Anon. Production of refractory coating on metallic surfaces. 69. Jan. 1.

Hones. Manufacture of steel alloys. 339. Jan. 5.

Hornsey. Manufacture of steel. 355-6. Jan. 5.

Kamishima. Alloys. 108-9. Jan. 3.

Krupp Grusonwerk. Working up complex ores etc. 153. Jan. 3. (Ger., 26.1.26.)

Lacell, and New Metallurgy, Ltd. 425. See XI. 609. See VII.

Novelly. Protecting iron against chemical actions etc. 32. Jan. 1.

X.—Complete Specifications

2289 (1926). Baraboshkin, and Trust Uralkupfer. Extraction of precious metals from the slimes of copper refineries. (263,042.)

10,085 (1926). Goldschmidt A.-G. Utilisation of ferro-silicon masses containing valuable metals. (251,268.)

*27,726 (1926). I.-G. Farbenind. Increasing the strength or hardness of magnesium or magnesium alloys. (263,755.)

*32,535 (1926). Kohlswa Fernverks Akt. Manufacture of steel. (263,811.)

*32,942 (1926). Brit. Thomson-Houston Co., Ltd. Refining metals. (263,856.)

*33,070 (1926). A.-G. Brown, Boveri et Cie. Electric smelting furnaces. (263,872.)

XI.—Application

Lacell, and New Metallurgy, Ltd. Electrolytic production of metals. 425. Jan. 6.

XI.—Complete Specifications

*32,181 (1926). British Thomson-Houston Co., Ltd. Electric furnaces. (263,792.)

*32,943 (1926). Brit. Thomson-Houston Co., Ltd. Electric furnaces. (263,857.)

*33,070 (1926). A.-G. Brown, Boveri et Cie. See X.

XII.—Application

Johnson (I.-G. Farbenind.). 515. See II.

XII.—Complete Specification

*12,209 (1926). Bollmann. Apparatus for deodorising fats and oils. (263,738.)

XIII.—Applications

Bedford, Craven, and Yorkshire Dyeware & Chemical Co. Manufacture of cement for linoleum etc. 143. Jan. 3.

Craven, and Yorkshire Dyeware & Chemical Co. Manufacture of solid resin. 67. Jan. 1.

Pahl. Apparatus for production of lacquers etc. 502-3. Jan. 7.

Potts. Paints. 198. Jan. 4.

XIII.—Complete Specifications

13,113 (1926). Scheiber and Nonck. Production of shellac substitutes. (252,715.)

*32,857 (1926). Quittner. Manufacture of elastic and waterproof coatings. (263,849.)

XIV.—Applications

Burrage. Vulcanisation. 242. Jan. 4.

Coles. Production of rubber articles etc. 582. Jan. 8.

Roessler & Hasslacher Chemical Co. Accelerators for the vulcanisation of rubber. 509. Jan. 7. (U.S., 26.11.26.)

XIV.—Complete Specifications

23,232 (1925). Marks (Du Pont de Nemours & Co.). Accelerators for rubber vulcanisation. (263,517.)

*32,957 (1926). Staudinger. Manufacture of hydro-cycloacoutchouc. (263,862.)

XV.—Complete Specification

9370 (1920). Boyet and Gueudre. Manufacture of artificial horn. (250,607.)

XVI.—Complete Specification

26,725 (1925). Hill, and Blaydon Manure & Alkali Co. (1877), Ltd. Treatment of phosphatic materials. (263,576.)

XIX.—Applications

Jennings. Irradiating milk, milk powder, etc. 428. Jan. 6.

Navarre, Rambaud, Fraisse Frères, and Navarre et Fils. Manufacture of preserved fruits. 213. Jan. 4. (Fr., 8.1.26.)

Thomas. Preparing oatmeal for human consumption. 368. Jan. 5.

XIX.—Complete Specification

*28,215 (1926). Staudt. — Sterilising, ageing, and bleaching flour, meal, etc. (263,760.)

XX.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of complex antimony compounds. 540. Jan. 7.

Chem. Fabr. vorm. Schering. Manufacture of hormone from sexual organs. 440. Jan. 6. (Ger., 261,26.) Manufacture of new derivatives of 2-aminopyridine. 441. Jan. 6. (Ger., 271,26.)

• I.-G. Farbenind. Catalytic dehydrogenations. 115. Jan. 3. (Ger., 41,26.)

I.-G. Farbenind., Lutter, and Schrauz. Manufacture of pharmaceutical compounds. 442. Jan. 6.

Johnson (I.-G. Farbenind.). Production of aldehydes from dicarboxylic acids. 513. Jan. 7.

Neville. Medicinal preparations. 116. Jan. 3.

XX.—Complete Specifications

16,915 (1925). Dreyfus. Production of organic compounds. (263,503.)

24,552 (1925). Bentley, and Blyth & Co., Ltd. See IV.

*30,409 (1926). Mannich. Manufacture of alkyl and aralkyl derivatives of cyclo-trimethylene-aryl-pyrazolones. (263,773.)

*32,896 (1926). Grasselli Chemical Co. Aldehyde amine condensation products. (263,853.)

*33,071 (1926). Chem. Fabr. Pott & Co. Condensation products of aromatic sulphonic acids. (263,873.)

*115 (1927). I.-G. Farbenind. Catalytic dehydrogenations. (263,877.)

XXI.—Application

Martinez. Photo-sensitive surfaces. 487—9. Jan. 7.

XXIII.—Application

Mackinnon. Means for neutralising poisonous gases. 232. Jan. 4.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number: *Australia*: Steam briquette presses (Agent-General for Victoria, Victoria House, Strand, W.C.2); *British India*: Crude oil engines (20); *China*: Plant and machinery for factories (35); *Germany*: Leather (29); *New Zealand*: Milk bottles (B. 3150); *Netherlands*: Iron, steel, tin (31); *Rumania*: Galvanised iron and steel wire and copper pipe fittings (A.X. 4083); *South Africa*: Dextrine, ink, steel, etc. (C. 2159); *United States*: Steel, pig iron (37); Pressure gauges for ammonia gas (B.X. 3149).

Chemicals at the British Industries Fair

Imperial Chemical Industries—the great chemical merger formed by the amalgamation of Brunner, Mond & Company, Ltd., Nobel Industries, Ltd., the United Alkali Company, Ltd., and the British Dyestuffs Corporation, Ltd., under the Chairmanship of Sir Alfred Mond, Bart., M.P.—is to make its first public appearance at the British Industries Fair organised by the Department of Overseas Trade at the White City, from February 21 to March 4. During the past few weeks the staffs of the respective companies have been collaborating in the organisation of the largest individual

exhibit which will be placed in the Chemical Section of the Fair.

The main object of the exhibit is to make an expression of Imperial Chemical Industries' individuality as one group, at the same time showing the interconnexion of the different companies comprising the merger, and pointing out to overseas buyers, the chemical trade in general, and the public at large the advantages derived by the amalgamation of the various interests. The exhibit will be imperial in its significance as showing the wide influence of the company in British commercial affairs. It will be practical in the sense that the man in the street will be able to visualise its numerous activities, and it will be scientific in the sense that the buyer of chemical goods will at once see the intimate relationship which exists between the products made in the factories belonging to the respective component parts of this great organisation.

Thymol

Howards' Pure Thymol Puriss, we understand from the makers, Messrs. Howards & Sons, Ltd., of Ilford, is a very elegant product conforming to all the tests of the British Pharmacopœia. The description Puriss is fully warranted by the tests, which show that Howards' Pure Thymol Puriss is of a higher melting point than that laid down in the British Pharmacopœia, and is therefore of superior quality, although the price is competitive.

PUBLICATIONS RECEIVED

AN INTRODUCTION TO CHEMISTRY. By C. G. Vernon, M.A., B.Sc. Pp. 276. London: G. G. Harrap & Co., Ltd., 1926. Price 4s. 6d.

PHOTOGRAPHIC CHEMICALS AND CHEMISTRY. By J. Southworth and T. L. J. Bentley. Pp. vi+121. London: Sir Isaac Pitman & Sons, Ltd., and Henry Greenwood & Co., Ltd., 1927. Price 3s. 6d.

KOLLOIDCHEMISCHE TECHNOLOGIE. EIN HANDBUCH KOLLOIDCHEMISCHER BETRACHTUNGSWEISE IN DER CHEMISCHEN INDUSTRIE UND TECHNIK. Edited by Dr. E. Liesegang, with the assistance of numerous collaborators. Lieferung 1. Pp. 80. Lieferung 2. pp. 81—160. Dresden und Leipzig: Th. Steinkopff, 1926. Subscription price, 5m. each.

SODIUM SULPHATE OF WESTERN CANADA: OCCURRENCE, USES AND TECHNOLOGY. By L. Heber Cole. Pp. vii+160. Canada Department of Mines, Mines Branch. Ottawa: F. A. Acland, 1926. Price 40 cents.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE. BUREAU OF STANDARDS. Washington: Government Printing Office, 1926:—United States Government Master Specifications: No. 252b, for Cheesecloth, Unbleached. Circular No. 258. Price 5 c. No. 63b for Hose, Oil Suction and Discharge. Circular No. 209. Price 5 c. No. 448, for Plumbing Fixtures (For Land Use). Circular No. 310. Price 15 c. No. 18b, for Varnish, Spar, Water-Resisting. Circular No. 103. Price 5 c. Measurement of the Degree of Sizing of Paper. By F. T. Carson. Pp. 703—732. Technologic Paper No. 326. Price 15 c.

Longmans, Green and Co., Ltd., have in the press and will publish early in the year a book on "Flame and Combustion in Gases," by Prof. W. A. Bone, D.Sc., F.R.S., and D. T. A. Townend, Ph.D., D.I.C.



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Telegrams :
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21 FEB. 1927

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY

CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, JANUARY 28, 1927

No. 4

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EDITORIAL

The Great Adventure of a Perkin Medallist

JOHN E. TEEPLE, of Trona, Cal., has received the Perkin Medal, and has told us why and all about it. He claims to have been a consultant for many years, and his remarks are colloquial and sometimes amusing. He recalled to our mind the saying of a favourite poet, "What youth was in thy years, what wisdom in thy levity?" For it seems to us that he has got the root of the matter in him; he has put his finger on the spot and has told us simply and pleasantly much that we ought to know. He tells us that good team work has converted a profitless enterprise into the largest borax plant in the world, and one of the three or four largest potash plants in the world. He hints, without wearying us with details, at the transformation of a patch of desert into a modern city where the men work and the women spend their time playing cards and talking scandal. He has some sensible ideas about dollars, and we judge that he is concerned in business, not for his health, but for other and mixed motives. He has little interest in applied chemistry that is a failure on account of lack of profits. "It is a part of the chemist's and engineer's job to see that he does not become attached to an enterprise that is doomed to failure regardless of his work." Then he tells us of his experience; it is an adventure; he has decided that, given time, patience and money, particularly money that is patient, it is very probable that a successful business can be built, if a little horse sense is mixed with the other ingredients. How much wisdom and experience is concentrated in those four words, "money that is patient"! They form a text upon which whole pages could be written, but which no one would believe unless he had had experience. Knowledge comes, but wisdom lingers. We enjoyed also his description of the business man contemplating

such an opportunity and going through the chemists he knows who are available for the work; selecting the best, he enquires if the chemist has the ambition, the spirit of adventure, and the technical equipment which are necessary. Unless all these questions can be answered positively the business man had better postpone the matter indefinitely. The worldly hope men set their hearts upon requires such a colleague. We have had correspondence about the need for college men; we have had the pleasure of reading many accounts of the proper training of a chemist. We do not need to discuss these now, but we shall recommend all young chemists who intend to enter the chemical industry to read the sage observations of John E. Teeple, and whether they follow our advice or not we shall read his paper again with the confident expectation that a third reading will please us as much as the first or the second. When we are appointed as professor of chemistry in either of our oldest universities—no other will satisfy us—we shall have engrossed in large black letters with red capitals and neatly framed the legend, "Does this particular chemist candidate before me have the ambition, the spirit of adventure, and the technical equipment which make it probable that he will be a contributor?" Mr. Teeple, on behalf of the community, we thank you.

Chemistry as an Exact Science.

It is very remarkable that chemistry, which plays so important a part in modern industry, in agriculture, in physiology, botany and medicine, should also have so much common ground with physics and mathematics. Those who aspire to a knowledge of chemistry have a great task in front of them; those who merely wish to follow some of the modern developments have frequent occasion to bring out their dusty books and their

musty ideas and polish them until they present that appearance of constant use which they formerly possessed. A grown-up man who is neither a professor of mathematics nor an engineer should be free from the differential and the integral calculus and from the mysteries of solid geometry and spherical trigonometry. Yet it is not so; we print this week an important paper by Professor Lowry on stereochemistry in which, naturally, there is frequent mention of the work of Sir William Pope; it has fallen to our lot to read Professor Andrade's latest edition of the Structure of the Atom, and a few weeks' ago we were invited by a correspondent to engage in the exhilarating pastime of space formulae as restricted by assumption, projection and assurance. Those who are accustomed to think in three dimensions, as we presume are ninety-five per cent. of the younger chemists, can picture to themselves without difficulty the tetrahedral forms which Lowry so airily discusses in connexion with carbon compounds, stannic iodide, silver molybdate and silica. Gadamar's suggestion that the tetrahedral atom can be turned inside out appears quite accessible to such an expert as Lowry, but some of us have to puzzle our brains a good deal to know the hypotheses of Pope and Barlow, the *er facile* Lowry, and the equations of Andrade, they are relieved here and there by subtle remarks of a less serious, even a light-hearted character. That a good training in the elements of crystallography is of value may be demonstrated by a consideration of the positions attained by those who learned and those who taught that subject at Finsbury. But in the application of mathematics to chemical considerations there are limits; Andrade thinks that Loring and Druce have gone beyond the limit in asserting the presence of the X-ray lines of the element No. 93 on one of their plates; we think that Andrade has gone beyond the limit in introducing hyperbolic functions; we will not hear a word against the friendly little sins and tans, which in times of frost and snow will prettily feed out of your hand, but as for $\coth \alpha$, no, no! We have cut this creature dead these many years. Lowry in his paper preserves a far better feeling for the decencies of life, but we have no notion to what lengths he might go in a book of 750 pages, which is Andrade's latest effort. We accept without question Lowry's vindication of the tetrahedral atom which seems to him to be analogous to a theory that a ring of five atoms is by far the most stable. A scoffing critic tells us that these five-atom rings are so stable that in the laboratory they are quite scarce by comparison with the six-atom rings. We confess that we found it easier to understand the rule in Shelley's case than the definition of valency, and our conception of valency is not rendered any clearer by Andrade's statement that "there gradually arose round the valency bonds a semi-mystical philosophy, which as it grew less and less able to respond to the questions put to it for solution, became the more diffuse and dogmatic." This is mild in comparison with what he says about the discussions of Flürscheim, Lapworth, Robinson, Lowry and Ingold, but then how can a man who is friendly with $\cosh \alpha$ and $\coth \alpha$ have any feeling for organic chemistry? Stereochemistry and electronic theories nevertheless remain to be guides and philosophers

to help the student of organic chemistry; there is one serious objection, and only one, to the tetrahedral atom of carbon. We know it from our own experience; with the aid of glue, gum or paste you may neatly stick together many solid figures carefully constructed out of cardboard; to stick together by their corners six or eight or ten cardboard tetrahedra, so as to present a neat and symmetrical appearance, requires so much patience as to strain even that of an editor. We look forward to the time when at the Chemical Industry Club we shall see learned chemists bringing tetrahedra out of their pockets and assiduously arranging them on the billiard table; meanwhile an assembly of seven tetrahedra adorns our mantelpiece, and affords to our frivolous visitors an appearance of erudition which we covet, but have no pretensions to deserve. If we ever succeed in adding to it three more atoms we will write such a stinging reply to Mr. Murgatroyd; about next Easter we think we shall be ready, and if we can find he has made a slip in his geometry somewhere we will point it out; there's not a trace upon our face of diffidence or shyness.

The Exact Science in Industry

That the chemistry required in industry is usually an exact science is illustrated by the paper we publish this week by Messrs. Lukirsky and Kosman, of the Physical Technical Laboratory of Leningrad, by many scores of other papers published in this journal in the past, by the exact experiments which have resulted in the synthetic manufacture of ammonia at Billingham, and by many other processes too numerous to mention. Messrs. Lukirsky and Kosman have made use of Stokes' law in their measurements of the size of particles. We are all perfectly familiar with this law, $v = 2gr^2(\rho - d_0)/9\eta$ nevertheless, it may be noted that v denotes the velocity of a falling small particle, g the acceleration of gravity, r the radius of the particle, ρ its density, d_0 the density of the medium through which it falls, and η the coefficient of viscosity of it. The principle of the apparatus they use is very simple: there are three cylinders filled with the same liquid; one in which the particles are placed communicates with the second at one level and with the third at a different level. So the particles descend in the cylinder; some at one level find their way into the second cylinder and slightly alter its level, others do the same in the third cylinder. Calculation enables the sizes of particles to be calculated and to a certain extent to be graded. The grading of particles and determination of their sizes are of supreme importance in the manufacture and use of pigments, and many devices have been adopted; there are many forms of settling in air, where the large particles settle in one place and the lighter ones in another. The same sort of separation can be arranged in liquid suspensions, and there are many crushing machines which automatically return the larger particles to be re-crushed. Sieves and meshes of every degree are in use in other branches of industry, and there is a great variety of apparatus for the removal of abnormal grains from liquids or fine powders. If the apparatus described by our Russian contributor is as accurate and simple as it appears on a hasty examination, then it should prove to be useful.

EXPANSION OR GROWTH*

By JOHN E. TEEPLE

The award of the Perkin Medal came to me this year as a distinct surprise, for two reasons. First, I am an habitual consultant; and, second, my inventive ability as measured by patents granted is rather small. Former medallists almost without exception can show long lists of patents, sometimes fifty or more. My list ends at number two, both issued many years ago, and neither ever served as the basis of an industry or proved remunerative to myself or anyone else. In defence of the Medal Committee, however, I should say that patents and inventions do often occur in my neighbourhood, and maybe I can claim to be a catalyst or a fertiliser of inventions, but nothing more. Reverting to the first charge of being an habitual consultant, none of my distinguished predecessors in this high honour seems to have practised this mode of life. Most of them were owners of a manufacturing business, or had been long and exclusively in the service of some one large manufacturing corporation, usually occupying high executive position in it. The two or three exceptions in the list were men on University faculties or in Government service.

It is needless to be inpolite to the Perkin Medal Committee by citing other deficiencies of the present medallist, since my true belief is that the work they have particularly mentioned in making this award, the development of an American potash industry, is well worthy to take its place beside those achievements they have honoured in previous years. There is no lack of modesty in this statement, because it refers to the work and not to the medallist. Some of my honoured predecessors could possibly accept this honour as a personal award because the accomplishments had been largely their own. Most of us, and this is particularly true in my case, can only come here and receive the medal as delegates, as representatives of a large body of workers who have all contributed, who have all distinguished themselves by their services to applied chemistry. It is sufficient glory for the present medallist to have participated with the others and to have contributed what he could.

Now, the story of American potash has been told repeatedly, and the history and problems of this particular plant at Trona, California, have been detailed elsewhere.¹ It will be sufficient here to say that when I first saw the plant, in 1919, it looked like a typical "war baby" with no war in sight. Attempts were still being made to operate in a half-hearted way, but production was only about 20 tons potassium chloride per day, of so low grade that it would now be considered unsaleable, and, although prices were still far above pre-war levels, the daily cost of operation was far in excess of income. To-day the same plant (at least, the buildings are the same ones) is capable of producing nearly 400 tons of very high-grade potassium chloride, borax and boric acid per day, and is marketing them at a profit at prices below pre-war levels and in competition with two of those foreign monopolies that are the *bête noire* of Mr. Hoover—a potash monopoly and a borax monopoly.

* Address delivered by the Perkin Medallist at the meeting of the American Section on January 14.

¹ *J. Ind. Eng. Chem.* 13, 249 (1921); 14, 787 (1922); 14, 904 (1922).

When we sent Mr. H. S. Emlaw, the first manager, to the plant, he was in charge essentially of a desert mining camp. To-day his successor, Mr. Frederic Vieweg, presides over our beautiful city of Trona with about 1000 inhabitants, with tennis courts, golf links, a magnificent swimming pool, steam heat, running water and electric lights furnished by the city, and afternoon teas and bridge for the ladies. The first production manager, Mr. Vieweg, found a plant run largely on tradition, a loud voice, and a strong arm. The present incumbent, Mr. Harald de Ropp, runs it theoretically on meters, thermometers, charts and accurate knowledge, and the actuality of this accomplishment is not far in the future. The first head of research and development, Mr. R. W. Mumford, spent much time with little results in finding data and reports covering research work before July, 1919, so we started at the beginning to determine how the chlorides, sulphates, carbonates, bicarbonates, borates, and metaborates of potassium and sodium would behave under all probable conditions and in all possible combinations. This work included, of course, refrigeration and all kinds of evaporation. The next step was for Mr. Mumford and his successor, Mr. William E. Burke, and the latter's assistant, Mr. Francis McDonald, and their cohorts to apply the information to plant practice. This included the design and operation of continuous vacuum coolers, continuous crystallisers, continuous leachers that leach, continuous vacuum crystallisers that sometimes work, continuous elutriators to handle waste salts from the evaporators—over one ton of salt per minute must be washed free from liquor, discharged from the plant, and the liquor returned to the evaporators. It included the entire re-design of the evaporating system, so that nothing is left of the original but some cast-iron shells, the replacing of many filters by a few continuous settlers, the design of double-tube coolers that could be used for a while without clogging. Every minute somewhere in the plant nearly 200,000 gallons of liquors or water pass through pumps, and every piece of apparatus, most of the pumps, and miles of pipe lines must be so designed that they can be emptied almost instantly and washed free from salts. The intention was to have every operation continuous, to bring brine in at one end of the plant and keep it moving forward steadily till the part we wanted was ready for the customer and the rest was out of the plant. This has been nearly realised. It is obvious that most of the apparatus used was designed to fit special conditions, would not be broadly applicable to other plants, and a detailed description of it would not be of general interest.

To-day this is by long odds the largest borax plant in the world, and one of the three or four largest potash plants in the world. It has a capacity of over one ton finished product every four minutes, and nearly 10,000 lbs. of water are evaporated from brine every minute, yet its evaporators are no larger than they were when the capacity was one-tenth as much, and there are fewer of them with less heating surface; the boiler capacity has been increased only 15%, and the refrigerating compressors not at all; the fuel oil bill is about the same as it formerly was, and the pay roll only a little larger. We have here an excellent example of the application of chemistry to industry, but a mere recital of the accomplishments shows that many other things besides

chemistry had to be applied in order to achieve the result. The chemist and the engineer often overlook these obvious necessities. Men must be well housed and fed; our labour turnover at one time was over 500% per year, an entire new pay roll on the average every ten weeks. Now it is normal. Our freight bill is probably 2,500,000 dollars per year; by proper representations and classifications a good traffic man can save possibly 20%, and a half million dollars per year saved this way is just as big as a half million saved by applied chemistry. Some seven or eight million dollars worth of goods must be sold per year, and in the beginning their reputation for quality was none too enviable. However, they were staple commodities, so our need was for a man who knew the technique of selling, and especially one who would make friends and play fair with every customer. When we selected Mr. A. A. Holmes to be Sales Manager I suggested these especial needs to him, but the admonition was quite unnecessary. By nature he plays fair and makes friends.

In an enterprise like this someone must run a railroad and keep the accounting as the Railroad Commission desires; someone must see that everything is properly covered by insurance, and fire mains, plugs, pumps and department are kept in working order; someone must keep a butcher shop and store, and boarding house and iceplant without either going broke or having the whole town about his ears; pay rolls always tend to increase; someone must keep a sharp eye and a pruning knife ready; purchasing agents like to buy in large lots—someone must use discrimination, or hundreds of thousands of dollars will be tied up uselessly in stores. In a continuously-operating plant like this stoppage may mean a direct loss of ten or twenty dollars per minute. A high speed and skilful maintenance department is a necessity, and its value is greatly increased if the accident is prevented before it happens.

You may say that I am only recounting the problems of any large manufacturing industry. This is largely true, but I want to emphasise the fact that all these things are an integral part of the application of chemistry to industry. No one man could or should give personal attention to them all, but someone must have every one of these problems as his definite responsibility, otherwise the chemical and engineering work may be never so good, and still as a sample of applied chemistry it will be a failure on account of lack of profits. The operation will be a success, but the patient dies, and I do not understand that any medals are awarded for such operations. It is a part of the chemist's and engineer's job to see that he does not become attached to an enterprise that is doomed to failure regardless of his work.

The above sketchy description was meant to show something of the situation at Trona in 1919, its present condition, and the mechanism connecting the two. We have indicated some of the difficulties encountered in work of this type, and now let us look for a moment at the extreme simplicity of it. Your consultant looks over the situation in 1919, and finds an abundance of cheap raw material containing staple products which have a ready market; he finds a plant rather expensively making a partial separation of the products; he finds many unknowns, many difficulties, but no really insurmountable obstacles seem to stand in the way of

a cheap production of certain staple products. So he decides that, given time, patience and money, particularly money that is patient, it is very probable that a successful business can be built, if a little horse sense is mixed with the other ingredients. Then, the time and patient money being available, you start picking men here and there who like work and responsibility. You show them your vision of what can be done. Soon there is a nucleus of men who have the vision and who attract other ambitious souls. The only bait needed is the picture of a big pioneer work to be done, the promise that a man can have all the work, responsibility and freedom from bossing and interference that he is capable of taking, and the assurance that the work will be completed. It is an adventure. Then you watch them grow, see them become resourceful, self-reliant, unafraid. One day it becomes an organisation, a living, growing, co-operating entity working toward a common end, disregarding personal discomfort, 115° in the shade, or 24 hrs. a day. It is no longer a place for the weak, the petty, or the deadwood; the man who is not contributing his best feels lost and fades away. When this peak has been reached you go fishing, and let them alone while they finish the job. You see it is really very simple. There are men in plenty who will work their heads off intelligently and accomplish really marvellous things if you will but realise, and make them realise, the dignity and importance of their work, and give them definite responsibility and authority to do it, asking only for final results. Above all, they must be freed from petty nagging, freed from gloom spreaders, and freed from a voice at their elbow constantly dictating just how and when and where each move should be made.

I am far from advocating such an organisation for all types of work or for all types of men. Your standard corporation organisation, after the efficiency expert gets through with it, presents an entirely different picture, a picture that reminds you of an army with all authority vested in the chief button pusher, and all eighteen vice-presidents looking and acting as much alike as colonels in uniform. Now, an army is a wonderful machine for destruction, or even for routine work. As a mechanism for concentrated physical action, requiring neither thought nor initiative, excepting in the supreme command, it is hard to beat. It is even capable of expansion. But where constructive work is to be done, where research and development work are in progress, where initiative, resourcefulness and good judgment are more important than obedience to orders, there your task becomes one of developing the individual rather than disciplining an army. Where something new is to arise that did not exist before, you need growth, not simply expansion, and growth consists in a change in individual cells, while expansion is simply the addition of more men to an existing army, or more bricks to an existing wall. In the army and the ordinary corporation organisation, the importance of the individual is minimised; he is simply a casualty or a unit of a certain type, and there are plenty of machine-made spare parts to replace him. In the growing organisation, the individual must be emphasised; he is usually hand-made or grown on the spot, and there are no exact duplicates. An army need not know where it is going or what is the immediate or remote object

of its movement, but it must have orders or it is lost. Your organisation for development needs few orders, the fewer the better; but it must have the complete vision of the end to be attained, and the map of its present locations, its immediate and remote movements, and the reasons for them. In the plant at Trona every man has opportunity to see the exact production of every material for the day before, while heads of departments and divisions also know costs of production and their department costs as soon as the officers know them. There are no secrets and no mysteries.

The ordinary non-technical executive, or even the technical one who has not come up through a period of research and development, utterly fails to grasp this distinction between the two types of organisation and the two ways of handling men in them. This statement is not made casually, but is the result of a quarter-century experience with many executives in many corporations. This lack of understanding on the part of executives is one of the most vicious causes of stagnation in many industries which should be progressing. They start a department of research and development, and then freeze it into immobility instead of fostering it and seeing that it grows. When a man has been nagged by an executive who doesn't know what he is talking about, that man doesn't return to his task with the clear brain and eager desire necessary for constructive work.

In the development of this American potash industry, then, there has been chemical work of a rather high order; there have been applications of chemistry and engineering to the problems in hand, both ingenious and effective. There has resulted a successful industry that did not exist before. But the thing in which I take most pride is the growth of the men themselves. They came there most of them rather young, with little or no experience in pioneer work, largely unaware of their own powers or possibilities. They developed ability, responsibility, assurance, and a just appreciation of their fellow workers. It becomes their plant, their business, and they are ready to attack any necessary problem connected with it, cheerful, self-reliant and unafraid.

Perhaps a short summary here would be helpful, and we should note first that all these remarks are meant to apply solely to the creation of something new, that did not exist before. We are not discussing matters of standard practice or the mere duplication of something already existing. The potential importance to industry of chemistry and its applications is so obvious that we spend little time discussing it here, but in order for the application to leave the potential state and become actual or kinetic the results of it must be reflected definitely and clearly on the right side of the ledger. Enterprises dependent on chemical progress are continually starting, and just as continually many of them turn out to be failures, reflecting discredit on both chemists and management. The chemist then desiring to do creative work must ask two questions before he starts; first, are the conditions such that I can do this work so far as it relates to my profession and carry it through to a finish? and second, assuming that my professional work is well done, will all the other factors necessary to commercial

success be available, such as sufficient money, knowledge of business and of the business, experience, salesmanship? Unless the chemist can answer both questions positively and rather decidedly, he had better move on before he starts, otherwise he will find himself ultimately out of a job and under blame for failure, or else he will find himself changed from a creative chemist into a mere work horse. On the other hand the business man who contemplates bringing creative work into his organisation would do well to ask a few questions, such as, Why do I want to take this step? Have I the time, patience and money to carry it through to a finish? Is there some man or men in my organisation with the intelligence and the understanding from experience to direct this work and to lead the men engaged in it so that they will grow and produce? And does this particular chemist candidate before me have the ambition, the spirit of adventure, and the technical equipment which make it probable that he will be a contributor? Unless all these questions can be answered positively the business man had better postpone the matter indefinitely.

For over twenty years a succession of chemists has been coming to my office to explain how they had done excellent creative work, but the business failed or the work was discontinued. In many cases I knew their stories were true. During all this time another succession of business men has been coming to explain how they started creative work at one time, but the chemists were impractical and spent money like drunken sailors, and never finished anything to the point where it was making profits. In many cases I knew their stories were true; but what a waste of money, of time, and of good chemists these stories reveal, and what a pity that there are not more chemists who know business and more business men who know chemistry, at least to the extent that they can talk each other's language intelligently.

Fortunately this is only the darker side of the picture, and the country has many progressive organisations where creative men are working productively and in complete co-operation and understanding, as they have been for many years. Aside from any contributions of a professional or business nature which I may have made to the development of an American potash industry, I have dreamed of an organism doing creative work and also producing profits, free from alibis for failure, ready to assume blame and to share praise, made up of men who had largely grown into their work, and not of stars who demanded that their names be in the biggest letters and brightest lights. I have dreamed of an organism where intelligence ranked higher than office, and ability to contribute was respected above either: where the men had a consciousness of the dignity of their work and an appreciation of the same dignity in the other man's work, and where loyalty and a determination to finish work undertaken were stronger incentives than the lure of the pay roll, but where the pay roll also attempted to keep intelligent pace with their work.

This dream, thanks to the co-operation of many, has been more nearly realised during the last seven years' work than I ever happened to see it elsewhere, and that realisation is one of the most important reasons why you are honoring me with this medal to-night.

THE IMPORTANCE OF FUEL RESEARCH IN THE COAL INDUSTRY*

By C. H. LANDER, D.Sc.

The important industrial position of Great Britain had been achieved directly by the aid of her natural coal resources. We were pioneers in the getting of coal, for even so late as 1870 our output still equalled that of all the rest of the world put together; we were pioneers in the treatment of coal, for it was in this country that the great gas industry had its beginning; and we were pioneers in the application of coal to industrial processes, particularly in the iron and steel trades, and the use of steam for power production.

It is thus not surprising to find the coal mining industry itself occupying a very prominent position, employing, as it normally does, more men than any other industry, except agriculture. But of particular significance to the economic stability of the country is the fact that coal alone has accounted for one-tenth of our total income from exports, whilst a cheap and plentiful supply of coal is essential to the prosperity of our iron and steel, shipbuilding and engineering trades.

Abnormal war and post-war conditions, however, have struck repeated and heavy blows at the well-being of the coal industry, and during the last few years, partly owing to a general depression in the world's demand for coal, partly to increased competition from other coal-producing countries, and partly to domestic troubles, it had gradually fallen upon very anxious times, its former prosperity had disappeared, and conditions generally had become very unstable. Such an unsatisfactory state of affairs is bound in varying degree to re-act unfavourably not only upon all other important industries, but upon every one of us individually.

In the past our advantageous natural position in regard to coal and iron deposits has allowed of a profitable return even from coal mined wastefully by crude methods, and industry has flourished in spite of an extravagant and inefficient use of fuel. But in face of present-day competition, the necessity both for winning and utilising our coal with the utmost possible efficiency is of primary importance if we are to hold the industrial field successfully against other nations; and it is obvious that the recovery of the coal industry and the regaining of its former prosperity will be greatly assisted by the steady application of scientific methods, whether to coal production, coal treatment, or coal utilisation. The field to be covered is necessarily a very wide one, and the best results can be achieved only by the co-operation of all concerned.

Of such significance did possible improvements to be effected by the development of further scientific methods in the winning of coal appear to the Royal Commission that they recommended that the British Colliery Owners' Research Association should be expanded and placed on such a footing that it could deal adequately with this problem, and co-operate with other existing organisations in allied problems.

The question of the partial purification of coal prior to its leaving the collieries is also one which may well exercise a considerable influence upon its selling value. The system adopted for getting the coal has a bearing upon its preparation for the market, since in addition to such inherent impurities as are derived from the natural inorganic matter or ash of the original plant-substances from which the coal has been formed, dirt (from the roof or floor) which is mainly associated with the small coal is gathered during the working of the seam. When the coal reaches the surface it is screened and graded, and the larger sizes are partially purified by hand-picking. In some cases it is also washed. Little systematic enquiry, however, has been devoted to the requirements of coal purification, and several organisations, including the Fuel Research Board, have therefore undertaken investigations of this problem which should lead to a marked increase in the value of colliery products; but it must be borne in mind that the economic success of such refinements depends in large measure upon local or special conditions, and that their adoption in some cases may be considered impracticable.

Although coal has played so prominent a part in our national development, our knowledge of its physical and chemical nature is still very incomplete; but it is clearly essential, both to the most economical use of coal at home and to its most advantageous disposal abroad, that full information in regard to the properties of the various coal seams should be available. Without such information it cannot be ensured that the different types of coal should be properly directed to the purposes for which they are best suited or to the markets where they are most likely to give satisfaction, and afford the most remunerative return; nor can the utmost proportion of the coal mined be turned to some useful end.

The important bearing of the nature of a coal upon its successful application to any given purpose is becoming increasingly evident, and the greater the precision with which processes of combustion or processes of coal treatment can be carried out, the greater also will become the precision with which it will be necessary to define the characteristics of different grades or types of coal. Progress in the field of fuel utilisation, and a growing appreciation of the importance of fuel conservation, is already reacting upon methods of purchase. Buyers overseas are becoming more alive to the significance of coal quality, and are showing a growing inclination to purchase coal to specification.

The desirability of organising a survey of the national coal resources was suggested by the Coal Conservation Committee in 1916, in a letter to the Department of Scientific and Industrial Research, which stated that it appeared "to be essential to the most economical use of our coal in this country and to the most advantageous marketing of it abroad that there should be available a collection of reliable data giving the chemical analyses of all our different coals. Further, it seems to be essential that these analyses should be prepared upon a uniform basis so as to be readily comparable." Such a survey was consequently undertaken by the Fuel Research Division, and has already yielded results of the greatest interest.

In the past there have been no standard methods of

* Read at a joint meeting of the Edinburgh and East of Scotland Section with the local Section of the Institute of Chemistry, on January 20, 1927, Mr. W. A. Williams presiding.

analysis, and different investigators have adopted variations in procedure, which have led to variations in results, and have rendered comparisons uncertain or even definitely misleading. The question of dependable methods of sampling is even more difficult than that of analysis, since the size of the original sample must be kept reasonably small if the cost is not to be prohibitive. Faced by these difficulties in the compilation of reliable data for the purposes of the National Survey, the Fuel Research Board, in 1921, appointed a Committee to examine methods for the accurate sampling and analysis of coal.

The recommendations made by the Sampling and Analysis Committee have been adopted by the Fuel Research Board, and, in so far as they are applicable, also by the Committee appointed by the Institution of Civil Engineers on standard forms of test for heat engines and boiler trials. It is hoped also that they will become the standard practice of analysts throughout the country, so that all results will be strictly comparable.

There remains the fundamental problem of the best utilisation of coal in our home industries, and it is the aim of every fuel technologist to ensure such economy in fuel consumption that the coal used in any industrial process, whether in its raw state or after conversion into electricity or coke, gas and tar, shall yield the utmost possible return for the least possible consumption.

I have pointed out on previous occasions the useful service which a comprehensive survey of the power, heat and light requirements of the various industries of the country, and a careful consideration of their probable future developments, would perform in the elucidation of this important problem.

The Coal Commissioners came to the conclusion that such a survey was imperatively required in the national interest, but that since the problems to be dealt with were so diverse and the sciences and practices concerned in a state of such active development, it should be a continuous process undertaken by a body of a permanent character. They, therefore, recommended to fulfil this purpose the appointment of a Standing Conference composed of representatives of the industries concerned, under some such title as the National Fuel and Power Committee.

Although it is acknowledged that in certain industrial processes such as steam raising, the advantages to be derived from a preliminary conversion of the energy of coal into other forms are very doubtful, it is equally well recognised that in many cases the use of coal in its natural state is both wasteful and obnoxious. But even where solid fuel still holds the field, enormous aggregate savings might be effected by the proper application of established scientific principles which in many cases could be effected by recourse to relatively simple methods of fuel control.

Many processes are available whereby coal can be converted more or less completely into gas, coke and oils, in various proportions, or into electrical energy, but their development must naturally be subservient to the commercial possibilities presented. The introduction of methods of pre-treatment by which the economic value of the products may be increased above that of the coal itself, however, or whereby the value of low grade

coals or smalls may be stepped up, would obviously be all to our advantage. At the present time the most important of such processes are included in electricity generation and in the various systems of carbonisation; but recently methods for the liquefaction of coal and for the conversion of water-gas produced from coke into alcohols have come into prominence.

Dr. Bergius, for instance, has shown that, by subjecting coal to high temperatures and pressures in the presence of hydrogen, yields of oil varying from 40 to 70% by weight can be obtained. It appears unlikely that liquid fuels could be produced by this process from black coal at prices approaching those at present ruling for natural oils; but the experimental results attained have already led to a commercial exploitation of the process in Germany, where two full-scale units are now under course of erection.

In these days liquid fuel is an essential commodity, and the prospect of establishing a home source of fuel oil is a very attractive one to this country, where natural oil is practically non-existent. Low-temperature carbonisation, however, is the process which it has been most sought here to develop for this purpose, since it offers a means of so treating coal as to obtain not only oil fuel and motor spirit, though in limited quantities, but also a free burning solid, smokeless fuel, suitable for either domestic or industrial purposes. Considerable progress has been achieved during the last few years towards the technical and commercial solution of this problem, but a safe pronouncement of its economic possibilities must await the results from full-scale installations working under ordinary commercial conditions.

Both in the Maclaurin plant at Glasgow, which is concerned primarily with the production of a smokeless domestic fuel, and the McEwen-Runge plant in the United States, which produces a pulverised coke intended for direct firing under boilers, however, various aspects of the problem are being investigated on a commercial scale, and should make it easier to reckon correctly the probable future of the process.

Both in France and Germany the synthetic production of alcohol has now passed the experimental stage, and commercial plants have been established.

It would be bold at this transition period to venture any definite forecast of probable future developments, but it seems safe to assume that we are rapidly nearing a period when natural oil supplies will be eked out by oils manufactured from coal. By what particular means this end will be achieved remains to be seen, but it must be borne in mind that since our coal deposits range over wide limits of composition, and since the demands for any particular form of energy vary both with locality and period, future methods of fuel treatment are likely to remain very diverse, and present methods will, no doubt, continue to exist side by side with such innovations as may prove to be workable upon a sound commercial basis. It is already evident that future generations will look back upon our methods of fuel utilisation as crude and inefficient, and that, by some means or another, we may confidently anticipate a certain increase in the proportion of usefully applied energy attainable from a given initial fuel consumption, whether for the production of power, heat or light.

RECENT ADVANCES IN STEREOCHEMISTRY*

By PROF. T. M. LOWRY, C.B.E., M.A., D.Sc., F.R.S.

The three principal dates in the history of stereochemistry (which happen to be separated by intervals of 25 years) are 1849, 1874, and 1899.

(i) In 1849, Pasteur¹ separated a levorotatory form of tartaric acid, which was the mirror-image of the ordinary dextrorotatory acid, and thus laid a firm foundation for his theory of molecular dissymmetry.

(ii) In 1874, le Bel² and van't Hoff,³ taking advantage of the rapidly-growing knowledge of molecular structure, sketched the broad outlines of chemistry in space. In particular, they showed that all the compounds in which optical activity had been recognised up to that date owed this property to the presence of one or more asymmetric carbon atoms.

(iii) The third date is 1899, when Pope,⁴ by making a few simple but essential modifications in Pasteur's methods, succeeded in preparing an optically-active compound which owed its rotatory power to an asymmetric atom of nitrogen, instead of to an asymmetric carbon atom, and thus opened the floodgates through which there has poured an endless stream of optically-active compounds, representing at least a score of new types of atomic and molecular dissymmetry.

MOLECULAR DISSYMMETRY

Pasteur's work on tartaric acid was remarkable alike for its experimental skill and for its clear theoretical interpretation. On the theoretical side, he showed that the essential condition for optical activity in solution is the existence of a state of molecular dissymmetry,⁵ analogous with the dissymmetry of crystal-form with which Herschel⁶ had correlated the optical rotatory power of quartz.

This property of dissymmetry consists in the ability of a three-dimensional figure to exist in two geometrically-similar but non-superposable forms, like a right and left hand. These opposite or "enantiomorphous" forms are characterised by the fact that one can be converted into the other by reflexion in a mirror, as anyone will discover immediately who tries to shake hands with himself in a looking-glass. The same property of right- and left-handedness exists in cricketers and in violinists, in spiral staircases and in corkscrews, and can even be recognised in a printed page, which is enantiomorphous with its image in a mirror. It should be distinguished clearly from asymmetry, since this term implies a complete absence of symmetry. Dissymmetry, however, may occur in figures which possess a very high degree of axial symmetry, although it cannot exist in any figure which possesses a plane, a centre, or an alternating axis of symmetry. Thus, a dissymmetric crystal of sodium chlorate has 7 axes of symmetry, a crystal of quartz has 4 axes, and even tartaric acid has 1 axis of symmetry, although all other elements of symmetry are lacking from these figures.

Whilst, however, Pasteur recognised that optical activity in solution must be attributed to some form

of molecular dissymmetry, and even suggested that it might be due to a structure analogous to a spiral screw or an irregular tetrahedron, he could not express his views in any greater detail because organic chemists had as yet no precise knowledge of molecular structure, and had not even arrived at the fundamental conception of the quadrivalency of carbon.

CHEMISTRY IN SPACE

When once the fundamental facts of molecular structure had become known, however, the notion of chemistry in space followed inevitably. It was, therefore, no mere coincidence that the conception of the asymmetric carbon atom, with all that it implies, was put forward simultaneously by two independent workers in France and in Holland. The time for this discovery was indeed already so ripe, if not over-ripe, that both of these workers would have had to yield priority to an Italian chemist if it had not been that one of the three dibromioethanes which Paterno⁷ in 1869 sought to explain by means of a three-dimensional carbon atom turned out to be non-existent. The recent celebration in Amsterdam and in Paris of the jubilee of stereochemistry may therefore be regarded as the commemoration of a period of maturity in chemical theory, as well as of the genius of the two youthful workers who were fortunate enough to gather the ripened fruit from the seed which Pasteur had sown.

STEREOCHEMISTRY OF CRYSTALS

Modern physics has provided abundant confirmation of the validity of the tetrahedral model of the carbon atom, which was foreshadowed by Pasteur and exploited so successfully by le Bel and van't Hoff. In particular the X-ray analysis of the diamond⁸ has revealed a structure in which every essential feature of the tetrahedral model is reproduced, but with the additional advantage that the model can be made to a definite scale, since we can now specify not merely the angle between the bonds, but also their length, which is fixed at 1.5 Å.U. A tetrahedral configuration has also been revealed in the four atoms of iodine which surround the metal in stannic iodide⁹ and the non-metal in carbon tetraiodide,¹⁰ in the four atoms of hydrogen which surround each atom of oxygen in ice,¹¹ and in the four atoms of oxygen which surround the molybdenum in silver molybdate,¹² the sulphur in the mineral sulphates,¹³ and the silicon in quartz and in the other crystalline forms of silica.¹⁴

More important, perhaps, is the fact (revealed by the X-ray analysis of the rhombohedral crystals of the calcite series) that carbon in the carbonates¹⁵ and nitrogen in the nitrates¹⁵ is characterised by a trigonal orientation of three oxygen atoms around the central atom of the anion, since it is clear that van't Hoff's tetrahedral model of the carbon atom now has a rival, and that (as many chemists have more or less vaguely suspected) an atom of carbon can have not one configuration, but two. As a result of this discovery Gadamar's suggestion¹⁶ that the Walden inversion depends on turning the tetrahedral atom inside out,¹⁷ in the process of replacing one radical by another, loses some of its weirdness, since, as I have pointed out,¹⁸ the trigonal configuration provides a "half-way house" in this unexpected transformation.

* From a lecture delivered at the Royal College of Science on Monday, Nov. 29, 1926

X-ray analysis has also revealed a *linear* configuration in the anion of $\text{Cs}[\text{ClClCl}]^{19}$, and of $\text{K}[\text{FHF}]^{20}$. This linear configuration also appears in the bivalent atoms

of hydrogen >O-H-O< in the X-ray model of ice,¹¹

although it is generally agreed that the bivalent oxygen atoms in water probably retain the characteristic angle of $109\frac{1}{2}^\circ$ which they possess when the atom is quadri-

valent, thus : $\text{H}-\text{O}-\text{H}$ not $\text{H}-\text{O}-\text{H}$.

TETRAHEDRON VERSUS CUBE

In view of the transient vogue of the cubic atomic models of Lewis²¹ and Langmuir²² ("eight looser electrons seated on the corners of a dry-goods case"). I should like to direct attention to the evidence in favour of the earlier tetrahedral models afforded by the following list of boiling-points : —

Fluorine	$\text{F}-\text{F}$	— 187°
Oxygen	$\text{O}=\text{O}$	— 183°
Nitrogen	$\text{N}\equiv\text{N}$	— 196°
Carbon	$-\text{C}-\text{C}-$	+ 3917°

When tetrahedral models are used, single, double and triple bonds can be represented by contact of a corner, edge or face of the tetrahedron ; but a quadruple contact of four corners is impossible, except by complete superposition of the two tetrahedra. It is therefore possible, by forming a diatomic molecule, to use up all the valencies of univalent fluorine, bivalent oxygen or trivalent nitrogen ; but in the case of carbon this is impossible. The bonds therefore spread out into a network, which extends until the whole area of a crystal of graphite, or the whole volume of a diamond, is included in a single molecule. When cubic models are used, single and double bonds are represented by edge-contact and by face-contact respectively ; but it is impossible to represent a triple bond except by complete superposition of the two cubes ; the abrupt change of behaviour recorded above should therefore obviously occur on passing from oxygen to nitrogen. In a precisely similar way the abrupt rise of boiling-point on passing from carbon dioxide to silica provides an experimental basis for the contention that non-polar double bonds, which are formed with great readiness by elements of the first short period, are difficult or perhaps impossible to produce in the case of elements of higher atomic number. The crystallographic evidence can indeed be interpreted by supposing that the crystals of carbon dioxide²³ are composed of individual molecules, whilst the various crystalline forms of silica¹⁴ are held together by a network of single bonds, joining quadrivalent silicon to bivalent oxygen, corresponding with the network of single bonds which unites the quadrivalent carbon atoms in the diamond, or the quadrivalent oxygen and bivalent hydrogen in ice.

This vindication of the tetrahedral model of the carbon atom is analogous to the much more familiar argument derived from the well-known strain theory of von Baeyer,²⁴ according to which a five-atom ring is by

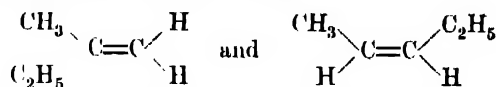
far the most stable, in view of the close approximation of its angles to those between the trigonal axes of a tetrahedron.

RESOLUTION OF DISSYMMETRIC COMPOUNDS

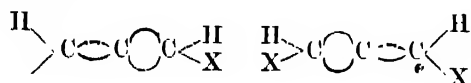
If le Bel and van't Hoff gathered the ripened fruits of Pasteur's theory, it is to Pope and his colleagues that we must look for any further development of his masterly experimental methods. Pasteur¹ had used three methods for separating the dextrorotatory and levorotatory tartrates from the racemates, in which they are contained as an optically-inactive 50 : 50 mixture. (i) by picking out the enantiomorphous crystals of sodium ammonium tartrate by means of their oppositely-oriented hemihedral facets, (ii) by finding a mould or ferment which would consume one form of the compound, but die of starvation in presence of the other, and (iii) by combining the racemic substance with a compound in which optical activity is already developed. During the years which followed attempts were made, by applying Pasteur's methods, to extend the range of optical activity beyond the asymmetric carbon-compounds, of which so many examples had already been provided by nature ; but these attempts ended in failure. Indeed, on the experimental side, no new method of any importance was developed during the half century which separated the pioneer work of Pasteur from the equally fruitful pioneer work of Pope. It was therefore no mean achievement when, by using a strong, stable, monobasic, optically-active, sulphonic acid, in a non-ionising solvent, in place of the weak, aqueous, dibasic, carboxylic acid which had been used hitherto for this purpose, Pope⁴ demonstrated for the first time the possibility of resolving an asymmetric base of which the optical activity was due to some other cause than the presence of an asymmetric carbon atom. Moreover, when once the spell of failure had been broken by the application of these new methods, a new spirit of optimistic activity was created, as a result of which the search for optical activity was soon extended to the whole range of multivalent elements, as well as to a large number of carbon-compounds in which molecular dissymmetry could be suspected on the basis of the most diverse theoretical considerations. We can therefore now record the production of optically-active derivatives of not less than 18 elements as follows : N,⁴ S,^{25, 26} Se,²⁷ Sn,²⁸ P,²⁹ Si,³⁰ Cr, Co, Ru, Rh, Ir, Fe, Pt, B,³¹ As,^{32, 33} Be,³⁴ Zn,³⁴ Cu.³⁴ Optically-active derivatives of the first four of these elements, namely, *nitrogen*,⁴ *sulphur*,²⁵ *selenium*,²⁷ and *tin*²⁸ were prepared by Professor Pope and his colleagues in 1899 and the years immediately following, whilst derivatives of the last four elements, namely *arsenic*,³² *beryllium*,³⁴ *zinc*,³⁴ and *copper*,³⁴ have been resolved during the past two years in the Cambridge laboratory by Mills and Raper³² and by Mills and Gotts.³⁴ Reference may also be made to the resolution of a series of centro-asymmetric compounds, the optical activity of which must be attributed to molecular dissymmetry, although it cannot be assigned specifically to any one asymmetric or dissymmetric atom in the molecule. From this enormous mass of material we can only pick out a few salient points for detailed illustration.

(a) *Centro-asymmetry*.—It was pointed out, both by le Bel² and by van't Hoff,³ that if the four hydrogen

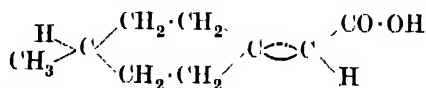
atoms of methane are represented as lying at the corners of a regular tetrahedron, the four hydrogen atoms of ethylene $H_2C:CH_2$ must be represented as coplanar. Indeed, le Bel² urged that, if it could be proved that both forms of amylene



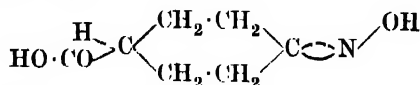
were optically inactive, the four radicals *must* be coplanar, since otherwise optical activity would at once become possible in the compound represented by the second formula. In the case of the hydrocarbon allene, however, the hydrogen atoms of the two methylene radicals, which lie on two parallel straight lines in ethylene, again become crossed as a result of the interposition of a third atom of carbon, as shown in the formula $H_2C:C:CH_2$. Optical activity, therefore, once more becomes possible, just as in the case of methane; but, whereas, in order to develop optical activity in derivatives of methane, all the four radicals must be different, it is sufficient in the case of allene that one hydrogen atom of each pair should be replaced by some other radical as in



This prediction, although set out clearly in 1874, has not yet received a direct experimental verification in spite of the efforts of competent workers,³⁵ since no optically-active derivative of allene has been prepared up to the present time. In 1909, however, Perkin, Pope and Wallach³⁶ prepared the optically-active forms of a centro-asymmetric compound, namely, *methyl-cyclohexylidene-acetic acid*:

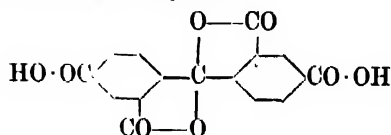


in which the same conditions were created by using a six-atom ring instead of a double bond. In the following year Mills and Miss Bain³⁷ prepared a somewhat similar compound, the *oxime* of cyclo-hexanone-carboxylic acid



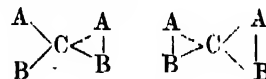
in which the symmetry of the molecule was destroyed by the fact that the three bonds of the nitrogen are not coplanar.

Reference may also be made to the *ketodilactone* of benzophenone-tetracarboxylic acid



which Mills and Nodder³⁸ prepared in optically-active forms in 1921. This compound is of interest in that the central atom of carbon is dissymmetric but not

asymmetric. This condition is achieved by using two identical but unsymmetrical bivalent radicals to occupy the opposite edges of the tetrahedron. In this scheme, therefore, the conditions of dissymmetry in methane are identical with those which exist in allene, since the link between A and B destroys the two planes of symmetry which would otherwise contain AA and bisect BB and conversely.



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(To be continued.)

OILS AND PAINTS IN CANADA

The financial statement of the Sherwin-Williams Company, Ltd., of Canada, manufacturer of oils, paints, varnishes, etc., for the fiscal year ended August 31, shows earnings equal to 9.53% on the outstanding common stock of the company, as compared with 8.79% in the preceding twelve months.

SALT IN S. AUSTRALIA

South Australia is the chief producer of salt among the Australian States, the output in 1925 amounting to 78,251 tons, valued at £178,000. The salt is obtained in the dry season from lakes, and only requires to be refined. The reserves in the salt crust in the main salt districts of the State are estimated at over 7,130,000 tons, whilst increasing amounts of solar salt are being produced. It is considered that the industry will expand owing to the increasing use of salt in alkali manufacture.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

ANNUAL GENERAL MEETING, 1927

The Annual General Meeting of the Society of Chemical Industry will be held in the Debating Hall of the University Union, Edinburgh, on Tuesday, July 5, 1927, at 10 a.m.

The following is the preliminary programme of the meetings to be held from July 4 to July 8, inclusive:—

MONDAY, July 4.

- 8—10 p.m. Informal Reception by Chairman and Committee of the Edinburgh and East of Scotland Section, followed by Conversation in the Ballroom of the North British Station Hotel.

TUESDAY, July 5.

9.30 a.m. Meeting of Council in the General Committee Room, University Union.

10 a.m. Debating Hall, University Union—Civic Welcome by The Lord Provost of the City of Edinburgh: Welcome by the Vice-Chancellor of the University of Edinburgh.

Annual Business meeting.
Presentation of the Society's Medal to Lieut.-Col. G. P. Pollitt, D.S.O.

11 a.m. Address by the President—Francis H. Carr, Esq., C.B.E.

1.15 p.m. Luncheon by invitation of the Edinburgh and East of Scotland Section in The North British Station Hotel (The Lord Provost of Edinburgh and the Vice-Chancellors of Edinburgh, St. Andrews, and Aberdeen Universities are expected to be present).

Afternoon—Garden Party.

8.30 p.m.—1 a.m. Reception by the President, and Dance in The Palais de Danse.

WEDNESDAY, JULY 6.

10 a.m. Joint Meeting with the Biochemical Society.

Meeting of Chemical Engineering Group—
Subject: "Paper."

2.15 p.m. Visit to Edinburgh University Chemical Laboratories, King's Buildings.

4 p.m. Reception by the University of Edinburgh in the Upper Library Hall.

7.15 for 7.30 p.m. Annual Dinner of the Society in the North British Station Hotel.

THURSDAY, July 7.

10 a.m. Meeting of Society—papers to be arranged.

Meeting of Fuel Section of the Society—
Subject: "Coal Cleaning."

Afternoon—Meeting of Fuel Section (continued).

Visits to works:—

Messrs. James Brown & Co.'s Paper Mills, Penicuik.

The North British Rubber Works.

(Others may be arranged.)

Evening—Civic Reception.

FRIDAY, July 8.

Excursions:—

(1) Whole day excursion to Melrose, Abbotsford, Dryburgh, and Peebles.

(2) Afternoon excursion to Forth Bridge and Inchcolm.

(3) Conducted tours of Old Edinburgh will be arranged on both Thursday and Friday.

HEADQUARTERS IN EDINBURGH

The office of the Society, during the meetings, will be in The North British Station Hotel.

ACCOMMODATION

Accommodation in Edinburgh during July will be very limited, and members are urged to make early application for the rooms they require. A limited number of rooms are being provisionally reserved in The North British Station Hotel, and members desirous of staying there should, without delay, make their reservations through the **Local Hon. Secretary, Dr. W. T. H. Williamson, 13, George Square, Edinburgh**. Members will be notified, in due course, of other accommodation available.

It is hoped that the world-renowned beauty of Edinburgh and the surrounding country, and their interesting historical associations, together with the social and other attractions of the meetings, will bring a large number of Members and their friends to this Annual Gathering of the Society.

TAR CONFERENCE PAPERS

The Papers that were presented before the Manchester Tar Conference in November last, together with the full discussion, will be published shortly in bound form, at the price of 2s. 6d., post free.

It was felt that the contributions proved so valuable that many of those interested would like to retain, for immediate reference, a complete account of what transpired at the Conference.

A limited number of copies will be available. It is consequently advisable for any who require copies to apply to the General Secretary of the Society of Chemical Industry, Central House, Finsbury Square, London, E.C.2, at once. Orders should be accompanied by the appropriate remittance.

DEATHS

Christie, John (original member), of Levenfield, Alexandria, Scotland, Dyer and Printer. On June 24, 1926.

Cottrell, Allin (elected 1917), Technical Chemistry Department, University of Edinburgh, Lecturer. On August 18, 1926.

Hart, W. Beamont (elected 1897), of 8, Exchange Street, Manchester, Consulting Chemist. On December 30, 1926.

Saulfeld, Adolphe (elected 1895), of Royds Street, Stockport Road, Manchester, Chemical Merchant. On June 5, 1926.

BIRMINGHAM SECTION

There was a large attendance on January 22 at the joint annual dinner, at the Queen's Hotel, Birmingham, of the Birmingham and Midland Sections of the Society of Chemical Industry and the Institute of Chemistry. Mr. J. C. Mann (chairman of the former section) presided.

The toast "The Society of Chemical Industry" was proposed by Mr. K. H. Wilson (chairman, Midland Section, Chemical Employers' Federation), who pointed to the importance of the three organisations named for the efficient administration of the Chemical Industry. All were necessary. It was no use a chemist spending much time on great chemical problems, if they on the selling side could not sell the product, and it would be

equally futile for the manufacturer to find a market for products if the chemist and the workmen had not made it satisfactorily. The Institute was rendering an admirable service as an examining body and in other directions, and the Society of Chemical Industry was performing a most valuable function as a medium for the publication of technical matters, and for providing facilities for discussions.

Mr. F. H. Carr, C.B.E., President of the Society of Chemical Industry, in acknowledging the toast, stated that chemists throughout the country understood, and had helped the world better than before to understand, how important chemistry and the work of chemists was to the life of the community. It was not necessary that chemists should try to convince the public of their importance: the aim was a far deeper one, namely, that there should be proper recognition of the objects to which chemists gave their lives. Many thousands spent their whole lives in furtherance of the chemical industry, and of the application of chemical science to the activities of the working people. They were inspired in their work to a very great extent in the same way as the man of pure science was inspired in his efforts to carry out research. They were anxious to see that the principles which they were applying to their work were applied to the purposes, first, of the country as a whole. They took an interest and pride in the prestige of the industrial community, and consequently an interest in the products, which by their investigations they made possible. They rejoiced to see an ever-increasing closer application of science to industry. The Society of Chemical Industry exercised a profound influence upon them as chemists, and upon their work, because without it they would feel they were working in an individualistic way for rather selfish ends, but by the Society's aid they were able, themselves, to make contribution, and to realise their part in serving the community. By promoting discussions, by giving awards, by encouraging industrial experiments, they were giving their quota for the development of our national trade, concurrently, they developed the corporate spirit. Some five or six years ago they brought out under the auspices of the Society a weekly journal in order to do more on the side of propaganda and to keep chemists better informed of doings in the chemical industry. Unforeseen difficulties occurred, one being the increased cost of printing, which they had not reckoned upon. They spent a good deal of money in carrying out this aim; they never wavered, having complete faith that sooner or later they would succeed. He was glad to state that they had now put an end to losses, and that during the last year they had managed to get a balance on the right side. It was intended further to improve the JOURNAL, and to make it more and more a part in the national life. His experience among those serving on the councils of the various chemical societies was that they were actuated by the one unselfish motive of doing their best in chemistry for the national interest. Recently the League of Nations in planning an Economic Conference sought a report on the world position of the chemical industry for consideration. They, in this country, heard nothing about it, neither did those in France, until it transpired that it had been considered

in Geneva. Apparently the only people who counted in chemical science and industry were the Germans, and they presented a report, which it would appear was intended to cover the whole ground. They spent a considerable time and delivered the report, which came to their hands at the end of last month. It was a careful and able report, but the position was exaggerated by the suggestion that outside some heavy chemicals which could be left to them, all the rest could be perfectly easily provided by Germany. It was urged that the development of the dye industries in various countries would have the effect of depriving the world of cheap articles in that overhead charges would be made unnecessarily high, and that the desirable thing was that such manufacture should be segregated in one or two countries. That information came to the knowledge of the Association of British Chemical Manufacturers, and by the various interests in the chemical industry the whole position had been brought under review. He was able to tell them that a report on the whole matter had been printed and delivered within two or three weeks of the receipt of the report he had referred to, and their report made it perfectly clear to those in Geneva that the position was not quite as one-sided as their German confrères had suggested. He had only mentioned this matter because he wanted to make it clear that action in a corporate way would not have been possible, if they had not had the Society of Chemical Industry and the other professional organisations, and the Chemical Employers' Federation, and the Association of British Chemical Manufacturers.

Prof. Haswell Wilson, in proposing the toast "The Institute of Chemistry," said it seemed to him that chemistry was playing a fundamental part in practically every industry of importance, and that the applications of chemistry were going to be still further extended in industry, and in the not too distant future the efficiency of many concerns might well be gauged by the extent to which output was controlled by professional chemists. Since the most ancient times chemistry had been related in some form or other with the application of medicine, but in the middle of the last century chemistry became practically dominant over medicine. Pasteur was the man who produced that change; he was a chemist, and he had no medical qualification. They could never forget his wonderful work in the domain of bacteriology, and in the treatment of disease. They found to-day that chemistry was dominating medicine in various directions. The Institute of Chemistry, which was responsible for the training and examination of chemists, had high ideals, and had set a standard which had placed chemistry high among the scientific professions.

Prof. G. G. Henderson (President of the Institute of Chemistry), in reply, said it was a pleasure to meet the President of the Society of Chemical Industry, because he felt that in Birmingham, as elsewhere in the country, there was prevalent a desire for unity between every branch of the profession: in other words, for co-operation in every possible way between chemists of every kind. It was a mistake to suppose that the only function of the Institute was to test the applications of those who practised chemistry and enter their names in a register, showing that they were qualified. The principal function

of the Institute was to promote in every possible way the welfare of the great profession of chemistry, and therefore, as he maintained, the welfare of the country. They knew, though it was almost a platitude to say it, there was not a single productive industry in this country which was not ultimately dependent upon the work of the chemist. He believed fervently that the future prosperity of the country would be very largely dependent upon the application to industry of the services of scientific men. He believed, moreover, that industrialists generally had a proper appreciation of the work of the chemist, but unfortunately the great majority of their fellow citizens were supremely ignorant of the importance of chemistry from the national point of view. Therein lay a danger, in his opinion. Unless their industry was prosperous the country must go down. Therefore he believed it was their duty, individually and collectively, and with the aid of their various societies, to educate the general public. If such education were to be successful, they must go outside the region of the scientific journal, which was not read by the man-in-the-street. Almost everybody read the newspaper, and it seemed to him that very valuable propaganda work could be done by utilising the press in the localities in which the chemist lived, by the writing of scientific articles dealing with new developments in chemistry, in popular language. In Glasgow much useful work had been done in that direction. It was not a case of magnifying their profession; it was simply with the idea of changing the attitude of the public mind in relation to men engaged in scientific work.

The toast of "The Guests" was proposed by the Chairman, who warmly acknowledged the work of the hon. local secretaries of the Institute and the Society of Chemical Industry in making the arrangements for that gathering. He cordially agreed with the suggestion that chemists should do all they could to promote the education of the public with regard to the functions of the chemists.

Councillor Hume, replying to the toast, stated that 85% of the products handled by a company with which he was connected was entirely due to the chemist. A few years ago the firm did a good deal of business with Germany, but he was glad to say that to-day they were practically independent of the German chemist. As a member of the Gas Committee, he had found from the records that during the Chamberlain régime nearly all the by-products from the gas works went to Germany. To-day they were taken by Birmingham and Midland industry.

The toast of "The Chairman" concluded a very pleasant evening.

GLASGOW SECTION

A joint meeting with the local section of the Institute of Chemistry was held in the Institute of Engineers and Shipbuilders, Glasgow, on January 21. Mr. S. H. B. Langlands was in the chair, and Mr. J. W. Donaldson, B.Sc., delivered a paper on "The volatility and carbonisation of oils for cylinder lubrication."

The lecturer briefly reviewed the objects of lubrication and pointed out the main features of internal lubrication, contrasting them with those of external lubrication.

The selection of oils for such purposes was a matter of great difficulty, and the usual tests made, such as specific gravity, flash point, and viscosity determinations, were of little help in making a suitable choice.

The nature of the deposits formed within the cylinder depended upon the types of oil and engines used. In some cases a gummy residue resulted, whereas in other cases the carbon deposit formed varied from a fine soot to a hard mass.

An account was given of the investigations which had been conducted with a view to the determination of the behaviour of different lubricating oils under various conditions of temperature, varying periods of time, and in spaces presenting different surface areas. Three oils—light, medium and heavy—were used, and the loss in weight, together with the nature of the residue, ascertained. The results showed that the percentage loss in weight varied with the period of heating and the area of the space in which the oil was heated.

The character of the residue was determined by the temperature. Light-bodied oils did not carbonise till most of the oil had volatilised, and only a small deposit was formed. Heavy oils only vaporised slowly, even at high temperatures, and tended to leave a large deposit.

In the ensuing discussion Dr. Cranston drew attention to the fact that a so-called "heavy" oil had often a low specific gravity, whereas a "light oil" had a high specific gravity.

Dr. Gordon suggested that the origin and chemical constitution of the oils investigated would, in large measure, determine their behaviour under the conditions of the experiment. He also referred to the "blending" of oils, and wondered if this operation was not carried out in an empirical manner.

Mr. Arnot said that the design of the engine had a profound influence upon the results obtained with lubricating oils, and that in a Diesel engine a carbon deposit was not objectionable. A gummy residue, on the other hand, was a very serious trouble. Regarding blending it had to be remembered that the results obtained under working conditions determined the composition of the oil used and not the characters of the individual components.

Mr. Fenton mentioned the results which had been obtained with oils from different sources, and referred to the practice of adding fatty oils to mineral oils for certain types of engine. A low-gravity oil and one which after use had a low viscosity, comparable with its original value, was the most satisfactory lubricant.

On the motion of the chairman, a vote of thanks was accorded to the lecturer, who, in reply, dealt with many of the points raised, and thanked the members for the illuminating discussion.

LIVERPOOL SECTION

The fourth meeting of the Session was held in the Muspratt Lecture Theatre, the University, on January 21. Mr. Alfred Smetham occupying the chair in the absence, through illness, of the Chairman. An application was read from the Prison Education Committee of the Mersey District Adult School Union for offers of lectures to be given at Walton Prison.

A lecture was delivered by Prof. W. C. M. Lewis, M.A., D.Sc., F.R.S., on "Some physico-chemical and biochemical aspects of malignant growths." The work described formed part of the chemical programme undertaken in connexion with Prof. Blair Bell's lead method of cancer treatment, and the Chairman mentioned that financial assistance for the work would be welcomed.

Prof. Lewis first emphasised that the chemical aspect necessarily deals only with a particular phase of the general problem of malignant growth. That the chemical side is, however, of fundamental importance is evident when it is recalled that the pathological, histological and clinical observations are manifestations of modification in structure and metabolism which are themselves a consequence of chemical change.

In systems which are essentially aqueous, purely chemical experience has shown that hydrogen ion and hydroxyl ion are the two most active reagents, and the fact that neither of these rises to any considerable magnitude in biological material, especially living material, shows that many of the chemical changes involved in such systems must depend on the intervention of enzymes. With our present rather rudimentary knowledge of biological enzymes, attempts at correlation along these lines would be premature. We must be content at this stage to follow a simpler plan, namely, to examine only those processes which exhibit the more striking departure from the normal. The fundamental problem for the chemist is to endeavour to disentangle chemical causes from chemical effects.

In connexion with the purely physico-chemical aspect of the subject, reference was made to electrical conductivity and permeability of malignant tissues. Cancerous tissues freshly removed from the body possess in many cases a higher electrical conductivity than normal tissues, though this feature appears to be less general than the increase in electrical capacity. Both phenomena point to an increase in permeability. In agreement with these conclusions, it is known that in actively-growing malignant tissue the calcium content is markedly low, whilst that of potassium is high. It is known from work on emulsification that a calcium compound tends to produce a system in which oil or fat is the continuous phase, i.e., one of low permeability, whilst potassium tends to produce the reverse type in which the aqueous phase is the continuous one, i.e., a system which would possess marked permeability for water-soluble or water-borne materials. The latter system appeared to be a rough analogue of malignant tissue.

Calcium, however, is not the only substance involved in permeability. It was necessary to take into account the phosphatides and cholesterol, substances which were usually found associated together along with other fatty materials. It had been found that lecithin as an emulsifying agent favours the formation of an emulsion in which water is the continuous phase, that is, a system of high permeability. Cholesterol, on the other hand, tends to form the inverse system, so that lecithin and cholesterol exhibit an antagonistic action. In view of its excessive permeability, it would be expected that, in malignant tissue, the ratio of lecithin to cholesterol would be abnormally high. Analyses showed that this is the case.

Further, it is of interest to consider the hydrogen ion concentration, that is, the acidity or alkalinity of the tissue. The blood in malignancy is normal in this respect, probably owing to its powerful buffering action and ease of elimination of excess acid. On the other hand, so far as evidence is available, malignant tissue appears to be slightly acid as compared with normal.

Turning to processes of a more definitely biochemical character, reference was made to the antitryptic activity of the blood in cancer and to glucolysis and lipolysis.

As regards modes of clinical treatment, which are intended to diminish or remove cancerous conditions, it would be anticipated, from the chemical point of view, that one or more of the outstanding biochemical processes, such as those mentioned, should be affected by the drug or treatment employed. At the present time little is known about the chemical mechanism of any of the clinical treatments pursued. As regards the lead method initiated by Blair Bell, all that can be said at present is that the preparation after injection is rapidly converted into lead phosphate in the blood and lodges itself, apparently preferentially in the tumour. It has been found that lead somewhat accelerates glucolysis and retards oxidation.

Dr. Cunningham, who had assisted Prof. Blair Bell in the work, gave some details from the clinical point of view, and answered a number of questions. He stated that out of 270 cases treated, 20% were influenced. In some the disease appeared to have been completely arrested. The lecturer supplemented this statement by mentioning that other methods of treatment had shown much less favourable results. An interesting discussion followed.

CALENDAR OF FORTHCOMING EVENTS

- Jan. 31. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (*Vantor Lecture III*). "Recent progress in optics," by L. C. Martin.
- Jan. 31. CHEMICAL INDUSTRY CLUB, 2, Whitehall Court, S.W.1, at 8 p.m. "Some scientific aspects of anti-aircraft searchlight work," by Lieut.-Col. C. H. S. Evans.
- Feb. 1. HULL CHEMICAL AND ENGINEERING SOCIETY, Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m. "The application of surface tension to industry," by J. Pryce-Jones.
- Feb. 1. INSTITUTE OF METALS, *Birmingham Local Section* (arranged by the Co-ordinating Committee), Engineers' Club, Waterloo Street, Birmingham, at 7 p.m. "Corrosion," by G. D. Bengough.
- Feb. 1. INSTITUTE OF METALS, *North-East Coast Local Section*, Armstrong College, Newcastle-on-Tyne, at 7.30 p.m. "Methods of measuring temperatures," by C. E. Pearson.
- Feb. 2. SOCIETY OF PUBLIC ANALYSTS, Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. (1) "Arsenic in printing inks," by T. H. Barry. (2) "The immersion refractometer and its value in the analysis of milk," by G. D. Elsdon and J. R. Stubbs. (3) "Irish moss mucilage and a method for its determination," by P. Haas and Barbara Russell-Wells. Informal dinner at St. James's Restaurant, 178, Piccadilly, at 6.30 p.m.

- Feb. 2. **ROYAL SOCIETY OF ARTS**, John Street, Adelphi, W.C.2, at 8 p.m. Ordinary Meeting. "Chemistry and the supply of drugs," by N. Evers. Mr. F. W. Gamble will preside.
- Feb. 2. **INSTITUTE OF BREWING, Burton-on-Trent Section**. "Small economies in breweries," by J. G. Wells.
- Feb. 2. **INSTITUTION OF MINING ENGINEERS**. The 37th Annual General Meeting. House of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1, at 11 a.m. Dinner in the evening at the Whitehall Rooms, Hotel Metropole (Whitehall Place entrance), at 7 for 7.30 p.m.
- Feb. 3. **UNIVERSITY OF LONDON**. University College, Gower Street, W.C.1, at 5 p.m. "The biological action of light," by Dr. D. T. Harris.
- Feb. 3. **CHEMICAL SOCIETY**, Burlington House, Piccadilly W.1, at 8 p.m. *Ordinary Scientific Meeting*. (1) "The nature of the alternating effects in carbon chains. Part XIV. The directive action of some groups of the form - CERⁿ·CO·R· in aromatic substitution," by J. W. Baker and C. K. Ingold. (2) "The nature of the alternating effect in carbon chains. Part XVII. The directive action of the groups ·CH₂·CH₂·NO₂· ·CH·CH·NO₂ and ·O(NO₂)· in aromatic substitution," by J. W. Baker and I. S. Wilson. (3) "The Storch equation, a general dilution formula and the validity of the law of mass action at limiting dilutions." (4) "The calculation of the equivalent conductivity of aqueous solutions of strong electrolytes at infinite dilution. Part II. Application to data at 0°, 18° and 25°C. Part III. The mobilities of the hydrogen and the hydroxyl ions," by A. Ferguson and I. Vogel.
- Feb. 3. **INSTITUTION OF THE RUBBER INDUSTRY, Birmingham and District Section**, Grand Hotel, Birmingham, at 7 p.m. "India rubber as an auxiliary to suspension," by Dr. F. W. Lancaster.
- Feb. 3. **SOCIETY OF CHEMICAL INDUSTRY, Bristol Section**. Joint meeting with the Chemical Engineering Group and the Fuel Section, at the University, Bristol, at 6.30 p.m. "Production of power from towns' refuse," by J. W. Reber and A. Scott.
- Feb. 4. **SOCIETY OF CHEMICAL INDUSTRY, Manchester Section**. Joint meeting with the Manchester Section of the Oil and Colour Chemists' Association. "Colour," by C. W. Gamble.
- Feb. 7. **INSTITUTION OF THE RUBBER INDUSTRY, London and District Section**, Engineers' Club, Coventry Street, W.1, at 8 p.m. (1) "Set in vulcanised rubber," by H. Turner. (2) "Rubber toys," by H. Standring.
- Feb. 7. **BIOCHEMICAL SOCIETY**, Lister Institute, S.W.1, at 5 p.m.
- Feb. 7. **SOCIETY OF CHEMICAL INDUSTRY, London Section**. Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. "Photographic sensitivity," by Dr. T. Slater Price.
- Feb. 8. **SOCIETY OF CHEMICAL INDUSTRY, South Wales Section**, Technical College, Cathays Park, Cardiff, at 7.30 p.m. "Micro-organisms of the soil," by Prof. J. Mangan.
- Feb. 8. **SOCIETY OF CHEMICAL INDUSTRY, Birmingham and Midland Section**, University Buildings, Edmund Street, Birmingham, at 7.15 p.m. "Metallurgical spectroscopic analysis," by F. Twyman.
- Feb. 11. **CHEMICAL ENGINEERING GROUP**. The meeting arranged for this date has been postponed.

CHEMICAL SOCIETY

Dr. Alexander Scott, F.R.S., Vice-President, occupying the chair at a meeting held on January 20, announced the vacancies about to occur among the Officers and Members of the Council, and reminded Fellows that the Annual General Meeting would be held in London on March 24, at 4 p.m., the Anniversary Dinner being held the same evening at the Hotel Victoria, Northumberland Avenue. The Kamerlingh Onnes Memorial Lecture would be delivered by Professor Ernst Cohen, at the Institution of Mechanical Engineers, on Thursday, February 10, at 8 p.m.

Dr. H. J. Emeléus gave an account of:—

The Glow of Arsenic.

ARSENIC undergoes a slow luminous oxidation at 260—300°. It has been shown that this glow occurs in pure oxygen only on reducing the pressure to a limiting value, which is analogous with the glow of phosphorus. The influence of temperature on the glow pressure was studied. The phenomenon was largely influenced by the dimensions of the apparatus, occurring most readily when conditions favoured diffusion and consequent removal of the oxidation product. In a gas stream arsenic glows at approximately the same temperature in air as in oxygen. Pressure reduction appears to produce the glow by accelerating the diffusion of the oxide.

Dr. N. V. Sidgwick asked why there is a difference for oxygen and air if the rate of evaporation is determined by the total pressure.

Dr. Emeléus said that a glow pressure is observed in oxygen-nitrogen mixtures also, if these are not too poor in oxygen. There was no evidence of differences in the oxidation of arsenic in air and oxygen. Replying to the Chairman, he said that the experiments with gas streams were conducted at atmospheric pressure. No experiments, however, were made with mixtures of arsenious oxide and arsenic, but it would not be expected that such added arsenious oxide would influence the results, since the space over the arsenic was probably saturated with arsenious oxide in any case. No account had yet been taken of the small amount of arsenic oxide also formed.

Mr. R. H. Purcell discussed:—

The Origin of the Spectrum of the Glow of Phosphorus. [With H. J. Emeléus.]

PREVIOUS work on the origin of the ultra-violet band spectrum observed in the light from glowing phosphorus is ambiguous. The spectrum of the phosphorescence of phosphorus pentoxide at the ordinary temperature and when cooled with liquid air was photographed, using a condensed spark for excitation. It gave a continuous spectrum in the visible region, with a maximum intensity in the green. None of the bands characteristic of the glow of phosphorus were observed. Photographs of the discharge through phosphorus pentoxide in a silica tube with external electrodes gave a complex band spectrum, which included all the known bands in the spectrum of the glow of phosphorus. A re-examination of the latter phenomenon has shown further bands common to these two spectra. It is concluded that the spectrum has its

origin in the molecule of an oxide, and not in that of a hydride.

Mr. I. Vogel read the following paper:—

Ring-chain Tautomerism. Part XVI. The effect of two adjacent gem-dimethyl groups on the ease of formation of the cyclopentane ring.

A study of the tautomerism of $\alpha\delta$ -diacetyl- $\beta\gamma\gamma$ -tetramethylbutane (I) has shown that the compound reacts exclusively in the form of the ring isomeride (II) as would be expected from the modified strain theory of Thorpe and Ingold. In addition to purely chemical evidence, confirmation of the structure (II) has been obtained from measurements of the parachor.



Replying to Professor G. T. Morgan, the author said that the characterisation of the isomerides was based on the fact that the *cis*-eliminated water much more readily than the *trans*-modification.

ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY

The 11th meeting was held on December 15 last, under the chairmanship of Mr. Macnaughtan, when Mr. A. W. Hothersall, B.Sc., of the Research Department, Woolwich, read a paper on "The acidity of certain electroplating solutions." Mr. Macnaughtan, introducing the speaker, observed that the importance of p_H determination was becoming increasingly apparent, and the benefit of its application to the plating shop was now widely appreciated. There was no doubt that future text-books on electro-deposition would make a practice of stating the precise p_H of each bath described.

Mr. Hothersall preceded his remarks by a detailed explanation of the conception of hydrogen-ion concentration and its relation to the actual strength or concentration of an acid. The plater had always felt the need for some method of estimating p_H , and had roughly satisfied this by attempting to control his bath by using litmus and Congo paper. By this means he had been enabled to keep his nickel solution at a p_H between 4 and 6.4; but with the advance of plating technique and modern requirements a more refined method of determining p_H was necessary. To do this accurately it would be necessary to use the quinhydrone electrode, but for the purposes of the plating shop this expensive apparatus was unnecessary, and sufficiently accurate results could be obtained by indicator methods. The quickest and most simple methods were undoubtedly by means of the Comparator and Capillator, the former of which could be used to obtain p_H values of coloured solutions, *e.g.* nickel solutions. These methods were described in detail, and references also made to the Gillespie drop ratio method and the double wedge Comparator. The author concluded his paper with tables of buffer solutions and indicators with ranges suitable for plating solutions.

During the course of the very interesting discussion which followed, in which Messrs. E. A. Olland, S. Field, W. James, H. Perring and S. Wernick took part, various phases of the applications of p_H to shop practice were discussed, particularly in connexion with the merits of the Comparator method as compared with the quinhydrone electrode. The only fact that militates against the introduction of the latter was undoubtedly its cost, while the disadvantage of the former, in addition to its relative inaccuracy, was the fact that the standards were not permanent and would require renewal at frequent intervals.

The 12th meeting was held on January 19, when Mr. H. Sutton, B.Sc., M.Sc. (Met.), of the Aircraft Station at Farnborough, read a paper on "Electro-deposited coatings for prevention of corrosion." Dr. R. S. Hutton occupied the chair.

Introducing the speaker, Dr. Hutton roughly compared the efficiency of galvanised zinc with electro-zinc. There could be little doubt that present-day galvanising was not as good as it once was, and this fact served to enhance further the merits of electrolytic zinc, remarkably thin coats of which gave adequate protection.

Mr. Sutton prefaced his experiences of the rust-resisting properties of various metals, with a description of the manner in which rusting occurred. The three important factors were, first, the metal; secondly, the mixture deposited as the result of temperature changes; and, thirdly, the oxygen of the air which oxidises the ions entering the solution, thus continually removing the iron from the solution to form insoluble hydroxide.

One of the best metals for preventing rust was zinc. A thickness of 0.0005 inch gave very good protection, thicknesses exceeding this giving no materially increased protection. Cadmium deposits afforded a protection of about the same order as zinc, improved results being obtained by heating to 200–300° C. Nickel was definitely inferior to zinc and cadmium, thick deposits being necessary even for moderate protection. Chromium also gave disappointing results, deposits up to 0.0025 in. being ineffective. Tin and lead, though unsatisfactory preventatives of corrosion, have been useful on parts which are exposed to various chemicals, *e.g.*, explosives.

A very interesting discussion was opened by Mr. S. Wernick, B.Sc., who gave his experience of the comparative protection afforded by zinc obtained from acid and cyanide baths; he stressed the need for a standard corrosion test so as to render results comparable. Mr. W. James stated he had had very satisfactory results with a very thin cadmium plate, whilst deposited chromium when polished gave remarkably good rust protection. Mr. A. E. Olland, A.R.C.Sc., indicated that interference on the part of those responsible for finishing specifications, specifying as they did finishes which were easily removed in subsequent operations, resulted in apparent anomalies in regard to the rust-resisting properties of such metals as zinc.

Mr. C. H. Humphreys, of the Udylyte Process Co. (U.S.A.), gave some interesting details of plating practice in America, where he stated cadmium had largely superseded zinc, a 0.0002-in. plate of cadmium being superior to 0.0005-in. zinc. The different results

obtained by various investigators were largely due to the different types of deposit obtainable from a cadmium cyanide bath. The bath was also very sensitive to the presence of impurities, *e.g.* thallium and lead; it had been found that the presence of as little as 0.001% of the former was sufficient to change the properties of the deposit.

HULL CHEMICAL AND ENGINEERING SOCIETY

At the meeting on January 18, a paper on the "Lodge-Cottrell process of electrical precipitation" was given by Mr. H. W. C. Hendersen, who said that in many works one is faced with the insistent problem of dealing efficiently with finely-divided dust or fume which is carried in suspension by gases from some particular process. For example, in the manufacture of sulphuric acid very great advantages result from thoroughly cleaning the hot burner gases before their entry into the Glover tower; the resulting acid liquor from the tower is perfectly clear, while the trouble caused by the objectionable sludge which otherwise accumulates in the acid plant is avoided. Again, valuable metallic fumes, instead of being lost up the stack, must be recovered from the gases from lead and copper blast-furnaces, tin smelting, etc. In another field, the efficient clearing of combustible gases, *e.g.*, iron blast-furnace gas, producer and illuminating gas, is essential to the satisfactory operation of the process in question.

When gases carrying suspended matter of any kind are subjected to a "corona" electric discharge taking place between two systems of electrodes, one of which is "earthed," while the other is insulated and charged to a high potential, the fine particles coalesce and are precipitated on to the earthed or "collecting" electrodes.

This principle was first tried on an industrial scale at a lead works in 1885, but because at the time the apparatus available was inadequate, the experiment was not successful. To-day, however, practically any fume can be dealt with, and about 300 plants are in successful operation in all parts of the world.

One particular application of the Lodge-Cottrell process which is coming to the fore is the collection of tar fog from the gases from producers, coke-ovens and distillation processes. Fractional precipitation can be successfully employed in such instances, and tar free from water and of good commercial value is obtained without difficulty.

No preliminary gas cooling is required in connexion with the electrical method, and there is no back-pressure caused by the installation to hinder the smooth operation of the furnaces or other process involved. The maintenance costs and power consumption of even large precipitation plants are very small.

An electrical precipitator has been installed for the removal of powdered fuel ash from the boiler gases at a large power house, the output of which is 200,000 kw. This plant handles continuously a gas volume of approximately 1.5 million cub. ft. per minute, and removes 95 per cent. of the ash dust delivered to it.

CORRESPONDENCE

THE JOURNAL

Sir,—To the plea of A. Pinkerton in your issue of December 24, may I add mine for the use in the supplement, *British Chemical Abstracts—B*, of paper equally as thin (and, if possible, of as good a colour) as that employed for the *JOURNAL*. The combined bound volume is not only a formidable weight, but of an appalling size for already over-crowded shelves. Any reduction in weight and thickness would be a boon.

I am, Sir, etc.,

"OVER-CROWDED"

PERSONAL AND OTHER ITEMS

Sir Charles Greenway, chairman of the Anglo-Persian Oil Co., Ltd., on whom a barony was conferred in the New Year Honours List, has chosen the title of Lord Greenway, of Stanbridge Earls.

Col. Sir Edward Brotherton, Bart., the founder of the well-known Leeds firm of Brotherton & Co., Ltd., ammonia and tar distillers, is gazetted as a Deputy Lieutenant of the West Riding of Yorkshire and of the City and County of York. Sir Edward Brotherton is distinguished both as a civic benefactor and as an industrial leader, and this new honour will be appreciated by the industry which he represents.

The Minister of Transport announces that Sir Andrew Duncan has accepted the position of chairman of the Central Electricity Board, constituted under the Electricity (Supply) Act, 1926. Sir Andrew Duncan was Coal Controller in 1919-1920, and on the formation of the Mines Department, he became chairman of the Advisory Committee of the Department.

On January 22, the Lord Mayor and Sheriffs of the City of London visited the International Rubber Exhibition at Paris.

Dr. H. Levinstein has joined the board of the newly-formed Non-Inflammable Film Manufacturing Company, of which Sir Herbert E. Blain is chairman.

Lieut.-Col. J. T. C. Moore-Brabazon, M.P., has resigned his office as Permanent Secretary to the Ministry of Transport to become Chairman of Sensible Heat Distillation, Ltd., the company which controls the "L. & N." process of coal distillation.

The following have passed the January Examination, 1927, for the Associateship in General Chemistry of the Institute of Chemistry:—A. G. Avent, E. H. Bunce, F. W. Clulow, L. Cocker, J. R. Hunecke, E. Myer, and A. E. Taylor.

The Council of the Institution of Electrical Engineers has made the sixth award of the Faraday Medal to Prof. Elihu Thomson, of Boston, U.S.A., Honorary Member of the Institution, who is well known as one of the pioneers in the development of electrical engineering.

The annual luncheon of the British Sugar Beet Society will be held on Thursday, February 17, at the Hotel Victoria, Northumberland Avenue, W.C. Any who wish to be present should apply to the secretary, 6, Lancaster Place, Strand, W.C.

We regret to announce the death, at the age of 49, of Mr. John Webster, the Home Office analyst. Mr. Webster, who was educated at Mason College, Birmingham, was assistant analyst to two successive senior analysts to the Home Office, Sir Thomas Stevenson and Sir William Willcox, and became senior analyst when Sir William Willcox retired in 1919. The great accuracy of his analytical work was proved in the course of a number of notorious trials. During the past 20 years he was pathological chemist to St. Mary's Hospital, Paddington, and had published papers on arsenical poisoning and the toxicology of salvarsan.

The late Mr. A. Oldroyd, a director of the Yorkshire Dyeware & Chemical Co., Ltd., left £118,088 (net personalty £114,398).

The late Mr. R. N. Lennox, F.I.C., of the Lennox Foundry Co., Ltd., and for many years assistant with Sir James Dewar at the Royal Institution, left £1510.

The death has occurred, at the age of 79, of Monsieur F. E. Turpin, who proposed the use of "melinite" (picric acid) as a bursting charge for shells in 1886. Sprengel had shown in 1871 that picric acid could be detonated, but no use was made of his observation until Turpin introduced melinite, also known as lyddite.

Dr. A. Helfenstein, who died recently in Vienna, aged 52, was the originator of the Helfenstein closed electric furnace, developed particularly for the manufacture of calcium carbide and ferro-alloys, but also used for smelting iron ore.

New Chemical Factory in Darlington

According to the *Northern Echo* a new chemical factory is to be built at Darlington by a British firm on a site covering 58 acres. The nature of the new industry is not disclosed, but it is understood that it will relate to a branch of the heavy chemical industry, and that the product is one which has hitherto been largely imported.

British Iron and Steel Output

The output of pig iron during 1926 was 2,441,500 tons, as against 6,261,700 tons in 1925, and the production of steel ingots and castings was 3,560,400 tons, against 7,385,400 tons.

British Trade in 1926

According to official statistics, the average values of imports into Great Britain for 1926 was 8.4% below that of 1924; in re-exports there was an increase over the 1924 values of 12.1% in 1925 and of 4.7% in 1926. Exports diminished in volume, compared with 1924, by 0.7% in 1925 and by 11.3% in 1926, and re-exports similarly decreased by 1.8% and by 14.3% respectively. The trade of 1926 was entirely distorted by the coal stoppage, a large export trade in coal having ceased for seven months and a large import trade in coal bought at high prices having taken its place. The following figures show the values, as declared, of the import and export trade for 1926 (including coal, coke, and manufactured fuel), the figures in brackets being those for 1925:—Total imports, £1,242,864,000 (£1,320,715,000); exports (U.K. goods), £651,893,000 (£773,381,000); exports of imported goods, £125,566,000 (£154,037,000). Omitting coal, the quantities of raw materials imported

and retained in 1926 were practically the same as those imported and retained in 1925 and 6.7% greater than the retained imports of 1924. Excluding coke and patent fuel, wholly or partially manufactured goods increased over 1924 by 12.2% in 1925 and by 16.8% in 1926. The following tables show certain of the declared values of the trade for 1926 and 1925, the 1925 figures being shown in brackets:—

	Total Imports.		Exports of Imported Produce.	
	£1000.		£1000.	
Raw materials and articles, mainly unmanufactured—				
Coal	43,021	(20)	49	(—)
Other non-metallic mining and quarry products etc. . .	5,575	(5,784)	49	(617)
Iron ore and scrap .. .	2,789	(5,108)	3	(1)
Non-ferrous metalliferous ores and scrap .. .	15,231	(16,494)	420	(305)
Oil seeds and nuts, oils, fats, resins and gums .. .	45,483	(55,494)	2,600	(3,495)
Hides and skins, undressed ..	10,556	(21,802)	12,788	(14,384)
Paper-making materials ..	11,946	(11,107)	47	(71)
Rubber .. .	33,516	(20,397)	16,300	(22,129)
Articles wholly or mainly manufactured—				
Coke and manufactured fuel	2,518	(10)	8	(—)
Earthenware, glass, abrasives etc. . .	11,510	(10,092)	21	(248)
Iron and steel and manufactures thereof .. .	20,535	(23,883)	284	(237)
Non-ferrous metals and manufactures thereof .. .	37,113	(38,121)	3,670	(4,208)
Machinery .. .	12,740	(17,901)	1,352	(1,553)
Chemicals, drugs, dyes and colours .. .	15,446	(14,387)	987	(1,211)
Oils, fats and resins, manufactured .. .	43,856	(36,341)	2,138	(3,644)
Leather and manufactures thereof .. .	14,080	(15,067)	1,026	(2,207)
Paper and cardboard .. .	15,755	(15,000)	243	(205)
Rubber manufactures .. .	7,620	(6,397)	786	(725)
Imports Retained.	£1,000.		Exports of U.K. Produce. £1,000	
Raw materials and articles, mainly manufactured—				
Coal	42,081	(20)	10,138	(50,477)
Other non-metallic mining and quarry products etc. . .	5,076	(5,117)	1,024	(1,052)
Iron ore and scrap .. .	2,786	(5,107)	280	(447)
Non-ferrous metalliferous ores and scrap .. .	14,811	(16,120)	1,578	(1,320)
Oil seeds and nuts, oils, fats, resins and gums .. .	42,883	(51,099)	6,221	(7,028)
Hides and skins, undressed ..	6,788	(7,408)	2,402	(2,880)
Paper-making materials ..	11,800	(11,036)	1,525	(1,867)
Rubber .. .	17,216	(7,268)	307	(288)
Articles wholly or mainly manufactured—				
Coke and manufactured fuel, earthenware, glass .. .	2,510	(10)	1,364	(3,830)
Abrasives etc. . .	11,298	(9,844)	17,925	(12,978)
Iron and steel and manufactures thereof .. .	20,251	(23,640)	55,077	(67,856)
Non-ferrous metals and manufactures thereof .. .	33,443	(33,913)	19,484	(16,887)
Machinery .. .	11,388	(10,348)	45,538	(49,053)
Chemicals, drugs, dyes and colours .. .	14,459	(13,176)	21,638	(23,625)
Oils, fats and resins, manufactured .. .	41,718	(32,097)	9,448	(10,227)
Leather and manufactures thereof .. .	12,163	(12,860)	6,882	(7,068)
Paper and cardboard .. .	15,512	(14,825)	9,797	(9,816)
Rubber manufactures .. .	6,834	(5,072)	7,946	(7,616)

Safety in Mines Board Research Station

The Research Station of the Safety in Mines Board at Harper Hill, near Buxton, was completed some three months ago, but the official opening will not be held until the spring. It is understood that the Prince of Wales or another member of the Royal Family will open the station. Minor investigations have already commenced under the supervision of Prof. R. V. Wheeler, the Director of Experiments, and after the opening, work will begin on a more extensive scale.

Centenaries during 1927

January 25 marks the three-hundredth anniversary of the birth of the Hon. Robert Boyle. Other centenaries

which occur during 1927 include those of Newton, Fresnel, Lister, Abel, Volta, J. H. Gladstone, E. Nicholson and M. Berthelot.

The Rubber Situation

In their annual review of the rubber market, Messrs. S. Figgis & Co., of Fenchurch Street, estimate the total shipments of rubber last year at 614,000 tons, and the world's consumption at 545,000 tons; this leaves a surplus of 69,000 tons, which they regard as the addition to supplies in Europe and America to-day. The shipments for the year show an increase of about 100,000 tons, while the consumption is estimated to have declined by 15,000 tons. American consumption shows a reduction of 25,000 tons to 365,000 tons, and in this connexion Messrs. Figgis draw attention to the increased use in America of reclaimed rubber; one estimate puts the amount last year at 125,000 tons, against 90,000 tons in 1925, but many good authorities, it is added, put the figure as high as 160,000 tons, against 125,000 tons in 1925. As regards the future, the review estimates shipments this year, allowing for British restriction at an average of 64 per cent., at 538,000 tons; an increase in European consumption is looked for, and it is thought that 1927 will be a good "replacement" year in America.

(*The Times*, January 18, 1927.)

Sugar Beet Industry

Speaking at a meeting of the Council of Agriculture for England, Mr. Guinness, the Minister of Agriculture, said the sugar beet industry in this country had proved a great success. In 1927 it is estimated that there will be 174,000 acres under sugar beet, an advance of about 44,000 acres on last year. Fourteen factories have been operating in the present season, and it is anticipated that new factories will be erected next autumn at Bardney and King's Lynn. Three other factories will offer increased facilities; at Felsted, Spalding and Kidderminster the capacity will be doubled. The average sugar content so far attained is 17.4, and the yield has increased in at least six factories. These improvements in the yield and in the sugar content make it hopeful that the industry will adjust itself to the inevitable period of decreased prices which must come as the rate of subsidy declines and finally ceases.

Sugar Beet Conference

On January 19 Lord Clinton presided over a well-attended conference of sugar-beet growers and scientific workers at Harpenden, which had been arranged by the Rothamsted Experimental Station and the British Sugar Beet Society. Opening the proceedings, Lord Clinton said the conference was being held at a particularly opportune time, because it was being realised that sugar beet cultivation was one of the most important new cultivations that had been introduced.

Mr. J. M. van Bommel van Vloten (Netherlands Sugar Industry) spoke of the experience of Continental growers, and referred to methods of testing and selecting seeds. Evidence was adduced to show that the weight of the beet and the yield of the sugar both fell as the space between rows was increased above 16 inches, and, discussing the English methods of paying for beet, it was urged that it would be worth while for the factories to pay well for rich beets.

In a paper on "What the factory wants and how the farmer can supply it," Mr. T. G. Fowler, commercial manager of the Cantley Beet Sugar Factory, complained that all growers tried to deliver all their beet when the sugar content was highest, and so starved the factory at one period and glutted it at another. Unless the yield per acre was increased by two or three tons before the subsidy expired, the industry would not be a success in this country. The yield should be from 10 to 12 tons an acre at least. The average farmer was making mistakes in cultivation. If he carried out the correct operations at the correct time and used no fertilisers, he would obtain an increase of two or three tons an acre. If to this proper fertilisers were added, an increase of three to four tons might be looked for.

The results of various experiments on fertilisers for sugar beet were given by Mr. H. J. Page (Rothamsted), who said that this crop demanded more nitrogen, phosphates and potash from the soil than any other. At Woburn the addition of a nitrogenous dressing increased the yield by one ton, but a treble dressing caused a fall of 19 cwt. Ordinary additional dressings of potash gave no increase in yield, but a 30% potash salts dressing added 17 cwt. an acre to the yield. This was more or less confirmed by Mr. R. N. Dowling, of Notts County Agricultural Organisation, who also stated that beet sown with 16½ in. between the rows yielded 13 tons 16 cwt. an acre, beet sown at 19 in. intervals gave 13 tons 13 cwt., and at 23 in. intervals yielded 13 tons 19 cwt.

Mr. I. J. Schapringer, who has had experience in Czechoslovakia, said that sugar beet could stand up to 8 degrees of frost when lifted, and even more when in the ground. Hence the lifting period, and, therefore, the factory working period in England, was from 80 to 100 days, while it was only 60 days in other countries. Thus, with the same capital, England could slice nearly double the quantity of beet. Daylight, as distinct from sunshine, was the maker of sugar in beet, and this explained the higher sugar content in the Northern Hemisphere.

Sir Frederick Keeble observed that the conference had shown that to obtain proper soil conditions was more important than to give the plant "dope." There was hope that the numbers and supplies of nitrogenous fertilisers would shortly be increased very largely. It was of national concern that the question of manures should be fully explored.

Mr. A. W. Ling said many experiments led him to conclude that they could not appreciably alter the sugar content, but they could certainly increase the weight per acre.

Sir John Russell, director of the Rothamsted Station, thanked the speakers, and referred to the fact that most of the varieties of sugar beet grown in England had come from the Continent, and he hoped an improvement might be made in the varieties. There was room for considerable experiment in cultivation, and until that foundation was sure there would be difficulties with manuring.

New Beet Sugar Factory

One of the largest beet sugar factories in the country is to be erected at once at Bardney, near Lincoln, at an

estimated cost of £552,000. It will have an initial capacity for dealing with 1,000 tons, rising to 1,400 tons, per day. A contract has been signed between the Lincolnshire Beet Sugar Company and Sir Robert McAlpine & Sons, the contractors, and the work will be carried out under the supervision of the Dyer Company of America.

Iron Ore in Italy

From Italy come reports of the discovery of deposits of iron ore in the Apuan Alps between Massa and Lucca. The ore—a hematite—is said to contain 41.9% of iron, the percentage increasing with the depth of the lode, which is about 14 ft. wide, and has been traced for a length of half a mile. Great expectations have been raised by the discovery in view of the lack of iron ore in Italy.

International Thomas Slag Cartel

The possibility is being discussed in Germany of the formation of a Thomas slag cartel to include producers in Belgium, France, Germany, Luxembourg, Sarre and Lorraine, representing a total capacity of 3 million tons. The negotiations would, it is suggested, be begun under the auspices of the "Rohstahlgemeinschaft."

Nitrogen-fixation in Iceland

The Dansk-Islandske Anlægsselskab A.-S., of Copenhagen, and the Islands Kemiske Fabriker have obtained a concession for the exploitation of four waterfalls at Arnarfjord, Iceland, and propose to erect plants for the production of nitric acid by the arc process. It is estimated that the four waterfalls will generate approximately 40,000 h.p.—(*U.S. Comm. Rep.*, November 15, 1926.)

Franco-German Potash Agreement

It is reported that the preliminary agreement which was drawn up early in 1926 by the French and German potash industries has been extended for seven years.

Proposed Developments in France

Proposals which are to be submitted by the Ministry of Public Works with the object of developing production, and thus assisting the financial recovery of France, include the development of water power and home production, so as to reduce imports of coal from 20 million tons to 12 million tons; the development of the production of potash and fixed nitrogen; and the creation of an experimental institute to study the production of a fertiliser containing a combination of potash, nitrate and Moroccan phosphate.

State-aided Industry in Japan

A Bill is under consideration in Japan for the encouragement of industry, including the dye and chemical industries, either by the help of a subsidy or by the granting of exemptions from certain taxes. A further increase in the import duty on certain dyes which are made in Japan is believed to be probable.

Artificial Silk Industry in Germany

According to the *Financial Times* a denial has been given to the report that an agreement with the Vereinigte Glanzstoff Werke has given control of the German artificial silk production to Messrs. Courtaulds. It is asserted that only a working association has been reached, without any exchange of shares.

Pulp and Paper in Canada

Price Bros., Ltd., is preparing plans for extending the capacity of the River Bend Mill, Isle Maligne, Quebec, from 200 tons to 400 tons of paper daily.

The Ste. Anne Power & Paper Co. is erecting a paper mill with daily capacity of 250 tons at Beaupre, Quebec. The plant will cost \$4,000,000. The Spanish River & Abitibi Companies, which are controlled by Chicago interests, are interested in this property.

The Canadian Cellulose Company has commenced the erection of a soda mill at Cornwall, Ontario, having a daily production of 50 tons of bleached soda pulp. The mill is expected to be in operation early next year. Suitable pulp-wood is obtainable in large quantities in this section of Ontario.

The St. Regis Paper Co. has contracted for the immediate erection of a large pulp and paper plant at Cap Rouge, on the St. Lawrence River, four miles from the City of Quebec. This makes the second large pulp and paper mill under construction almost within the precincts of the city, the other being the Anglo-Canada in Limoilou ward.

Arrangements have been made with the Government of British Columbia for the erection of a pulp and paper mill, costing about \$30,000,000, near the City of Prince George, B.C. Eastern Canadian industrialists represented by Frank P. Jones, President, Canada Cement Company, Ltd., of Montreal, and Angus McLean, President, Bathurst Company, Ltd., Bathurst, N.B., pulp and paper manufacturers, are interested.

The second of the two additional newsprint machines of the Belgo-Canadian plant of the St. Maurice Valley Corporation is now operating. With its completion the daily output of the company is 885 tons newsprint.

Petroleum and Natural Gas in Canada

The natural gas production of Canada during the year 1925 was 16,902,897 thousand cb. ft., valued at \$6,833,005. The Province of Alberta, with 9,119,500, has become the leading producer, Ontario falling into second place.

At the middle of November the Vulcan well, in Turner Valley, Alberta, blew in with a daily flow of over 10 million cb. ft. wet gas, and this flow has been maintained. Royalite 4, in the same district, which blew into production two years ago, has an average daily output of 18–20 million cb. ft.

Official returns for 1925 show a decided increase in the production of crude petroleum in Canada. Whereas in 1924 the total output from wells was 160,773 barrels (35 gals. per bl.), valued at \$467,400, the production in 1925 amounted to 332,001 barrels, valued at \$1,250,705. Alberta has become the chief producing province due to the oil recovered from the wet gas of Royalite 4, which has averaged 500 barrels daily since it blew in, and is still maintaining this yield.

The Vulcan gas well, with its flow of 10 million cb. ft. of wet gas, is daily yielding 145 barrels of light naphtha of 0.72° Beaume.

Canadian Glass Industry

The value of pressed and blown glass produced in Canada during 1925 was \$7,444,246, and plate, cut, and ornamental glass \$2,673,358, making a total of \$10,117,604, slightly less than the value of the preceding year.

REVIEW

INDUSTRIAL STOICHIOMETRY. By WARREN K. LEWIS and ARTHUR H. RADASCH. Chemical Engineering Series. Pp. xi + 174. London: McGraw-Hill Publishing Co. Ltd., 1926. Price: 12s. 6d.

In view of the rapid strides which have been made in the United States during the last few years in chemical engineering, one naturally turns to this book with curiosity and interest, in order to ascertain whether it truly reflects the advance which has been made. It cannot be denied that the book is of surpassing interest, not only to students of chemical engineering, but to works chemists and chemical engineers.

Industrial stoichiometry relates to the interpretation of data quantitatively, and is of inestimable value. Just as no accountant considers his work complete until his books are balanced, so no works chemist or chemical engineer should regard his task as finished, pending the cross-checking of industrial chemical data, an operation which is apt to be more involved than that of cost accountancy. Process control and the design of equipment involve consideration of three groups of factors. The first comprises the quantity relationships included in the laws of stoichiometry in the narrower sense of that word, i.e., the laws of the indestructibility of matter and of the elements, the laws of combining weights and of the conservation of energy. The second involves the equilibrium relationships of chemical reactions and the third the rate relationships.

In the preliminary presentation of the subject, illustrations are chosen in order to familiarise the beginner with the fundamental concepts, and the subject is made delightfully explicit. The book then deals with fuels and combustion, gas producers, sulphur compounds, lime and cement, the stoichiometry of furnace and kiln design, metallurgy, stoichiometry of plant design, crystallisation and miscellaneous problems.

Altogether, it is an eminently useful contribution to an aspect of industrial chemistry, the importance of which was emphasised by Quinan during the war. The authors certainly merit congratulation. P. PARRISH

COMPANY NEWS

GAS LIGHT AND COKE CO., LTD.

The following dividends have been recommended for the half-year to December 31 last:—On the 4% consolidated preference stock at the rate of 4% per annum; on the 3½% maximum stock at the rate of 3½% per annum, and on the ordinary stock at the rate of 5% per annum, carrying forward £64,647. The year's distribution is thus 5s. 8d.%, as against 5s. 2s.% for 1925.

COMMERCIAL GAS CO., LTD.

A final dividend is proposed of 5s. 6s. 8d.% per annum on the 4% stock and 5s. 3s. 4d.% per annum on the 3½% stock, both less tax. For the first half of the year the dividends were at the same rate, and similar dividends were paid in respect of 1925.

NON-INFLAMMABLE FILM MANUFACTURING CO., LTD.

The formation is announced of the Non-Inflammable Film Manufacturing Company. The chairman of the company is Sir Herbert E. Blain; the board includes Sir John de F. Pennefather, M.P., and Dr. Herbert Levinstein. The capital is 500,000 £1. ordinary and 100,000 1s. deferred shares.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned. Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime—£7 10s. per ton, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate.—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots, £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included.
Sod. Chlorate.—2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
Arsenic, Sulphide, Yellow.—2s. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 2d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 per ton. Scarce. Grey, £17 5s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£8 5s.—£10 per ton and upwards, according to grade and locality. Very scarce and fair demand.
 Iron Liquor.—1s. 6d. per gal. 32° Tw.; 1s. 2d. per gal. 24° Tw.
 Red Liquor.—10d.—11d. 16° Tw. per gal.
 Wood Creosote.—2s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 10d.—4s. per gal., 60% O.P. Solvent, 4s. per gal., 40% O.P. Both scarce and in fair demand.
 Wood Tar.—£4—£5 per ton and upwards, according to grade.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carbolie.—Crystals, 6½d.—6½d. per lb. Crude 60's, 1s. 9½d.—1s. 10½d. per gal.
 Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 1d. per gal. Pale, 95%, 1s. 10d.—2s. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 3½d.—1s. 4½d. per gal., ex works in tank wagons; Standard motor. 1s. 11½d.—2s. 4½d. per gal., ex works in tank wagons; Pure, 2s. 2½d.—2s. 5½d. per gal., ex works in tank wagons.
 Toluole.—90%, 2s. to 2s. 6d. per gal. Firm. Pure, 2s. 3d.—2s. 8d. per gal.
 Xylol.—2s. 3d.—2s. 8d. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal.
 Naphtha.—Crude, 10d.—1s. 1d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, 1s. 11d.—2s. per gal. Solvent 90/100, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s. per ton.
 Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—117s. 6d.—130s. per ton, f.o.b. according to district. Prices nominal.
 Pyridine.—90/140.—9s. 6d.—17s. per gal. Nominal. 90/180.—7s. 6d. per gal. Heavy.—7s.—10s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—9½d. per lb., naked at works.
 Aniline Salts.—9½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d.—4½d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—9d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xyldine Acetate.—2s. 11d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid. Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4d.—2s. 5d. per lb. Firm.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity.
 Acid, Boric B.P.—Cryst. £40 per ton. Powder £44 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s. 21s. per lb.
 Acid, Citric.—1s. 3½d. per lb. Less 5%. Quiet.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in owt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 6d. per lb. Firm and good enquiry. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 0½d. per lb. Less 5%.
 Amidol.—9s. 6d. per lb. d/d.
 Acetanilide.—1s. 7d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Aspirin.—2s. 4d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzonnaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.

- Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr paid any station in Great Britain in ton lots.
- Bromides.—Ammonium.—2s. 3d.—2s. 5d. per lb. Potassium.—1s. 10d.—2s. per lb. Sodium.—2s. 1d.—2s. 3d. per lb. All spot. Market firmer.
- Calcium Lactate.—1s. 5d.—1s. 6d. per lb.
- Chloral Hydrate.—3s. 3d.—3s. 6d. per lb., duty paid.
- Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
- Cresote Carbonate.—6s. per lb.
- Ether meth.—1s. 1d.—1s. 1½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
- Formaldehyde.—£39 per ton. Ex wharf in barrels.
- Guaiacol Carbonate.—6s. 6d.—7s. per lb.
- Hexamine.—2s. 4d.—2s. 6d. per lb.
- Homatropine Hydrobromide.—30s. per oz.
- Hydrastine Hydrochlor.—English make offered, 120s. per oz.
- Hydrogen Peroxide (12 vols.).—1s. 8d. per gal. f.o.r. makers' works, naked.
- Hydroquinone.—4s. per lb.
- Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
- Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
- Iron Perchloride.—22s. per cwt., 112 lb. lots.
- Magnesium Carbonate.—Light Commercial £33 per ton net.
- Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%; Heavy Pure 2s.—2s. 3d. per lb., according to quantity.
- Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 12s.—13s. per lb., according to quantity. Liquid (95%), 12s. per lb. Detached cryst., 15s. per lb.
- Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig, 6s.—6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 2d.—4s. 3d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 4s. 11d.—5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.
- Methyl Salicylate.—1s. 9d. per lb.
- Methyl Sulphonol.—15s. 6d. per lb.
- Metol.—11s. per lb. British make.
- Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
- Paraldehyde.—1s. 4d. per lb.
- Phenacetin.—3s. 9d.—4s. per lb.
- Phenazone.—5s. 9d.—6s. per lb.
- Phenolphthalein.—6s.—6s. 3d. per lb.
- Potass. Bitartrate.—99/100% (Cream of Tartar) 83s. per cwt., less 2½% for ton lots.
- Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
- Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
- Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
- Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
- Potass. Permanganate.—6½d. per lb. spot.
- Quinine Sulphate.—2s. per oz.—1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
- Resorcin.—4s.—4s. 3d. per lb. spot.
- Saccharin.—55s. per lb.
- Salol.—3s.—3s. 3d. per lb.
- Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
- Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
- Sod. Ferrocyanide.—4d. per lb., carr. paid.
- Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
- Sod. Nitroprusside.—16s. per lb.
- Sod. Potass. Tartrate (Rochelle Salt).—80s.—85s. per cwt. net, according to quantity.
- Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb.
- Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
- Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton, according to quantity, 1-cwt. kegs included.
- Sulphonol.—10s. 6d. per lb.
- Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
- Thymol, Puriss.—12s.—13s. per lb., according to quantity. Cheaper. Natural.—14s. 9d. per lb. Very firm.

PERFUMERY CHEMICALS

- Acetophenone.—7s. 3d. per lb.
- Aubepine (*ex Anethole*).—10s. 6d. per lb.
- Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb. Amyl Salicylate.—3s. per lb.
- Anethole (M.P. 21/22° C.).—5s. 8d. per lb.
- Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
- Cinnamic Aldehyde.—Natural, 17s. per lb.
- Coumarin.—11s. per lb.
- Citronellol.—15s. per lb.
- Citral.—9s. 6d. per lb.
- Ethyl Cinnamate.—10s. per lb.
- Ethyl Phthalate.—3s. per lb.
- Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb. Geraniol.—9s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Shui Oil*) 12s. per lb.—(*ex Bois de Rose*) 16s. per lb. Linalyl Acetate.—(*ex Shui Oil*) 14s. 6d. per lb.—(*ex Bois de Rose*) 18s. per lb.
- Methyl Anthranilate.—9s. per lb.
- Methyl Benzoate.—4s. 6d. per lb.
- Musk Ketone.—36s. per lb.
- Musk Xylol.—8s. 6d. per lb.
- Nerolin.—3s. 9d. per lb.
- Phenyl Ethyl Acetate.—12s. per lb.
- Phenyl Ethyl Alcohol.—11s. per lb.
- Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—19s. per lb.

ESSENTIAL OILS

- Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—29s. per lb. Bourbon Geranium.—11s. 3d. per lb.
- Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb.
- Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.
- Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 19s. per lb. Lemon.—8s. 3d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—9s. 9d. per lb.
- Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 23s. 6d. per lb. Japanese, 9s. per lb.
- Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 20s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Mar. 19th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Feb. 3rd. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

1.—Applications

- A.-G. Brown, Boveri, et Cie. High-pressure vessels etc. 1189. Jan. 14. (Ger., 161.26.)
- Bojner and Pehrson. Apparatus for heating charge in rotary furnaces. 975. January 12. (Sweden, 201.26.)

Carrier Engineering Co. Controlling saturation temperature of gases. 884. Jan. 11.

Heide (Gaisman). Grinding-machines. 648. Jan. 10.

Kearley and Morrice. Centrifugal apparatus. 796. Jan. 11.

Lanyon. Refrigeration. 877. Jan. 11.

Marks (Selden Co.). Catalytic oxidation. 752. Jan. 10.

Parker, and Vickers, Ltd. Grinding-mills. 734 and 761. Jan. 10.

Quiggin. Distilling-apparatus. 1128-9. Jan. 14.

Synthetic Ammonia & Nitrates, Ltd., and Humphrey. Centrifugal apparatus. 1227. Jan. 15.

I.—Complete Specifications

24,696 (1925). Tintometer, Ltd., and Lovibond. Colour-estimating apparatus. (263,924.)

5082 (1926). Krupp, Grusonwerk. Expressing liquid constituents from materials. (248,372.)

23,817 (1926). Zwicky. Filters. (258,905.)

*21,714 (1926). Svensson and Norling. Centrifugal treatment of liquids. (264,130.)

II.—Applications

Blythe. Chlorination of coal under pressure. 942. Jan. 12.

Donald. Carbonisation of coal etc. 787. Jan. 11.

Easton. Retorts for lignite etc. 819. Jan. 11.

Hobson. Distilling fuel etc. 672-3. Jan. 10.

Hughes (Fujisawa). Manufacture of active carbon. 1068. Jan. 13.

Huntington. Removal of wax from petroleum etc. 1022. Jan. 13.

Internat. Bergin-Corp. voor Olie en Kolenchemie, and Debo. Hydrogenation of hydrocarbon compounds. 731. Jan. 10.

Johnson (I.-G. Farbenind.). Manufacture of unsaturated hydrocarbons. 701. Jan. 10.

Lessing. Separation of powdered etc. coal etc. 856. Jan. 11.

Parsons and Stoney. Cooling, dehydration, etc. of oil. 988. Jan. 12.

Verein für Chemische Industrie A.-G., and Walter. Process for producing products of unsaturated hydrocarbons. 851. Jan. 11.

II.—Complete Specifications

• 24,814 (1925). Davidson, and Patent Retorts, Ltd. Distillation of carbonaceous substances. (263,933.)

24,813 (1925). Davidson, and Patent Retorts, Ltd. Gas-producers. (263,932.)

24,891 (1925). Tapping. Binder for briquetting fuels, minerals, etc. (263,942.)

5703 (1926). Petroleum Chemical Corp. See XX.

*444 (1927). Internat. Combustion Engineering Corp. Treatment of coal. (264,169.)

III.—Application

Internat. Bergin-Corp. voor Olie en Kolenchemie, and Debo. 731. See II.

III.—Complete Specification

30,914 (1925). Soc. Etabl. Barbet. Apparatus for preliminary treatment of crude benzols. (244,130.)

IV.—Applications

Carpmael (I.-G. Farbenind.). Reduction of aromatic nitro-compounds. 1082. Jan. 13.

I.-G. Farbenind. Manufacture of grey to black dyestuffs. 960. Jan. 12. (Ger., 12.1.26.) Manufacture of alkyl-pyrazolanthrones. 961. Jan. 12. (Ger., 13.1.26.) Manufacture of carbazolequinones. 1292. Jan. 15. (Ger., 15.1.26.)

Scottish Dyes, Ltd., Drescher, Harris, Thomas, and Wylam. Dyes etc. 746. Jan. 10.

IV.—Complete Specifications

19,739 (1925). Wylam, Harris, Thomas, and Scottish Dyes, Ltd. Preparation of dyes, colouring-matters, etc. (263,898.)

24,696 (1925). Tintometer, Ltd., and Lovibond. See I.

V.—Applications

British Dyestuffs Corp., and Hailwood. Manufacture of artificial textile fibres. 966. Jan. 12.

Calico Printers' Assoc., Levin, and Whinfield. Acetyl cellulose artificial silk. 1071. Jan. 13.

Courtaulds, Ltd., and Stokes. Production of artificial threads etc. 1277. Jan. 15.

Heberlein & Co. Improving artificial fibres. 1291. Jan. 15. (Ger., 15.1.26.)

Naaml. Vennoots. Nederlandsche Kunstzijde-fabriek. Apparatus for manufacture of artificial silk etc. 922. Jan. 12. (Holland, 17.12.26.)

Schaub. Manufacture etc. of nitrocellulose. 1197-8. Jan. 14.

Soc. Lyonnaise de Soie Artificielle, and Chevalet. Preparation of modified cellulose. 703. Jan. 10. (Fr., 11.1.26.)

Cellulose product. 704. Jan. 10. (Fr., 22.2.26.)

Strocker. Production of cellulose. 1069. Jan. 13.

V.—Complete Specifications

24,867 (1925). Dreyfus. Treatment of cellulosic materials. (263,938.)

24,868 (1925). Dreyfus. Manufacture of cellulose derivatives. (263,939.)

14,764 (1926). Grand. Production of artificial silk yarns. (253,547.)

*331 (1927). Lilienfeld. Manufacture of artificial materials from viscose. (264,161.)

*703 (1927). Soc. Lyonnaise de Soie Artificielle, and Chevalet. Preparing a modified cellulose. (264,181.)

VI.—Applications

Hill. Production of finishing effects on textile fibres etc. 634. Jan. 10.

Lord. Apparatus for treating hanks of yarn with liquids. 1033. Jan. 13.

Silver Springs Bleaching & Dyeing Co., Ltd., Hall, and Mason. Production of piece-dyed woven fabrics. 928. Jan. 12.

VI.—Complete Specifications

25,053 (1925). British Alizarine Co., Ltd., Dawson, and Soutar. Dyeing acetyl silk. (263,946.)

*32,421 (1926). I.-G. Farbenind. Treatment of animal fibres. (264,146.)

VII.—Applications

Aluminum Co. of America. Production of sodium aluminum etc. 895. Jan. 11. (U.S., 21.1.26.)

Auchinachie, Blackburn, and Thomas. Manufacture of ammonia. 1211. Jan. 14.

Holmes, Jardine, and Kingcome. Apparatus for recovery of soda ash. 814. Jan. 11.

Hüttenwerke Tempelhof A. Meyer, and Meyer. Manufacture of copper sulphate. 986. Jan. 12. (Ger., 13.1.26.)

I.-G. Farbenind. Manufacture of phosphorus oxides. 1164. Jan. 14. (Ger., 15.1.26.)

Johnson (I.-G. Farbenind.). Manufacture of sulphuretted hydrogen etc. 700. Jan. 10.

Soc. d'Etudes Minières et Industrielles. Manufacture of ammonia. 1173. Jan. 14. (Fr., 6.7.26.)

* Woosnam (Norsk Hydro-Elektrisk Kvaestofaktieselskab). Production of hydrogen etc. 732. Jan. 10.

VII.—Complete Specifications

16,874 (1926). Spence & Sons, Ltd., Kirkham, and Spence. Manufacture of titanium compounds. (263,886.)

24,686 (1925). Haynes. Manufacture of carbon dioxide. (263,922.)

VIII.—Applications

Imray (Hirao, Suzuki, and Suzuki). Manufacture of abrasives. 1290. Jan. 15.

Moss. Ovens for firing bricks etc. 1238. Jan. 15.

Scheidhauer & Giessing A.-G. Producing refractory etc. products. 869. Jan. 11. (Ger., 11.1.26.)

Soc. Anon. des Manuf. des Glaces et Prod. Chim. de St. Gobain. Glass. 707 and 837. Jan. 10 and 11.

VIII.—Complete Specifications

23,272 (1926). Soc. La Radiotechnique. Low-expansion glass. (258,872.)

*869 (1927). Scheidhauer & Giessing A.-G. Producing refractory acid-proof products. (264,192.)

IX.—Applications

Batchelor. Apparatus for distributing liquids etc. in kilns in manufacture of cement etc. 941. Jan. 12.

Goodall. Drying, fireproofing, or dyeing timber. 930. Jan. 12.

Jones. Road-surfacing material. 748. Jan. 10.

La Trinidad. Manufacture of asphaltic etc. emulsions. 801 and 893. Jan. 11. (Fr., 12.1.26.) Manufacture of asphaltic etc. products. 892. Jan. 11. (Fr., 25.1.26.)

Coatings for roadways. 1251. Jan. 15. (Fr., 29.10.26.)

IX. Complete Specifications

27,654 (1925). Alchemin A.-G., and Lichtenstern. Impregnating unpaved roads. (263,975.)

4711 (1926). Itier. Rendering cement liquid-tight* and impervious to chemical agents. (247,976.)

X. Applications

A.-G. Brown, Boveri, et Cie. Electric resistance annealing-furnaces. 1046. Jan. 13. (Ger., 19.5.26.)

British Thomson-Houston Co., Ltd. Protective coatings for metals etc. 713. Jan. 10. (U.S., 9.1.26.)

Browne. Production of silicon iron. 709. Jan. 10.

Dassdorf, Henning, Lehnig, and Loos. Coating metal etc. articles. 849. Jan. 11.

Electric Furnace Co., Ltd., and Campbell. Refining metals. 1293. Jan. 15.

Kropf. Alloys. 1278 and 1282. Jan. 15. (Ger., 16.1.26 and 10.5.26.)

McConnachie. Preparing materials for blast furnaces etc. 1166. Jan. 14.

Metallbank und Metallurgische Ges. Purifying aluminium etc. 1055. Jan. 13. (Ger., 8.2.26.)

X.—Complete Specifications

24,801 (1925). Tapping. See II.

*6328 (1926). Siemens & Halske A.-G. See XI.

*31,283 (1926). Meyer and Meyer. Recovering antimony from alloys. (264,139.)

*713 (1926). British Thomson-Houston Co., Ltd. Protective coatings for metals. (264,183.)

XI.—Applications

A.-G. Brown, Boveri, et Cie. 1046. See X.

Godfree and Macartney. Electrolyte. 870. Jan. 11.

Joseph. Primary electric batteries. 716. Jan. 10.

XI.—Complete Specification

*6328 (1926). Siemens & Halske A.-G. Electrolytic refining of copper. (264,116.)

XIII.—Applications

Arnot. Production of resinous media. 1204. Jan. 15.

British Thomson-Houston Co., Ltd. 713. See X.

Franko. Production of red-lead paints etc. 742. Jan. 10. (Ger., 15.1.26.)

XIII.—Complete Specifications

24,696 (1925). Tintometer, Ltd., and Lovibond. See I;

2360 (1926). McMinn. Anti-corrosive paint. (264,022.)

*713 (1927). British Thomson-Houston Co., Ltd. See X;

XV.—Application

Campbell and Vredenburg. Artificial leather etc. 715. Jan. 10.

XVII.—Complete Specification

17,827 (1925). Maxwell. Extraction of juice from sugar-cane and kindred substances. (263,893.)

XVIII.—Application

Sak. Production of compressed yeast. 1170. Jan. 14.

XIX.—Applications

Bousfield. Bleaching flour etc. 755. Jan. 10. Sterilising etc. foods. 756. Jan. 10.

Laporte, Ltd., and Stewart. Preservation of liquid etc. foods. 1289. Jan. 15.

Pitchford. Preservation of meat. 666. Jan. 10.

XIX.—Complete Specifications

18,912 (1925). Chitty, Jones, and Woodlands, Ltd. Heat-treatment of cereal substances. (263,897.)

13,892 (1926). White (Northwestern Yeast Co.). Manufacture of a food. (264,064.)

XX.—Applications

Busch and Wülling. Preparing water-soluble silicic acid albumen compounds. 863. Jan. 11.

Carpmael (I.-G. Farbenind.). 1082. See IV.

Chem. Fabr. vorm. Schering. Manufacture of chloriodo compounds of alpha-aminopyridine etc. 979. Jan. 12. (Ger., 15.1.26.)

Johnson (I.-G. Farbenind.). 701. See II.

Marks (Selden Co.). 752. See I.

Newport Co. 3:4-Diaminobenzoyl-o-benzoic acids. 708. Jan. 10. (U.S., 13.9.26.)

Soc. of Chem. Ind. in Basle. Process for obtaining highly-active substances from sexual organs. 1169. Jan. 14. (Switz., 2.2.26.)

Verein für Chemische Industrie A.-G., and Walter. 851. See II.

XX.—Complete Specifications

5703 (1926). Petroleum Chemical Corp. Preparation of alcohols from olefine-bearing gases. (249,834.)

10,991 (1926). Barbet. Production of dehydrated alcohol. (264,050.)

*16,840 (1926). Carbide & Carbon Chemicals Corp. Manufacture of glycols. (264,124.)

*32,057 (1926). Canadian Electro Products Co., Ltd. Manufacture of hydroxyacid esters. (264,143.)

XXI.—Applications

Sommavilla. Production of photographic pictures. 977. Jan. 12.

Thornton. Multi-colour films etc. 772. Jan. 10.

XXII.—Application

Schaub. 1197—8. See V.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Industrial chemicals, road-making and rubber manufacturing machinery (41); Solid drawn steel flue and boiler tubes (A.X. 4123); Steel boiler

plates (A.X. 4121); Solid drawn brass boiler tubes (A.X. 4122); Solid drawn copper flue tubes (A.X. 4124). *Brazil*: Leather, galvanised pipes, tinplate, copper (67). *British India*: Stationery, drugs, patent medicines (45). *Egypt*: Scientific and electrical apparatus (B.X. 3156). *France*: Paper (56). *Germany*: Heavy chemicals, tar products (58). *New Zealand*: Galvanised bolts and nuts, copper and bronze wires, tinplate (48). *Salvador*: Galvanised corrugated sheets (69). *South Africa*: Chemists' and druggists' sundries (52); Enamelling plant (A.X. 4116). *Uruguay*: Galvanised iron water piping, tin, white metal, rolled silver solder, brass, copper, iron steel (A.X. 4119).

United States Trade in Chemicals

Imports of chemicals and allied products into the United States during the first nine months of 1926 showed little change in value from the corresponding period of the previous year. Exports, however, rose by 6%.

A New Pyrometer

The Cambridge Scientific Instrument Co., Ltd., 45, Grosvenor Place, London, S.W.1, have produced a pyrometer for taking the temperatures of heated curved surfaces under working conditions. The apparatus is easy to use, light and gives a reading in three to five seconds. It is used particularly for measuring the temperatures of hot rollers used in textile, rubber, linoleum and paper-making, the ranges being from 0–200° C. and 0–400° F.

New Dyestuffs

A further addition to the water soluble colours for lake making made by the British Dyestuffs Corporation, Ltd., is Lake Orange O, which possesses a bright fiery orange shade, being distinctly redder than Acid Orange G. Lake Orange O finds its principal use in the production of a brilliant reddish orange lake for paper-surfacing and printing-ink colours. It is also of value for use in the preparation of imitation red leads. It is soluble in water, and gives the best results when converted into a barium lake.

Of interest is the B.D.C. pattern card of Fashionable Shades, Spring, 1927, which includes patterns of Picasso, Larkspur, Rubric, Naples, Cocoa, Heather, Lime Green, Lagoon, Pompadour, Sedge, Caramel, Gorse and Mist. The dyeing of these colours is carried out in the usual way for acid colours, with the addition of 10% Glauber's salt and 2% sulphuric acid.

Pigment and Lake Colours

Some time ago John W. Leitch & Co., Ltd., Milnsbridge Chemical Works, Huddersfield, issued a selection of the firm's range of pigment and lake colours. We have now received samples of the following additions to the range, namely pigment fast scarlet BL, pigment fast red 5RL extra, lake fast Bordeaux BKL, and lake fast Bordeaux GKL, all in full and pale shades. These colours, it will be remembered, are of excellent fastness, and are used in the manufacture of paint, distempers, ink, wall-papers, and so on.

Filtration

The Premier Filterpress Co., Ltd., of Finsbury Pavement House, London, E.C.2, have sent a photo-frame

calendar for 1927, which is both neat and distinctive, and reminds us, albeit most modestly, of the filterpresses, pumps, diaphragm pumps, filter cloth, and other products made by this company.

Plant

United Water Softeners, Ltd., have received an order for a number of water-softening plants from the Great Southern Railway of Ireland.

The Hinckley Urban District Council Gas Department has placed an order with the Woodall-Duckham Vertical Retort & Oven Construction Co. (1920), Ltd., for a second installation of continuously-working vertical retorts, with a carbonising capacity of 60 tons of coal daily.

PUBLICATIONS RECEIVED

THE DYEING OF COTTON FABRICS. By Franklin Beecel. Third edition, revised and enlarged by A. J. Hall, B.Sc. Pp. xii+296. London: Ernest Benn, Ltd., 1927. Price 18s.

THE CHEMICAL AGE YEAR BOOK, DIARY AND DIRECTORY. Pp. 155. London: The Chemical Age Offices at Benn Bros., Ltd., 1927.

THE STRUCTURE OF THE ATOM. By E. N. Da C. Andrade, D.Sc., Ph.D. Third edition, revised and enlarged. Pp. xviii+750. London: G. Bell & Sons, Ltd., 1927. Price 30s. net.

TREATISE ON THERMODYNAMICS. By Dr. Max Planck. Translated with the author's sanction by A. Ogg, M.A., B.Sc., Ph.D., F.Inst.P. Third edition, translated from the seventh German edition. Pp. xiv+297. London: Longmans, Green & Co., Ltd., 1927. Price 15s.

KUNSTLICHE ORGANISCHE FARBSTOFFE. By Dr. H. E. Fierz-David. Part III of Technologie der Textilfärberei. Edited by Prof. R. O. Herzog. Pp. xv+719. Berlin: Julius Springer, 1926. Price, bound, 63 r.m.

THE MANUFACTURE OF ENAMEL PAINTS. By Douglas Wait. Pp. viii+153. London: Scott, Greenwood & Son, 1927. Price 10s. 6d.

DIGEST OF COMMENTS ON THE PHARMACOPOEIA OF THE U.S. OF AMERICA, AND ON THE NATIONAL FORMULARY FOR THE CALENDAR YEAR ENDED DECEMBER 31, 1922. By A. G. DuMez. Hygienic Laboratory Bulletin No. 144. Pp. vii+272. Treasury Department, United States Public Health Service. Washington: Government Printing Office, 1926. Price 35 cents.

A ZONING PRIMER. By the Advisory Committee on Zoning, appointed by Secretary Hoover, B.H.3A. Department of Commerce of the United States. Pp. 10. Washington: Government Printing Office, 1926. Price 5 c.

The Cambridge University Press will shortly have ready *The Collected Papers of Sir James Dewar*, edited by Lady Dewar, Mr. J. D. Hamilton Dickson, Mr. H. Munro Ross, and Mr. E. C. Scott Dickson. These two volumes include not only the papers which appeared under Sir James Dewar's name only, but also those published jointly with other investigators, with the exception of the long series of papers on Spectroscopy by himself and Dr. G. D. Liveing, which have already been published in one volume.

The Chemical Catalog Co., Inc., 19–25, East 24th Street New York, is moving into new premises at 419, Fourth Avenue, corner of 29th Street, New York. In order to have to remove as few books as possible, a discount of 20% off list prices is offered on all orders for the company's books which are placed in the post before February 1, 1927.

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No. 5

EDITORIAL

The Chemical Industry

MANY accounts have been prepared of the state of the chemical industry of this country; these have varied in their accuracy and importance. The Association of British Chemical Manufacturers, as stated by the President of the Society of Chemical Industry at Birmingham, has recently prepared a valuable monograph on the chemical industry of the world. A German monograph was prepared last autumn, and we understand that a few copies were issued in this country just before Christmas. It speaks well for the industry and determination of those in charge of the A.B.C.M. that the British monograph, giving a mass of well-arranged statistics, should have been prepared in the very short space of a fortnight and circulated within three or four days thereafter. It was a great achievement, and it is a pity that the German monograph cannot be criticised or discussed in public, and that the English one can only be mentioned in guarded and general terms. It is not possible to give reliable figures of the chemical industry of the world; some countries include in such industry the soap industry, the artificial silk industry, and the paint and varnish industry; other countries exclude some or all of these. Although accurate statistics are not available, it is clear that in many countries the chemical industry has grown very rapidly in recent years, and in many branches the present capacity now exceeds the demand. This is partly due to the war; plants for the manufacture of munitions of war grew up in great numbers in very many countries, whether belligerent or not, and the phrase "munitions of war" includes a great variety of materials; the war, by restricting imports and exports, brought home to many people the inconvenience of being dependent for essential materials on a foreign country which is involved in a war and unable to undertake its accustomed supply. Germany had in some branches of the chemical industry become recognised as the usual supplier of materials to many other countries, and when this source of supply was shut off, the other countries determined to arrange for at least a partial supply within their own boundaries; this determination was put into practice so soon as peace was declared. The production of synthetic nitrogen compounds is increasing rapidly in Europe, Asia and America, and for the time being may exceed the demand; the capacity for production of aniline dyes in the world has doubled since the war, but the demand has remained

nearly the same; the productive capacity for sulphuric acid of many of the leading industrial countries is very much in excess of their demands. Many European countries which formerly imported large quantities of superphosphate, erected new plants and now meet their home needs from their own resources. It is estimated that in Germany the output of aniline dyes is less than a third of the works' capacity, in the United States and in Italy about a half, in Great Britain less than a half, and in no country so much as three-quarters. So far as synthetic nitrogen is concerned, it seems likely that the manufacture of nitrogenous fertilisers is certain to increase; Dr. J. Lipmann, of New Jersey, thinks that twenty million tons of pure nitrogen are annually removed from the soil of the United States; to what extent this amount is replenished by bacterial agencies we do not know; that it is not greatly restored in the shape of nitrogenous fertilisers is obvious, for the whole production of these in the world is only one and a quarter million tons a year. It is interesting to note that the consumption of nitrogen for agricultural purposes in the United Kingdom and Ireland is about $6\frac{1}{2}$ lb. per acre of arable land; this is half the consumption in Germany, and a quarter the consumption in Belgium. We do not know whether this remarkable difference is due to the difference in scientific knowledge in the three countries, or to the fact that the clay soils of many parts of England retain the nitrogen longer than the sandy soils of some parts of Germany and Belgium, or to both these factors. It is worthy of note that in estimating the cost of fertilisers, nitrogen costs more than potash or phosphorus; we should welcome more information as to the calculations involved in this statement. The question of fertilisers is a great one; half the world's production of sulphuric acid goes to make superphosphate, and a good deal of the remainder goes to make sulphate of ammonia. The aniline dye question is also important; we shall return to this next week. Industries which advance very slowly may, it is conceivable, increase their production in excess of the demand, and then wait a few years until the natural growth of the demand has overcome this excess. Such a course is hardly possible in an industry which changes so rapidly as the chemical industry; we think of the rise of synthetic indigo and synthetic ammonia, largely German in their origin, of the rise of artificial silk, largely British in origin, of synthetic varnishes, largely American, of other discoveries made

in France and Italy: what will be the state of Billingham ten years hence, or of Larderello? No one can say, but it is easy to see that no reliance can be placed on the hope that in a few years' time the demand for a particular substance will be double its present demand, and that plant now standing idle can be economically used for its production at that date. It has taken us a long time to understand the post-war conditions: in all probability in another six or eight years we shall have settled down pretty well. The pacification of Europe should then be an accepted fact: the disarmament question will then either be settled or recognised as a perpetual problem always facing us: the munition factories cannot be wholly separated from the potential munition factories. Experience has taught us all many things: first, that war is futile and ruinous, and, secondly, that in time of war a powerful and well-organised chemical industry can improvise methods of preserving the unwarlike members of the community, while it is also busy with means of offence and defence. Economics should guide us largely: that war is still a possible result of human ambitions, fears and passions, is a fact which teaches us not to rely exclusively on economics. No civilised country can run the risk of neglecting any large department of the chemical industry.

The Use of Coke Oven Gas for Town's Supply

There is a growing demand for the co-ordination of ideas relating to fuel, and in this the Fuel Section is playing its part. In our issue this week we publish an outstanding paper by Dr. E. W. Smith, Honorary Secretary of the Fuel Section, on a subject in which co-ordination is badly needed. Carbonisation of coal is undertaken by two industries - the gas industry and the coke oven industry. To the former, gas is the main product, but to the latter, coke is the main product. Yet these two great industries, with so many common interests, have had little understanding of each other's problems. Modern coke ovens produce large quantities of surplus gas, for which the coke oven managers seek an outlet. But they cannot expect to come to a satisfactory commercial agreement with a gas company until they understand the requirements and obligations of those whose responsibility it is to maintain the supply of gas to a town. Dr. Smith, in his paper, with his almost unique knowledge of both industries, holds the balance carefully, and shows both the gas engineer and the coke oven manager their obligations and opportunities. Dr. Smith suggests that the National Fuel and Power Committee might well be asked to report on the subject of the supply of coke oven gas for town's purposes, with special regard to the methods of ensuring maintenance of supply in times of labour and other difficulties. It is by attention to matters like this that the Board of Trade Committee could play an important part in the co-ordination of fuel supplies. The carbonisation of coal is also of prime importance in connexion with the supply of tar, pitch, intermediates, ammonia, nitrogenous fertilisers, disinfectants, and dyes. It may some day yield us oils and motor spirits, but this is not yet a business certainty. We are glad that the Fuel Section is tackling the subject in a broad and comprehensive manner.

THE USE OF COKE OVEN GAS FOR TOWN'S SUPPLY*

By E. W. SMITH, D.Sc., F.I.C.

To-day, few gas engineers question whether or not satisfactory gas can be supplied from well-run batteries of regenerative coke ovens, if the necessary care be taken to comply with their own requirements of supply. This last reservation is not a serious one, and where difficulties have arisen they have been due to a pardonable lack of experience at the coke oven end of gas practice which would not have arisen if there had been more co-ordination between the two sides.

The subject is a big one, and it is impossible to devise a detailed scheme which would be applicable in all cases, but there are some fundamental questions which need careful consideration before some gas engineers will give serious thought to the purchase of coke-oven gas for town's supply.

There will have to be a greater appreciation of, and sympathy for, the legal obligations of the gas authorities to the public in maintaining an adequate supply of gas made to a definite specification. A coke oven manager may sell his coke to sample, or on his reputation, or to an agreed analysis. At the worst, he will lose a customer in an open market if he fails in his obligations. The gas engineer not only loses his custom, but is often subject to public criticism, and his company may be fined by the Board of Trade for failure to comply. It is consequently an essential duty of the gas engineer to insist on all necessary restrictions in the supply of coke oven gas, if he is to maintain his obligation to the public--all the more necessary as he is responsible for a monopoly in his own area.

At the present time some eighteen gas undertakings are taking gas from coke ovens. The experience of most of these undertakings during the coal stoppage was a sorry one, and but for standby plant, would have been more serious. This strike experience lays stress on the primary consideration in the extended use of coke oven gas in town's supply, which is--"What can be done to ensure as great a certainty of maintenance of supply as exists under present conditions, in which the gas engineer has entire charge of his own production in an industry that is less affected by labour troubles than the coal and coking industry?"

Interruptions of supply may be due to the following causes:

1. Strike at the colliery.
2. Strike at the coke ovens.
3. Depression in the coke market, leading the coke oven people to desire to shut down their coke ovens.
4. Blockage on the main between coke ovens and gasworks.
5. Termination of the agreement between coke ovens and gasworks.

* From a paper read before the Midland Section of the Coke Oven Managers' Association at Sheffield, on January 26.

Constancy of supply of gas can be assured under the first head, when not accompanied by a strike at the coke ovens, by keeping a sufficient stock of coal, say four to six weeks' supply, at the coke ovens. A strike at the coke ovens can only be dealt with by having a spare plant at the gasworks. Most gas engineers would consider it necessary, when using coke-oven gas, to have a complete standby plant at the gasworks, ready to be put to work at a moment's notice, not only to deal with temporary stoppage of supply through strikes, but also so that they will not be entirely stranded at the termination of the period of agreement. Many of the agreements made many years ago, when coke-oven operators were willing to accept 4d. per thousand, are now terminating, and the coke-oven operators, realising the value of their gas, are only offering to renew agreements at a price many times this figure. Unless the gas undertaking has a proper standby in good condition, it is in a very weak position for bargaining with the coke-oven operators.

Blockage on the main between coke ovens and gasworks has been known, due to supplying crude gas from the coke ovens, which has not been properly freed from tar, and which may contain very considerable quantities of naphthalene. This difficulty can be provided for in new contracts.

If the coke ovens are producing domestic coke, then the question of the depression of the coke market is not so important as if the coke ovens were producing a metallurgical coke only.

In the past, gas engineers, taking coke-oven gas, have kept complete standbys in the form of carbonising plants in most cases. These have had to be maintained, and would later on have to be extended. It would be cheaper, where necessary, to keep a carburetted water-gas plant as a standby from every point of view, and would be quicker to start up. Having a standby plant, the provision of the necessary men must be considered. It has been found satisfactory to keep a nucleus of experienced retort-house men on the gasworks who can be put on to the work of gas-making in times of emergency. During the interval these men have been occupied in selling coke, generally purchased from the coke ovens. It was also necessary to keep a stock of coal at the gasworks, and, further, in order to preserve the coking and gas-making properties of the coal, this coal has to be renewed every few months. This is generally done by selling the coal for household purposes, gradually replacing it by fresh coal.

The coke-oven manager, if he wants to sell his surplus gas, will have to give more thought as to what arrangements he can make for the maintenance of his supplies. Can he give the same guarantees as to continuity as the gasworks? It should in some cases be possible.

Some coke-oven owners appear to have the belief that, if a gas undertaking is selling its gas at, say, 3s. 6d. per 1,000, it should be able to pay 10d. to 1s. 4d. for unpurified gas at inlet to gasworks purifiers, and make a substantial profit. This is by no means true, and the sooner these gentlemen make a study of the position from the gas undertaking's point of view the better.

The fundamental difference between the two industries, from the point of view of costs, is that, in the gas industry,

gas is the main product, and the net difference between all charges, including dividends and the receipts from residuals (by-products) is met by the receipts from the sale of gas. Variations in the price of gas can be made at the discretion of the gas undertaking, but the undertaking cannot make the progress it desires unless the charges for gas are attractive to the consumer.

The coke-oven industry has for its main product coke, which stands in relation to the coking industry as gas stands to the gas industry—except that, after determining the remunerative selling price of coke, it has to meet other coke in direct competition. The ultimate costs in each industry cannot be usefully compared, except to indicate their essential differences. Coke-oven gas, supplied direct to steel works, can be sold at a much higher rate, bringing a greater return to the coke-oven owner than it could command from a gas undertaking. Coke-oven gas has to bear no capital charges from the coke ovens. It is a by-product pure and simple. Gas made on gasworks has to bear all capital charges.

The price it is possible for the gas engineer to pay for coke-oven gas is determined first by the cost at which he can manufacture gas into the holder on his own works. This cost is made up of the following items:—

- A. Cost of coal after deducting value of residuals.
- B. Carbonising wages.
- C. Works salaries.
- D. Wear and tear.
- E. Purification.

Of these items, when a supply of purified coke-oven gas is taken, the wages figure would probably be reduced by a third. The salaries bill would also be reduced, but this is generally only a small figure, and need not be considered as altered very much. The purification figure would be eliminated. In place of the wear and tear item, would have to be a contribution to a sinking fund, which would provide the money for putting the retort house into first class order, and replacing it with modern plant, should the coke oven gas supply terminate. This figure would probably, for the first year or two after the coke-oven gas supply is commenced, not be very different from the ordinary figure taken for wear and tear, but this can be progressively reduced. This is almost the largest single item in the case of gas manufacture, and the saving effected on this head would enable an appreciable reduction in the price of gas to be effected, irrespective of the cheaper price of gas from the coke ovens.

One other point arises. The gas engineer who takes a supply of coke-oven gas would naturally wish to be in as favourable a position as, say, a neighbour gas engineer who is making his own gas, to reduce the price of gas, as the price of coal and value of residuals varies. In order to meet this, the gas engineer generally requires to have a sliding scale, which is based on the price of coal.

Should coke ovens supply unpurified gas, the gas undertaking will have to provide purifiers, holders and governors to deal with the coke-oven gas, and it is often not realised what bearing these charges have on the cost of production of gas.

I have prepared the following table of capital cost figures for a typical gasworks, which gives a good comparative picture of expenses under this head.

Apportionment of the capital cost of a gasworks (Works only).

Basis: 24 million cb. ft. per maximum day of 200 working days per year			
	Carbousing plant and house	Purifiers and shed	Holders
Estimated cost	£116,000	£27,600	£138,000
Percentage of total works cost	25.2%	6.0%	30.2%

Gas undertakings must provide a renewals fund, which shall provide for the upkeep of plant kept in reserve and also be sufficient for the provision of the most modern type of plant if and when necessity arises. In the accounts of most undertakings there will be found a figure of about 7d. per thousand, which is the amount put away to such a renewal fund, and is included in works' costs.

Another matter that a larger gas undertaking has to consider in the utilisation of coke-oven gas is the question of load. There are daily and hourly fluctuations that are provided for by hourly holder capacity. The usual Sunday morning load is frequently in great excess of the hourly or daily manufacturing capacity of the works, and reserves are accumulated during the week. Sudden fogs or cold weather are sources of sudden increase of output. These demands are supplied from holder stocks, and often from water-gas plants, and modifications in the manipulation of the carbousing plants. There are, too, the seasonal fluctuations. The daily mid winter load is often twice the daily midsummer load. The coke ovens should feel the effect of fluctuations at least as much as the gasworks plant, and the holder capacity of the combined coke ovens and gasworks should be equal to one day's maximum output, and it would often be of advantage for a proportion of the holder capacity to be at the coke ovens.

The purification of coke-oven gas can be done at the gasworks if plant is available. If not, it is advantageous for the gas to be purified at the coke ovens. Almost everything depends on whether or not conditions can be so adjusted as to ensure as great a security of supply from the coke ovens as from gasworks. If such security can be attained, coke ovens would be well advised to study the problem of water-gas production for themselves, which would enable them to provide for town's purposes a gas available for use anywhere *en route*, and be put into town's mains at any desirable point. It would also provide an outlet for surplus coke made at the coke ovens.

One of the problems that has to be handled is that of transmission of gas from the coke ovens to the gasworks. What size of mains and what pressures shall be employed? Each case has its own special features, but it may be of interest if I put before you the following figures based on actual experience and known costs. It will be noted that, although no one pressure is the cheapest for all quantities of gas to be compressed, pressures between 10 and 30 lb. per sq. in. would appear to be the range to be employed. The figures are based on the size of main corresponding with the quantities of gas to be delivered.

Total cost of distribution in pence per 1000 cubic feet (Amortisation in 20 years)

Quantity of gas, cb. ft. per day	Length of main (Miles)	Inlet pressure in lb. per sq. in.				
		5	10	20	30	40
5 million	5	0.704	0.740	0.870	0.936	1.048
	10	1.074	1.062	1.142	1.199	1.292
	15	1.491	1.425	1.420	1.468	1.554
	20	1.950	1.805	1.768	1.713	1.784
	25	0.534	0.577	0.700	0.799	0.906
10 million	5	0.782	0.779	0.877	0.953	1.049
	10	1.048	0.989	1.057	1.110	1.208
	15	1.310	1.240	1.249	1.253	1.348
	20	0.481	0.535	0.603	0.743	0.872
	25	0.678	0.692	0.704	0.854	0.979
15 million	5	0.885	0.866	0.943	0.989	1.093
	10	1.103	1.015	1.000	1.124	1.221
	15	0.449	0.504	0.625	0.731	0.843
	20	0.609	0.620	0.750	0.827	0.930
	25	0.758	0.779	0.859	0.941	1.028
20 million	15	0.952	0.920	0.980	1.039	1.120

The figures in italics show minimum costs.

Taking a typical example of two million a day, the following figures show that the cost of distribution is not more than 2d. per 1000 cb. ft. for a distance of ten miles.

Cost of distribution of coke-oven gas

Basis :-

2 million cb. ft. per day.	
C.V. 550	S.G. 0.45 (air=1).
Therms	11,000 per day.
Distance	10 miles.
Size of main	10 inches.
Inlet pressure	10 lb. per sq. in.
Outlet pressure	1 lb. per sq. in.
Cost of main and lay- ing same	£32,400.
Interest and deprecia- tion	1.6 pence per 1000.

<i>Cost of Compression.</i>	<i>Per 1000</i>	<i>Per therm.</i>
	d.	d.
Capital charges (15%)	0.148	
Steam at 18d./1000 lb.	0.310	
Labour	0.103	
Oil etc.	0.030	
	0.591	0.107
Add cap. charges on main	1.600	0.291
Total cost of distribution	2.191	0.398

NOTE. This could be reduced if a higher inlet pressure were used as minimum cost of distribution is obtained in general with low pressures for large volumes with high pressures for small volumes.

Sometimes one heard that changes in specific gravity may have serious effects on distribution costs and cause difficulties. It will be seen that within all practicable town's gas ranges, the effect cannot be more than 2-3% as expressed by the changes in size of main that would have to be made to maintain the same conditions.

Variation of size of main for same volume but varying specific gravities

Specific gravity (Air = 1)	Diameter of Main Inches	Increase per cent.
0.45	9.5	
0.50	9.7	2.1
0.60	10.1	5.0
0.70	10.4	9.2
0.80	10.6	12.2
0.90	10.9	14.9

Thus, the cost of distribution per 1000 cb. ft. would be approximately the same, but the cost *per therm*

(since high specific gravity in general denotes low calorific value) would increase in inverse proportion to the C.V.

It is only when distributing producer gas that such difficulties occur, due to the high percentage of inerts, and I believe that the majority of gas engineers agree that, whatever calorific value may be the standard employed, the inerts should be as low as is practicable.

Gas engineers—after they have satisfied themselves that continuity of supply is assured—will still require that the gas bought shall be to as close a specification as they themselves adhere. The calorific value of the gas shall not vary more than prescribed limits. The specific gravity (total inerts) shall be constant. The H_2S in unpurified gas shall not exceed a given limit. This last should not be difficult to attain, as crude coke-oven gas usually contains less H_2S than gasworks crude gas. The gas must be low in temperature, leaving the coke oven works, and therefore free from moisture.

One subject which has been occupying the attention of those interested in gas manufacture has been the proposition of removing the moisture from gas prior to its distribution. When gas stored over water in holders is subsequently cooled in the mains condensation takes place. This involves great expense in the installation and maintenance of syphons, and causes irregularities in supply and corrosion of mains, meters, and services. The necessity of the use of cast-iron mains for the distribution of gas is mainly due to the internal corrosion caused by the presence of the water, and with dry gas these mains might be replaced with steel mains. In addition to this, moisture is of no value, but costs a considerable amount to distribute. 1,000,000 cb. ft. of gas, saturated at 70° C. contains nearly 25,000 cb. ft. of water vapour.

There are various methods of treating gas for the removal of water, amongst which may be mentioned compression, refrigeration, treatment by hygroscopic substances, and treatment by adsorbents. Treatment by means of refrigeration may conveniently be carried out by bringing cooled water into intimate contact with the gas. One firm associated particularly with air conditioning, the Carrier Engineering Company, has devised an apparatus for gas cooling along these lines. For small works ammonia or carbon dioxide refrigeration would probably be the best, but in large plants the centrifugal type of refrigerating system would appear to be the most convenient. The method of dehydration by means of refrigeration has the advantage that the cooling of the gas also removes naphthalene and tar fog from the gas. Gas subjected to this treatment would therefore not require any special naphthalene washing plant.

An interesting suggestion for dehydrating by means of sulphuric acid has been put forward by the Koppers Company of America, in which the gas is dried by means of sulphuric acid, the diluted sulphuric acid being used on the sulphate of ammonia plant. In this case a catch box must be employed to prevent any possible entrainment of sulphuric acid.

A further scheme for drying gas is by means of silica gel, which has highly absorptive properties as regards moisture.

One of the most important points to consider is the cost of drying gas, and it appears that the process of drying gas would cost somewhere in the neighbourhood of 0.25d. to 0.5d. per 1,000 cb. ft. according to the quantity to be dried.

One of the difficulties to be met is that the gas cooling has to be done on the outlet holder, unless the holder liquid is oil. Cooling on the outlet holder demands the installation of a plant sufficient to cool the maximum hourly output.

Coke ovens must supply gas low in naphthalene. Complete removal is attained in some gas works. Many remove it to as low as 2 grains per 100 cb. ft., and it would be of advantage if all did so. With gas rich in naphthalene there is a tendency for the naphthalene to be deposited in the mains, causing back pressure and blockage. When the gas contains light oils, these act as a solvent for naphthalene, and prevent deposition. Naphthalene troubles become a matter of first importance when considering the bulk distribution of coke-oven gas. Any blockage of the main increases the power costs of distribution, and is difficult to locate. It is therefore essential that gas to be delivered for town's purposes by coke-oven plants should have a low naphthalene content. To maintain the steady low naphthalene content demands gas washing.

When benzole is recovered by means of wash oil this at the same time involves a satisfactory removal of naphthalene, as long as certain conditions are watched. When benzole is being washed out by means of a creosote oil, it is possible for the creosote oil to increase rather than reduce the naphthalene in the gas.

The following table shows the maximum temperature which must be employed to obtain a gas of desired naphthalene content when using a wash oil with varying degrees of saturation with naphthalene. Thus, using a wash oil saturated to the extent of 15% with naphthalene, if a gas containing four grains of naphthalene per 100 cb. ft. is required, a temperature not exceeding 23° C. must be employed.

Naphthalene removal by creosote

Table showing maximum temperature of wash oil for different degrees of saturation

Grains naphthalene per 100 cb. ft.	° Saturation of oil with naphthalene.				
	5%	10%	15%	20%	25%
2	28° C.	17° C.	6° C.	2° C.	—
4	37	29	23	16	10° C.
6	—	34	29	25	20
8	—	37	33	28	25
10	—	40	35	31	28
12	—	—	37	33	31
14	—	—	39	35	32
16	—	—	—	36	34
18	—	—	—	38	36

The efficiency of naphthalene scrubbers depends upon intimate contact between the gas and the wash liquid. In America the tower type of scrubbers are most favoured. These require small ground space, give very little back pressure, and are simple and cheap to operate.

In the Koppers Company process a maximum oil consumption of 25 gals. per million in summer, 5 gals. per million in winter, will reduce the naphthalene and gum-forming constituents to a trace.

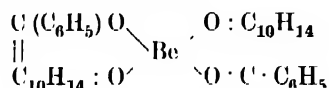
The loss in heating value of the gas is less than half of 1 B.Th.U. per cb. ft. The cost of operation of such a plant is very low.

conclusion was based upon the experimental fact that the compound $\text{PtCl}_2 \cdot 2\text{NH}_3$ exists in two forms, which are regarded as *cis* and *trans* isomerides.

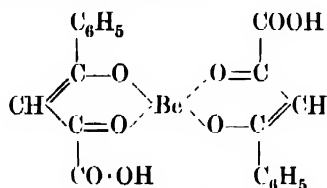


Confirmation has been supplied by the X-ray analysis of $\text{K}_2[\text{PdCl}_4]$ and $\text{K}_2[\text{PtCl}_4]$,⁴² which has revealed a square configuration of the four radicals around the noble metal. On the other hand, the same method has indicated a tetrahedral configuration of four atoms of beryllium round a central atom of oxygen, and of four atoms of oxygen around each of these atoms of beryllium, in basic beryllium acetate,⁴³ $\text{OBe}_4(\text{O}_2\text{C}\cdot\text{CH}_3)_6$, a compound in which an atom of oxygen occupies the centre of a tetrahedron, of which the corners are occupied by four atoms of beryllium, whilst the six acetyl-groups occupy the six edges of the tetrahedron, and serve to bracket together the pairs of beryllium atoms at the corners.

In these conditions it was of special interest to know whether the tetrahedral configuration of a 4-co-ordination compound can be established by the ordinary chemical method, depending on the development of optical activity in a suitable compound of the metal. As in the case of the 6-co-ordination compounds, this can be achieved most readily by making use of bivalent or chelate radicals; but whereas in the 6-co-ordination compounds three *symmetrical* oxalate (or ethylene diamine) radicals can be used, it is essential that the two bivalent radicals of the 4-co-ordination compound should be *unsymmetrical*, since otherwise the resulting model would possess elements of symmetry which would render it incapable of existing in optically-active forms. A clear indication of this tetrahedral configuration was obtained when it was discovered that beryllium benzoylcamphor undergoes mutarotation in solution:⁴⁴



This could be explained most readily by supposing that the beryllium is linked to four oxygen atoms, and that the two possible tetrahedral configurations of these four oxygens are interconvertible, thereby reversing the sign of the rotatory power of the dissymmetric metallic atom. Since, however, the optical activity of the benzoylcamphor could not be eliminated, this explanation remained unproved until Mills and Gotts⁴⁴ succeeded in developing a transient optical rotatory power in the salts of *beryllium-benzoylpyruvic acid*.



This result was not unexpected, since the tetrahedral configuration of the beryllium-complex had already been established in the case of the basic acetate; but an entirely new field is opened up by the fact that similar observations were made with the zinc and copper

derivatives of the acid. These two metals, although normally bivalent, resemble bivalent nickel sufficiently to justify the expectation that they might yield derivatives with an octahedral or square configuration. The fact that their 4-co-ordination compounds can be obtained in dissymmetric forms proves that in these compounds at least the configuration is tetrahedral and not planar.

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- 60 Wyckoff, J.A.C.S., 1922, 44, 1230.
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NOTES FROM GERMANY

Sodium Sulphide Convention in Germany

A price convention for sodium sulphide has been formed in Germany by the I.-G. Rhenania Kuhlheim, Verein. Chem. Fabriken, Goldschmidt A.-G., Roos & Co, and Concordia companies.

German Fertiliser Industry

According to a preliminary estimate, the consumption of fertilisers in Germany during the year ended April 30, 1926, amounted to 330,000 metric tons of nitrogen, 368,000 tons of phosphoric acid (P_2O_5), and 609,000 tons of potash (K_2O), figures which compare with 335,000 tons, 370,000 tons, and 664,000 tons in 1924-1925, and 210,000 tons, 630,000 tons, and 557,356 tons in 1913-14, when the territory was some 5 million hectares larger.

The German output of fixed nitrogen during the fertiliser year 1926-27 is estimated at 600,000 tons. The consumption of phosphates is about 59% of the pre-war consumption of 634,000 tons in 1912-13, and as the production is some 600,000 tons, or about 35% of its pre-war output, the leading producers have formed a cartel, the "Deutsche Superphosphat Industrie G.m.b.H." One reason for this decline is the increasing use of basic slag, although the production is only about 1,000,000 tons, compared with 2,200,000 before the war. Concentration for mass and cheaper production is being effected in the potash industry, and sales in 1926 are expected to amount to 1,100,000 tons K_2O , which is roughly equal to sales in 1913. The potash syndicate is divided by two associations of concerns, each said to be primarily interested in obtaining control of the syndicate: the Salzdetfurth group, controlling 52.1% of the total German output of potash, and the Wintershall group, controlling 39%.—(U.S. Comm. Rep. 48, 1926).

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING,

July 4 to 8, 1927

A preliminary programme of the annual meetings to be held in Edinburgh appeared on p. 81 of the issue of *CHEMISTRY AND INDUSTRY* for last week, and further information will be published from time to time.

Meantime, in view of the great demand for accommodation during the week of the meetings that the Edinburgh hotels are already experiencing, it is thought desirable to give now the names and addresses of the chief hotels in the city, with their tariffs, in order that members of the Society and others intending to be present at the meetings may book their accommodation *without delay* :—

HOTELS

Caledonian Station Hotel, Princes Street :	
Bed and breakfast	14s. 6d.
Bruid Hills Hotel : Bed and breakfast ...	14s. 0d.
Roxburghe Hotel, 38, Charlotte Square :	
Single room with bath and breakfast ...	13s. 0d.
Double rooms from	11s. 6d.
Royal British Hotel, 12, Princes Street :	
Bed and breakfast	11s. 6d. to 13s. 6d.
Queen Hotel, 1 and 2, St. Colme Street :	
Bed and breakfast	8s. 6d. to 12s. 6d.
George Hotel, George Street : Bedroom, bath and breakfast	10s. 6d.
County and West End Hotel, 19, Lothian Road : Double rooms only. Bed and breakfast	8s. 6d.
Palace Hotel, 1, South Castle Street : Bed and breakfast from	8s. 6d.

Temperance Hotels

Darling's Regent Hotel, 21, Waterloo Place :	
Single bedroom and breakfast	10s. 0d.
Double bedroom and breakfast	8s. 6d. to 10s.
St. Andrew Hotel, 10, South St. Andrew Street :	
Double bedrooms only	8s. 6d. to 10s. 6d.
Cockburn Hotel, Cockburn Street : Bed and breakfast from	8s. 6d.
Maitland Hotel, Shandwick Place : Bed and breakfast	8s. 6d.

Private Hotels

Mrs. Craw, 32, Abercromby Place : Bed, bath, and breakfast	10s. 6d.
Grosvenor Hotel, 17 and 19, Grosvenor Street : Bed and breakfast	9s. 6d.

UNIVERSITY HOSTELS

Masson Hall, 31, George Square : Single bedrooms (men or women). Bed and breakfast	8s. 0d.
Students' Hostel, East Suffolk Road : Single bedrooms (men only). Bed and breakfast	8s. 0d.

Those who decide to stay at the North British Station Hotel (official Headquarters of the Society during the meetings) or at one or other of the University Hostels are requested to arrange *at once* their accommodation through the Hon. Local Secretary of the Society, Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

Accommodation to be reserved at any of the other hotels should be arranged direct with the Manager of the hotel.

TAR CONFERENCE PAPERS

The papers that were presented before the Manchester Tar Conference in November last have now been published in bound form at the price of 2s. 6d., post free.

Copies can be obtained from the General Secretary of the Society of Chemical Industry, Central House, Finsbury Square, London, E.C.2, and orders should be accompanied by the appropriate remittance.

CALENDAR OF FORTHCOMING EVENTS

- Feb. 7. SOCIETY OF ENGINEERS. Inaugural Meeting for the year 1927. Apartments of the Geological Society, Burlington House, W.1, at 5.30 p.m. Presidential address by D. C. Fidler. Presentation of premiums awarded in 1926 by the retiring President, G. O. Case.
- Feb. 7. INSTITUTION OF THE RUBBER INDUSTRY, *London and District Section*, Engineers' Club, Coventry Street, W.1, at 8 p.m. (1) "Set in vulcanised rubber," by H. Turner. (2) "Rubber toys," by H. Standing.
- Feb. 7. BIOCHEMICAL SOCIETY, *Lister Institute of Preventive Medicine*, Chelsea Bridge Road, S.W.1, at 5 p.m. (1) "A new type of alkali lignin," by C. Dorée and E. C. Barton-Wright. (2) "Observations on the purification and properties of insulin," by F. Dickens, E. C. Dodds, W. Lawson, and N. F. MacLagan. (3) "The significance of phosphoric acid in muscular contraction," by P. Eggleton and M. G. Eggleton. (4) "The lipins of yeast," by I. Smedley MacLean and C. G. Daubney. (5) "Methylated derivatives of hexosephosphoric acids," by W. T. J. Morgan. (6) "Meyerhof's theory of alcoholic fermentation," by A. Harden. (7) "Proteins of the cerebro-spinal fluid," by L. F. Hewitt. (8) "Nitrogen metabolism technique for use with small animals," by M. H. Roscoe. (9) "An efficient gas scrubber," by H. W. Southgate. (10) "On the nature of provitamin D," by O. Rosenheim and T. A. Webster. (11) "The effect of the reaction on the osmotic pressure of serum proteins," by J. R. Marrack.
- Feb. 7. SOCIETY OF CHEMICAL INDUSTRY, *London Section*, Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. "Photographic sensitivity," by Dr. T. Slater Price.
- Feb. 8. SOCIETY OF CHEMICAL INDUSTRY, *South Wales Section*, Technical College, Cathays Park, Cardiff, at 7.30 p.m. "Micro-organisms of the soil," by Prof. J. Mangan.
- Feb. 8. SOCIETY OF CHEMICAL INDUSTRY, *Birmingham and Midland Section*, University Buildings, Edmund Street, Birmingham, at 7.15 p.m. "Metallurgical spectroscopic analysis," by F. Twyman.
- Feb. 8. INSTITUTION OF PETROLEUM TECHNOLOGISTS. Rooms of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m. "The production of oil from coal: an account of the work of the Fuel Research Station," by Dr. C. H. Lander.
- Feb. 9. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Ordinary Meeting). "The romance of the organic chemical industry," by Dr. E. F. Armstrong. Mr. A. Chaston Chapman will preside.

- Feb. 10. INSTITUTION OF THE RUBBER INDUSTRY, *Manchester and District Section*. The Textile Institute, 16, St. Mary's Parsonage, Manchester, at 7.30 p.m. "Proofing," by J. Lloyd.
- Feb. 10. INSTITUTE OF BREWING, *North of England Section*. Midland Hotel, Manchester. "Recent work on the preservative principles of hops," by Prof. F. L. Pyman.
- Feb. 10. OPTICAL SOCIETY. Annual General Meeting.
- Feb. 10. INSTITUTION OF MECHANICAL ENGINEERS. Leeds Meeting. "Use and economy of high pressures in steam plant," by Profs. A. L. Mellanby and W. Kerr.
- Feb. 10. INSTITUTION OF ELECTRICAL ENGINEERS. Annual Dinner and Reunion. Hotel Cecil, Strand, W.C., at 7.15 for 7.45 p.m. H.R.H. the Prince of Wales, K.G., will be present.
- Feb. 10. CHEMICAL SOCIETY. A Memorial Lecture in honour of the late Kamerlingh Onnes will be delivered by Prof. Dr. E. Colien (of Utrecht), at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W. 1, at 8 p.m.
- Feb. 10. ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY. Joint Meeting with the London Section of the Institute of Metals, Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, at 7.30 p.m. "Nickel coatings and methods of production," by W. R. Barclay.
- Feb. 11. CHEMICAL ENGINEERING GROUP. The Meeting arranged for this date has been postponed.
- Feb. 11. WEST OF SCOTLAND IRON AND STEEL INSTITUTE. "Silica brick," by A. H. Middleton.
- Feb. 11. GLASGOW UNIVERSITY ALCHEMISTS' CLUB. Annual Dance at 7.30 p.m.
- Feb. 11. INSTITUTE OF METALS, *Sheffield Local Section*. The University, St. George's Square, Sheffield, at 7.30 p.m. "Bronze," by R. T. Rolfe.
- Feb. 11. INSTITUTE OF METALS, *Swansea Local Section*. University College, Singleton Park, Swansea, at 7.15 p.m. "The design of annealing furnaces," by J. S. Caswell.
- Feb. 14. INSTITUTE OF CHEMISTRY, *Manchester and District Section*. "Electronic theories of valency in organic chemistry," by Prof. R. Robinson.
- Feb. 14. SOCIETY OF CHEMICAL INDUSTRY AND THE INSTITUTE OF CHEMISTRY. *Joint meeting of the Edinburgh and East of Scotland Sections*. The Pharmaceutical Hall, 36, York Place, Edinburgh, at 8 p.m. "The use of the microscope in qualitative analysis," by B. D. W. Luff.
- Mar. 9 and 10. INSTITUTE OF METALS. Annual General Meeting. The Hall of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W. 1. On March 9, at 10 a.m. General Meeting. Papers as follows: (1) "Investigation of the effects of impurities on copper. Part V.—The effect of bismuth on copper," by Prof. D. Hanson and Grace W. Ford. (2) "Investigation of the effects of impurities on copper. Part III.—The effect of arsenic on copper. Part IV.—The effect of arsenic plus oxygen on copper," by Prof. D. Hanson and C. B. Marryat. (3) "Brittleness in arsenical copper," by C. Blazey. At 2 p.m.

"Electric furnaces in non-ferrous metallurgy," by D. F. Campbell, followed by a general discussion on "Electric furnaces in non-ferrous metallurgy." At 6.45 p.m. Annual Dinner and Dance at the Trocadero Restaurant, Piccadilly Circus, W. 1. On March 10 at 10 a.m. the meeting will be resumed and the following papers read: "The penetration of mild steel by brazing solder and other metals," by R. Genders. "The penetration of brass by tin and solder, with a few notes on the copper-tin equilibrium diagram," by J. H. Miller. "The attack of molten metals on certain non-ferrous metals and alloys," by H. J. Hartley. "Notes on the manufacture and properties of hair springs," by H. Moore and S. Beckinsale. "The application of strain methods to the investigation of the structure of eutectic alloys," and "Note on the crystallisation of the lead-tin eutectic," by F. Hargreaves. Discussion will follow. At 2 p.m. the following papers will be read and discussed: "The influence of calcium on aluminium containing silicon." With an appendix on "The estimation of calcium in aluminium alloys," by P. G. Ward. "The magnesium-rich magnesium-copper alloys," by M. Hansen. "The mechanism of inverse segregation in alloys," with an appendix on "The accurate determination of copper in bronze by electrolysis," by R. A. F. Hammond. "Magnetic analysis as a means of studying the structure of non-magnetic alloys," by Prof. K. Honda and Prof. E. Hikoze. "An etching reagent for copper," by Prof. B. W. Holman. "Examination of a fifteenth-century brass," and "Note on the silver contents of Roman lead from Folkestone and Richborough Castle," by J. N. Friend and W. E. Thorneycroft.

GLASGOW UNIVERSITY ALCHEMISTS' CLUB

A meeting, to which the members of the local sections of the Society of Chemical Industry and the Institute of Chemistry had been invited, was held on January 26, when Sir James Walker, F.R.S., delivered an address, entitled "Electrosyntheses," the President, Dr. T. S. Stevens, occupying the chair.

About the year 1850, Kolbe showed that, by the application of electricity, it was possible to prepare ethane from sodium acetate, and it had been found that this method was suitable for synthesising normal hydrocarbons of high molecular weight.

Sir James reviewed the early research, and indicated that, while aliphatic compounds had been successfully synthesised, the method was not applicable to the aromatic series.

It was noteworthy that the electrode influenced the nature of the products—a gold electrode giving entirely different results from a platinum one, even although the conditions of experiment were otherwise constant. He outlined the two theories proposed to account for the reactions, namely, (1) the union of discharged ions, and (2) the oxidation hypothesis—commenting particularly upon Fichter's recent work.

The importance of the physico-chemical aspect was stressed, and an account of recent investigations along such lines was given.

CORRESPONDENCE

THE TESTING OF DISINFECTANTS

SIR,—Referring to Mr. C. T. Kingzett's letter in your issue of 21st January, I was aware of the published papers by Messrs. Kingzett & Woodcock, but I could not see at the time, nor can I yet, that their work had any direct bearing on the main point of my paper, viz., the effect of slight variations in the method of standardising Rideal Walker broth on the phenol coefficient values of coal-tar disinfectants. It should be evident from the paper that only coal-tar disinfectants were under examination, and no attempt was made to discuss the value of the Rideal Walker generally, or the values of other types of disinfectants, such as are referred to by Mr. Kingzett.

Yours faithfully,

QUINTIN MOORE, JNR

Technical Chemistry Department,
The Royal Technical College, Glasgow.

THE MANUFACTURE OF WHITE SUGAR

SIR,—(1) In the paper by Dr. C. A. Browne entitled "The sugar industry in its chemical aspects," published in the JOURNAL of January 14, 1927, attention should be drawn to a seriously inaccurate statement. Dr. Browne (page 29) says that:—

"No plantation has yet found it possible to manufacture white sugar equal in purity and uniformity of grade to refined sugars."

This statement is not correct.

(2) Standard refined granulated sugar, equal in all respects to the product of the large bone-char refineries, is being manufactured on cane sugar plantations in Louisiana, Natal and Porto Rico. The sugar is refined at the raw sugar factory by means of the activated vegetable carbon—Suchar.

(3) The brokers in New Orleans and New York handling this refined sugar report that it fully meets the demands of the most exacting consumers as regards colour, purity and uniformity.

(4) We shall be grateful if you will publish this correction in order that your readers may not be misinformed.

Yours faithfully,

for BRITISH SUGAR PROCESSES, LTD.,

R. G. W. FARNELL,

21, Old Broad Street,
London, E.C.2.

Director

PERSONAL AND OTHER ITEMS

Sir Alfred and Lady Mond have returned to London from the South of France.

Amongst the names of new vice-presidents of the Federation of British Industries put forward for election is Sir William Clare Lees, of the Bleachers' Association, Ltd.

Mr. B. D. W. Luff has resigned his post as research chemist with the North British Rubber Company to become the manager of the analytical laboratories of Lever Brothers, Ltd., at Port Sunlight.

The degree of D.Sc. in chemistry of the University of London has been conferred upon Mr. J. W. Cook, Mr. S. B. Dutt, and Mr. W. G. Shilling.

Mr. A. P. Davson, of Ealing, public analyst for Northampton, has, in addition, been appointed public analyst for Bermondsey, in place of the late Mr. R. Bodmer.

Dr. G. D. Rosengarten, vice-president of Powers-Weightman-Rosengarten, Inc., Philadelphia, has been elected to the presidency of the American Chemical Society.

Mr. John A. Benn, a grandson of the late Sir John Benn, has been appointed a director of Benn Brothers Ltd.

The "Horace Brown Memorial Lecture" will be delivered in the Lecture Theatre of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, at 8.15 p.m. on February 25, by Professor Henry Edward Armstrong, D.Sc., LL.D., F.R.S., to whom the "Horace Brown Medal" will be presented during the course of the evening.

As the Imperial College of Tropical Agriculture has received a Royal Charter of Incorporation, the former company bearing the same title has been dissolved. The activities of the College continue, as before, in Trinidad, but on a larger scale.

Lead mines at Greenhow, near Harrogate, have been reopened after being closed for 60 years. In addition to lead, various mineral by-products are obtained.

One man was killed and two others seriously injured by an explosion which occurred in a still house at the Hendon chemical works of Johnson & Sons on January 31.

The death is announced from Persia of Mr. H. E. Nichols, a director of the Anglo-Persian Oil Company and head of the production department of the company.

The death is announced of Dr. W. W. Seton, secretary of University College, London, who was associated with Sir Gregory Foster in the development of the Department of Chemical Engineering in University College, and the other activities connected with the Ramsay Memorial Fund, of which he was secretary.

Professor Carl Graebe, who died recently at the age of 86, will be remembered for his work on the relation between colour and chemical constitution and for his fundamental work on the constitution of quinone (*p*-benzoquinone), which led to his synthesis (together with Carl Liebermann) of alizarin. The process, though of great interest, was not of commercial value.

Carbonisation Congress

The Congress which it was proposed to hold during March this year under the joint auspices of the Institution of Gas Engineers, the Coke Oven Managers' Association, and the Fuel Section of the Society of Chemical Industry, has been postponed until October owing to the number of other important meetings that are being held during the spring. Very shortly the programme of the Congress will be issued, together with other details.

The Patent Fuel Industry

The patent fuel industry of the United Kingdom, which is centred mainly in South Wales, has a productive capacity of over 2,500,000 tons per annum. Since 1920, however, production has not exceeded 50 per cent. of capacity, and in 1926, owing to the shortage of small coal and of pitch, the output, it is estimated, was only about 800,000 tons, whilst exports were about 500,000 tons, compared with 1,200,000 tons in 1925. The consumption of pitch by the industry constitutes between 8 and 9% of the total output of patent fuel.

British Trade in Dyes

Exports of dyes from Great Britain during the first 11 months of 1926 amounted to 3552 tons (£570,812), compared with 4984 tons (£803,083) during the corresponding period of 1925. This decrease was due largely to the coal stoppage, whilst the unsettled state of China led to reduced exports of synthetic indigo.

Imports of dyes during the same period of 1926 amounted to 1745 tons (£797,282), as against 1823 tons (£579,546) during the corresponding period of 1925, whilst imports of intermediates fell from 54 tons (£11,482) to 15 tons (£3548).

Anodic Oxidation of Aluminium

The striking resistance of aluminium to corrosion by industrial waters and sea-water is ascribed to the presence of a protective film of aluminium oxide or hydroxide. This observation suggested that the resistance of aluminium to corrosion might be greatly increased if a strong and tightly adherent film of oxide or hydroxide were formed on the metal instead of the thin film ordinarily present. As an outcome of investigations carried out on behalf of the Department of Scientific and Industrial Research by the Corrosion Research Committee of the Institute of Metals, a method has been developed of protecting aluminium or its alloys by anodic oxidation. The work, carried out by Dr. G. D. Bengough and Mr. J. M. Stuart, is described in a report on anodic oxidation published by the Department (H.M. Stationery Office, price 1s. 3d.), which gives a full account of the application of the process and large-scale experiments with it at Farnborough. The cost of treatment in an experimental plant was 1.93d. per sq. ft. (largely for labour), the coating obtained being glassy, adherent, and giving greater resistance to corrosion, which, it was found, was further improved by treatment with lanoline. At present the process is not applicable to all aluminium casting alloys. Anodically-treated sheets were found to absorb various dyes.

Tests on the Freeman Multiple Retort

The Department of Scientific and Industrial Research has published a Report by the Director of Fuel Research (H.M. Stationery Office, price 1s.) of tests carried out on the Freeman multiple retort of the British Oil and Fuel Conservation, Ltd., of Willesden, under the scheme by which the Department tests plants for the low-temperature carbonisation of bituminous coal. The plant consists of an externally heated, vertical continuous retort, built up of six cylindrical chambers, placed in vertical alignment, and provided with a central shaft fitted with ploughs to turn over the coal during carbonisation. A description of the retort and of the results

obtained are given in the report. It is concluded that the retort carbonises a weakly caking coal satisfactorily, and gives a higher yield of tar than has been obtained from any other plant using similar coals which has been tested by the Fuel Research staff. The coke produced was highly combustible, but small in size, and would have to be briquetted for domestic use, or used as a pulverised fuel. It was not possible, owing to lack of time, to determine how far a more strongly caking coal could be used.

International Superphosphate Producers' Association

Considerable interest is taken in the United States in the recent formation, at a meeting in London, of the International Superphosphate Producers' Association by representatives of the industry from Great Britain, Belgium, Denmark, Czechoslovakia, Germany, Norway, Sweden, Poland, Finland, French North Africa, and the Union of South Africa. A resolution is to be moved at a forthcoming meeting of the National Fertilizer Association (U.S.A.) with the object of joining the international organisation.

The president of the International Association is Mr. Martens, and its headquarters are in London. The object of the organisation is to exchange information, sales propaganda, and technical collaboration, and to study all matters connected with phosphoric acid and superphosphates.

Modern Developments in regard to Fuel

In view of the great importance of the fuel problem at present, the Governors of the Sir John Cass Technical Institute have arranged a special course of lectures on "Modern developments in regard to fuel," which will deal with some of the technical aspects of the subject. The course will consist of seven lectures of an advanced character given on Monday evenings from 6—7 p.m., commencing on February 7, as follows:—"Recent developments in coal mining," by H. M. Morgans; "Preparation of fuel," by Prof. K. N. Moss; "Pulverised and colloidal fuel," by L. C. Harvey; "Coke oven practice," by E. M. Myers; "Gas works practice," by H. G. Colman; "Low-temperature carbonisation," by F. S. Sinnatt; and "Liquid fuel," by Prof. J. S. S. Brame. The fee for the course of seven lectures is 10s.

"Vegetable Wool" as an Industry for Quebec

An official communication points out the favourable situation of Quebec for the establishment of a new industry—the manufacture of "vegetable wool" from pine needles, from which the fibre is separated by a chemical treatment. The resulting fibre is said to resemble natural wool closely, and can be worked in a similar manner. Waste from the process is used to make briquettes which have proved an excellent fuel, and resin is recovered which also finds a use. Quebec has to import all its coal, so the briquettes would find a ready market, whilst the Province contains well-nigh inexhaustible supplies of the raw material.

Canadian Research in Pulp and Paper

At the annual meeting in Montreal of the Canadian Pulp and Paper Association a proposal to endow a research laboratory in the University of McGill at a cost of \$250,000 (£50,000) was unanimously approved.

The Action of Acid on Leather

At a recent conference of the Advisory Committee for the leather industry of the United States with experts of the U.S. Bureau of Standards, the action of acid on leather was discussed at length. In view of the importance of the problem, it was decided to begin investigation by a study of the effects of sulphuric acid on leathers tanned with different types of vegetable tanning materials.

U.S. Output of Alcohol

During the year ended June 30, 1926, the output of alcohol in the United States totalled 202,271,670 proof gallons, an increase of 36,106,152 gallons over the previous year. This increase is attributed to the growing use of alcohol for fuel, light and power, and for the manufacture of new products.

United States Imports of German Iron

The Secretary of the U.S. Treasury has imposed a special "anti-dumping" duty on German iron, after an inquiry had shown that German pig-iron was being sold in the United States at less than a fair value.

The New German Fertiliser

It is announced that the new complete fertiliser produced by the I.-G. Farbenindustrie is being marketed by the Stickstoff Syndikat. The fertiliser is sold under the name of "Nitrophoska I.-G." in two forms, one containing a guaranteed minimum of 17% N, 11.7% water-soluble P_2O_5 (as well as 1% citric-soluble P_2O_5) and 21.1% K_2O , and a second containing 14.7% N, 10.2% water-soluble P_2O_5 (plus 0.09% citric-soluble P_2O_5) and 25.6% K_2O . The nitrogen is present as to one-third combined as nitrate with the potash and as to two-thirds as ammonia combined with P_2O_5 . The product is neutral, easily soluble, whitish-grey in colour, and contains nothing injurious to plant life. It is prepared in the form of small grains to facilitate distribution. The fertiliser factory of the I.-G. can turn out 120,000 metric tons a year with its present equipment.

The Fixed-Nitrogen Industry

At a recent meeting of the Wintershall Konzern it was stated that the company had acquired the rights to patents covering the nitrogen-fixation processes of a Swedish concern. If expectations are not realised within two years the contract will be cancelled.

The operation of the Mont Cenis process by the Gewerkschaft der Steinkohlenzeche Mont Cenis, at Solingen, is reported to be running smoothly. A maximum daily production of 4.2 tons has been attained, but the limiting factor has been the capacity of the Messerschmidt hydrogen plant. It is quite likely that production will be doubled as soon as the installation of a Linde unit for separating hydrogen from coke oven gases is completed. The Mont Cenis process is based on the employment of a catalyst, which, it is claimed, permits operation with much lower pressure than was formerly considered necessary. The operating expenses are said to be less than those of other methods which are based on reactions under high pressure and temperature. The Mont Cenis company is primarily a coal-mining enterprise, with a daily output of 3000 to 4000 tons. About one-third of the output is coked, and the company desires to utilise more fully its coke oven gases.

REVIEWS

CHEMISTRY OF THE PROTEINS AND ITS ECONOMIC APPLICATIONS. By DOROTHY JORDON LLOYD, M.A., D.Sc. Pp. xii+269. London: J. and A. Churchill, 1926. Price 10s. 6d.

Dr. Lloyd is to be congratulated upon her volume on the Chemistry of the Proteins, which is a decidedly useful contribution to this class of literature.

The book is divided into two parts, the first of which (114 pages) deals with the analysis, composition and classification of these bodies, whilst the second part (152 pages) discusses especially their physical-chemical properties.

Miss Lloyd's purpose has been to provide a concise record in the English language of the position of protein chemistry as it has been affected by the developments of the last few years. The book shows quite clearly that the task has been very conscientiously performed, for it gives evidence, not only of the author's unusually thorough acquaintance with the enormous literature on this subject, but also of her intimate knowledge of the most recent contributions. Indeed, the frequency of her references throughout the whole book to papers of 1922-25 places such an emphasis upon recent work that the reader cannot help feeling that the author is personally in touch with a live and rapidly developing subject. On the other hand, this emphasis has the effect of ascribing too great a relative value to some of the recent contributions.

The scope of the book is ambitious, especially for such a small volume, but one of its best features is the valiant attempt to preserve a balance between the many aspects of the proteins. The chemistry of foodstuff proteins is one of the chief considerations, perhaps rightly so, but the proteins of the wool, silk, adhesive and leather industries are dealt with in outline. Both from the standpoint of pure and applied chemistry the author correctly recognises that "the literature is so vast that completeness is impossible."

The first part of the book is undeniably good. Criticism might be levelled at the classification of the proteins, but as any other classification would equally invite similar criticism, one cannot blame a biochemist for emphasising the broad association of protein behaviour with biological origin and function. The so-called "chemical classification" of the physiologist is also submitted and discussed, as well as the undoubted need for its revision. In a small book summarising a big subject it would be unfair to saddle the author with the onus for the nomenclature of the proteins. One of the most unfortunate features of protein chemistry has been the invention of names which cover a mixture of protein degradation products, but which apparently indicate a definite substance or a group of similar substances. Possibly the author is open to criticism that some of these unfortunate cases have been passed on to new readers, but such criticism is only sound if the designations have been clearly shown to be nonsensical. In making the "histones" co-ordinate with the "albumins" Dr. Lloyd is guilty of such a mistake.

The physical chemistry of the proteins discussed in Part II of the book is a reasoned account of various

modern and divergent views, with possibly a little natural emphasis upon those view points which approximate to the author's own opinions. Little criticism is attempted in this part of the book, but the author has had the commendable courage to state on various points "this is not yet understood."

The most disappointing feature of this section is that the following sentence (p. 157) should occur, and be italicised, but should be insufficiently discussed and developed: "The tendency to form molecular aggregates associated with the solvent is characteristic of the proteins as a class." There is little doubt that in this sentence Miss Lloyd has emphasised the best clue in regard to the correct understanding of the physical chemistry of the proteins, but has not only failed to follow up the clue herself, but in subsequent chapters has failed also to point out that many other workers, such as Procter, Wilson and Loeb, have missed this clue completely, and so impaired the value of much of their work. The book correctly castigates the absurd word "peptisation," but does not adopt any alternative term, such as "solation." The sol-gel transformation, indeed, could with value be more fully discussed.

On the whole the book is excellently paragraphed, the literary style is much better than is usual in such books; there is also a very commendable freedom from mistakes, indicating careful proof revision. There are also useful bibliographies attached to each chapter. The subject index could be extended with advantage, but probably the worst feature of the book is its full title, which is unnecessarily cumbersome and grammatically doubtful.

H. G. B.

CHEMISCHE BODENANALYSE. METHODEN UND ANLEITUNG ZUR UNTERSUCHUNG VON BODEN IM LABORATORIUM. By K. K. Gedroiz. Translated from the Russian by Dr. L. Frey. Pp. xii + 245. Berlin: Gebrüder Borntraeger, 1926. Price 12 m.

Those who have been following the advances in soil chemistry made by the author will welcome the appearance of this volume, which deals comprehensively with methods of soil analysis.

The sections describing the recent methods of investigating the easily replaceable bases, the capacity of absorption, and the degree of unsaturation of soils are particularly interesting because of the pioneer work of Gedroiz on these subjects. Although some of the methods may not yet be wholly satisfactory, this branch of soil investigation promises to yield important results, and it is very useful to have a set of methods collected in a text-book. Gedroiz recognises the importance of employing simple and rapid methods in soil work, and deals at some length with colorimetric methods, giving at the end a summary of the literature on this subject.

Other important sections of the work deal with the ultimate analysis, the soil solution, the water extract, and the methods of determining lime requirement. The final chapter describes the preparation of the principal reagents required.

The book is well arranged and very completely indexed. It is to be regretted that there is no English translation.

W. G. Ogg

COMPANY NEWS

GAS LIGHT AND COKE CO., LTD.

The gross revenue for the year 1926 amounted to £12,548,619 (£9,569,292 for 1925), and after meeting all expenses the net revenue was £1,337,846, compared with £1,262,059. The cost of coal during the year amounted to £3,923,981, as against £2,973,034. An increase of nearly 2½% in the sales of gas is recorded for 1926, the number of consumers increasing by 24,699 and the number of gas stoves sold and let out on hire by 112,732. For the first three months of the year the price of gas was 9·4d. per therm, which, owing to the high cost of foreign coal during the strike, was raised to 9·6d. per therm as from September quarter, to 10·6d. as from October, and to 11·6d. as from December. In March the price will be reduced by 1·4d. per therm.

SOUTH METROPOLITAN GAS CO., LTD.

Subject to audit, a dividend has been recommended for 1926 of 6%, less the interim dividend of 2½% paid in September last, being the same as for 1925.

MOND NICKEL CO., LTD.

An interim dividend has been declared for the year ending April 30, 1927, of 5% on the ordinary shares, payable on March 1. A similar interim was paid for each of the three preceding years.

W. J. BUSH AND CO., LTD.

An interim dividend has been paid of 3% on the ordinary shares, being the same as last year's interim.

COURTAULDS, LTD.

This company announces that it has concluded an arrangement with the Vereinigte Glanzstoff-Fabriken A.G. of Elberfeld and the Snia Viscosa Co. of Turin for the purpose of bringing about commercial and technical collaboration between the three companies. This arrangement is in the nature of an international artificial silk cartel, as all three companies are the biggest operating in their respective countries. The capital of the three companies totals about £30,280,000, the capital of Courtaulds being £20,000,000. According to the *Financial Times*, it is generally conceded in Milan that the Snia Viscosa Co. will stand to benefit by the arrangement more than the other two companies, as it is not so far advanced in development, and it will now receive the full assistance of the British and German concerns. The three companies will each concentrate on those qualities with which they are best equipped to deal. The Snia Viscosa Co. has still to complete its works to bring the output up to 100,000 kg. daily, and a special arrangement has been made permitting it to finance itself in Great Britain for an amount which, it is believed, is fixed around £2,500,000, the proceeds to be applied to the completion of the plant and certain important technical transformations rendered necessary by the new processes and patents which will be available.

NON-INFLAMMABLE FILM CO., LTD.

This company has a capital of £550,000, divided into 500,000 ordinary shares of £1 each and 1,000,000 deferred shares of 1s. each. The company is to acquire the sole

rights throughout the British Empire (with the exception of Canada) in processes for the manufacture of cellulose acetate and the conversion thereof into non-inflammable film suitable for cinemas, splinterless glass, and many other purposes. The company has contracted to sell its entire output of positive cinema film for the next seven years (exclusive of Government requirements), and on the basis of an output of 250,000,000 ft. under this contract, of 125,000,000 ft. of other film, in addition to special film for splinterless glass, etc., the profits are estimated at £207,500 per annum. The purchase price for the rights and other assets is £45,000 in 1s. deferred shares and £70,000 in cash, and after payment of the latter and allowing £225,000 for contemplated extensions, additions, etc., and paying all preliminary and formation expenses, there will be a working capital of not less than £150,000. The directors are Sir Herbert E. Blain, Kt., (C.B.E., M.Inst.T. (chairman), H. Levinstein, M.Sc., F.I.C. (deputy chairman), Sir John W. Courtis, Kt., J.P., Mr. D. MacCallum, J.P., Mr. E. W. Mann, Sir John de Fonblanque Pennesfather, Bart., J.P., M.P., and Mr. T. S. Stewart-Smith. The consulting chemist is Dr. Karl Krieser, F.R.P.S., late of the Bayer Company, and the technical management is under Mr. H. J. Mallabar, F.R.P.S., inventor of the non-inflammable film, and Dr. F. Westhoff, lately chemist of the Nobel Film Co. The secretary is Mr. J. E. M. Maw, and the registered office is at 3, Regent Street, S.W.1.

MIDLAND BANK, LTD.

The Ordinary General Meeting was held on January 28. The Chairman, the Right Hon. R. McKenna, said he proposed to give some answer, partial though it may be, to the question: Why is it that for the past six years we have suffered from trade depression and unemployment of almost unparalleled severity, while America has enjoyed great and increasing prosperity? In the present case he could not escape the conclusion that the monetary element had been of deep importance.

Since the autumn of 1921 there had been a great expansion in bank deposits in the United States. The average total deposits of the reporting member banks of the Federal Reserve system rose from £2,860 millions for the twelve months ending November, 1922, to £3,751 millions for 1926. Over the same period the total deposits of the ten London clearing banks fell from £1,783 millions to £1,661 millions. Those who think that any increase in the volume of money must be stigmatised as inflation would doubtless be alarmed by this growth of credit in the United States; but if the supply of new money did no more than keep pace with the increase in production, there was, in fact, no inflation. We had to distinguish clearly between inflationary and non-inflationary growth in the volume of credit, and to do so we must start with the question of how additional money comes into being. Apart from the action of a bank, the public in practice was powerless to increase or diminish permanently the total of money except by destroying their notes or sending them out of the country. The Government, independently of action by the Bank of England, was no less passive than the public. We must therefore look to action by the banks, and particularly the Bank of England as the central institution, for the cause

of these movements. All banks, however, maintain a fairly regular proportion between their cash and deposits, so that if we were to discover the real causes of fluctuation in the quantity of money we must look for them in whatever produces variation in the total of bank cash, which means currency holdings together with balances at the Bank of England.

It was not generally recognised that the principal cause of any but the most transient movements was not something done by the banks, but something done by the Bank of England. If the Bank of England makes a loan, or discounts bills, or buys gold or securities, the amount paid becomes bank cash. Conversely, when a loan by the Bank of England was repaid, or discounted bills were met at maturity, or gold or securities were sold, bank cash was correspondingly diminished. Indirectly, therefore, the Bank of England was in practice the controller of the volume of money. The Bank itself, however, was governed by the terms of its constitution, and even such freedom for the exercise of policy as it might possess was in considerable measure limited by the rigidity of its system. This is the point which he wished to emphasise.

It was accepted as an axiom that an influx of gold into the Bank of England stimulates trade here. The stimulus, however, was due to the additional bank cash which the purchase of gold creates. The effect on the total of bank cash was precisely the same whether the Bank buys gold or bills or War Loan or bricks and mortar, whether it lends to the Government, the Bank of France, or any other of its private customers. When the Bank buys gold, however, its reserve is strengthened and the ratio improved: when it buys anything else the reserve remains unaffected and the ratio declines. It naturally followed that an increase of bank cash which arose from an influx of gold was regarded with equanimity and even satisfaction, whilst a proposal for an increase of bank cash specifically to meet trade needs would not be viewed with the same cordiality.

The American system had been framed to suit modern conditions, and in fixing reserve requirements the development of deposit banking had been duly recognised. On the other hand, the Bank of England operated under the Act of 1844, and as a consequence its reserve was insufficient to permit open market operations with a view to increasing the volume of credit on anything more than quite a small scale. If our central bank were to be re-established on the same reserve basis as either the Federal Reserve Banks or in accordance with any modern system, the Bank of England would have a larger reserve and could work with greater freedom of policy and with manifest advantages to our trade. This subject merited the most disinterested and painstaking investigation. The vital need for the future was to ensure that the maintenance of prosperity, with a growing population and ever-improving standard of living, both requiring an expansion in the volume of trade, shall not be hampered by false restrictions on the quantity of money. We needed careful and expert consideration of the theoretical basis and practical technique of our credit and currency system, including the position of the Bank of England as the custodian of our monetary resources.

[For the accounts, see CHEM. AND IND., Jan. 14, p. 41.]

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
 Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—2s. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 2d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. R.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamylide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 per ton. Scarce. Grey, £17 5s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£8 5s.—£10 per ton and upwards, according to grade and locality. Very scarce and fair demand.
 Iron Liquor.—1s. 6d. per gal. 32° Tw.; 1s. 2d. per gal. 24° Tw.
 Red Liquor.—10d.—11d. 16° Tw. per gal.
 Wood Creosote.—2s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 10d.—4s. per gal., 60% O.P. Solvent, 4s. per gal., 40% O.P.
 Wood Tar.—£4—£5 per ton and upwards, according to grade.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid 'Carbolic.—Crystals, 6½d.—6½d. per lb. Crude 60's, 1s. 8½d.—1s. 9½d. per gal.
 Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 1d. per gal. Pale, 95%, 1s. 10d.—2s. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 3d.—1s. 4d. per gal., ex works in tank wagons; Standard motor. 1s. 11d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 2d.—2s. 5d. per gal., ex works in tank wagons.
 Tolnole.—90%, 1s. 11½d. to 2s. 4d. per gal. Firm. Pure, 2s. 2½d.—2s. 6d. per gal.
 Xylol.—2s. 3d.—2s. 7d. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal.
 Naphtha.—Crude, 9½d.—1s. 0½d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, 1s. 11d.—2s. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s. per ton.
 Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—110s.—120s. per ton, f.o.b. according to district. Prices nominal.
 Pyridine.—90/140.—9s. 6d.—17s. per gal. Nominal. 90/180.—7s. 6d. per gal. Heavy.—7s.—10s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionip.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—9½d. per lb., naked at works.
 Aniline Salts.—9½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d.—4½d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—9d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 11d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 3½d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 5d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 0½d. per lb. Less 5%.
 Amidol.—9s. 6d. per lb. d/d.
 Acetanilide.—1s. 7d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £30 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Aspirin.—2s. 4d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzophenanthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 6d. per lb. Potassium.—2s. 1d. per lb. Sodium.—2s. 4d. per lb. All spot. Market firmer.
 Calcium Lactate.—1s. 5d. per lb.
 Chloral Hydrate.—3s. 3d.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—6s. 6d.—7s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 8d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £33 per ton net.
 Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%; Heavy Pure 2s. per lb. in 1 cwt. lots.
 Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 12s.—14s. per lb., according to quantity; 10s. 6d. for 1 cwt. lots and upwards. Liquid (95%), 12s. per lb. Detached cryst., 15s. per lb.
 Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig. 6s.—6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 2d.—4s. 3d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 4s. 11d.—5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonol.—15s. 6d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. 9d.—4s. per lb.
 Phenazone.—5s. 9d.—6s. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 85s. per cwt., less 2½% for ton lots. Dearer.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d. per lb. for 1 cwt. lots.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6½d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d. per oz. for 1,000 oz. lots in 100 oz. tins.
 Resorcin.—4s.—4s. 3d. per lb. spot.
 Saccharin.—55s. per lb.
 Salol.—3s.—3s. 3d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s. per lb. for 1 cwt. lots; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—80s.—85s. per cwt. net, according to quantity.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal 1s. 10d.—1s. 11d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton, according to quantity, 1-cwt. kegs included.
 Sulphonol.—10s. 6d. per lb.
 Tartar Emetio B.P. cryst. or powder.—2s.—2s. 2d. per lb.
 Thymol, Puriss.—11s. 9d.—13s. 9d. per lb., according to quantity. Firmer. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
 Aubepine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—11s. per lb.
 Citronellol.—15s. per lb.
 Citral.—9s. 6d. per lb.
 Ethyl Cinnamate.—10s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb.
 Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Shui Oil*) 12s. per lb.—(*ex Bois de Rose*) 16s. per lb.
 Linalyl Acetate.—(*ex Shui Oil*) 14s. 6d. per lb.—(*ex Bois de Rose*) 18s. per lb.
 Methyl Anthranilate.—9s. per lb.
 Methyl Benzoate.—4s. 6d. per lb.
 Musk Ketone.—36s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—11s. per lb.
 Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—19s. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—20s. per lb. Bourbon Geranium.—11s. 3d. per lb.
 Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb.
 Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—8s. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 19s. per lb. Lemon.—9s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—9s. 9d. per lb.
 Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 23s. 6d. per lb. Japanese, 9s. per lb. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Mar. 28th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Feb. 10th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Artner. 1492. *See X*.
 Bartling, Honigman, and Trocknungs- Verschwelungs- u. Vergasungs-Ges. Heat treatment of fine grained material. 41. Jan. 18.
 on and Denholm. Drying-apparatus. 1510—1. Jan. 18.
 on and Smallwood. Furnaces. 1899. Jan. 22.

Haddan (Stettiner Chamotte Fabrik). Ovens for chemical etc. processes. 1389. Jan. 17.

Hammond and Shackleton. Concentrators, dehydrators, etc. 1925. Jan. 22.

Hase. Optical pyrometer. 1516. Jan. 18.

Heppner. Materials for storing explosive gases. 1657. Jan. 20. (Ger., 20.1.26.)

I.-G. Farbenind. Converting insoluble substances into a state of aqueous solution etc. 1769. Jan. 20. (Ger., 20.1.26.)

Staatliche Porzellan-Manufaktur. Suction filters. 1544. Jan. 18. (Ger., 19.1.26.)

Ward. Separating liquids from gases. 1796. Jan. 21.

Wilderman. Filter presses. 1888. Jan. 21.

I.—Complete Specifications

22,271 (1925). Heraeus (Ges.) and Feussner. Thermocouples and thermo-elements. (264,201.)

25,735 (1925). Hatfield. Chemical analysis of liquids. (264,237.)

1689 (1926). Rees. Pulverising, mixing, and separating machines. (264,324.)

12,641 (1926). Morgan. Heat-exchange apparatus. (264,377.)

21,148 (1926). Braeg. *See VII*.

II.—Applications

Akt. Ijungsströms Angturbin. Producing an air mixture for combustion in furnaces. 1512. Jan. 18. (Sweden, 19.2.26.)

Boehringer Sohn. 1338. *See XX*.

Broadhead. Regenerator settings for manufacture of gas. 1323. Jan. 17. Producers for heating carbonising-plant. 1325-26. Jan. 17.

Hackford. Burning fuel. 1698. Jan. 20.

Haddan (Kohlenveredlung A.-G.). Distillation of bituminous substances, fuels, etc. 1742. Jan. 20.

Heppner. 1657. *See I*.

I.-G. Farbenind. Production of unsaturated hydrocarbons. 1364. Jan. 17. (Ger., 19.1.26.) Conversion of saturated hydrocarbons. 1627. Jan. 19. (Ger., 20.1.26.)

Mardles and Stern. Preventing detonation in internal-combustion engines. 1525. Jan. 18.

Nishida and Shinada. Preparing artificial petroleum etc. from rubber waste etc. 1980. Jan. 22.

Smit. Adsorption charcoal. 1746. Jan. 20. (Holland, 23.1.26.)

II.—Complete Specifications

32,894 (1925). Hamp. Apparatus for making artificial fuel. (264,309.)

14,091 (1926). Fischer and Tropsch. Purifying gases from sulphur. (254,288.)

*32,598 (1926). Steinschneider. Distillation of oils from petroleum, tar, etc. (264,476.)

*495 (1927). Brégeant. Gas-producing apparatus. (264,482.)

*952 (1927). Burger. Apparatus for splitting acetylene. (264,500.)

III.—Complete Specifications

*32,598 (1926). Steinschneider. *See II*.

*891 and 3 (1927). Soc. Anon. La Trinidad. *See IX*.

IV.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of mordant disazo dyestuffs. 1523. Jan. 18. Manufacture of indigoid dyestuffs. 1853. Jan. 21.

IV.—Complete Specifications

*960 (1927). I.-G. Farbenind. Manufacture of grey to black vat-dyestuffs. (264,502.)

*961 (1927). I.-G. Farbenind. Manufacture of alkyl-pyrazolanthrone. (264,503.)

*1292 (1927). I.-G. Farbenind. Manufacture of carbazole-quinones. (264,530.)

V.—Applications

Hands. Compositions containing cellulose esters etc. 1441. Jan. 18.

Potts (Arnold Print Works). Treatment of cellulosic materials. 1792. Jan. 21.

V. Complete Specifications

25,702 (1925). Oberrheinische Handelsges., and Ubbelohde. Producing fibres capable of being spun. (264,233.)

15,032 (1926). Dubac. Increasing the strength and elasticity of vegetable fibres. (254,695.)

24,721 (1926). Oberrheinische Handelsges., and Ubbelohde. Producing fibres. (264,428.)

*1291 (1927). Heberlein & Co. Improving artificial fibres. (264,529.)

VI. Applications

Benckiser and Drausbach. 1871. *See* VII.

Brandwood. Apparatus for colour treatment of yarns. 1910. Jan. 22.

Hill. Production of finishing on textile fabrics etc. 1777. Jan. 21.

VI.—Complete Specification

14,164 (1926). British Celanese, Ltd., Addy, Billing, and Halkyard. Treatment of yarns or threads. (264,382.)

VII. Applications

Benckiser and Drausbach. Stabilising bleaching-liquors. 1871. Jan. 21.

L.-G. Farbenind. Concentration and distillation of hydrogen peroxide solution. 1363. Jan. 17. (Ger., 18.1.26.)

Krebs. Apparatus for electrolysing solutions of alkali chlorides. 1850. Jan. 21 (Norway, 23.1.26.)

Montecatini Soc. Gen. per l'Ind. Mineraria ed Agricola, and Khen. Manufacture of sulphuric acid. 1606. Jan. 1. (Italy, 19.1.26.)

Soc. Chim. Usines du Rhône. 1601. *See* XX.

Stockholms Superfosfat Fabriks. 1876. *See* XVI.

Takayama. Collecting potassium salt etc. from waste liquor. 1979. Jan. 22.

Tardan. Manufacture of lead monoxide. 1885. Jan. 21. (Fr., 30.1.26.)

VII.—Complete Specifications

21,148 (1926). Bracq. Pyrites and other furnaces. (264,411.)

*30,881 (1926). L.-G. Farbenind. Process for the production of sodium sulphide. (264,464.)

*223 (1927). Norsk Hydro-Elektrisk Kvaestofakt. Production of granulated dust-free nitrate of lime. (264,480.)

*986 (1927). Meyer and Meyer. Manufacture of copper sulphate. (264,810.)

*1164 (1927). L.-G. Farbenind. Manufacture of phosphorus and phosphorus oxides. (264,520.)

*1363 (1927). L.-G. Farbenind. Concentration and distillation of solutions of hydrogen peroxide. (264,535.)

VIII.—Application

British Thomson-Houston Co., Ltd. Treating silica articles. 1845. Jan. 21. (U.S., 21.1.26.)

VIII. Complete Specifications

*707 and 837 (1927). Soc. Anon. Manuf. des Glaces et Prod. Chim. de St. Gobain. Glass. (264,490 and 264,495.)

IX.—Application

Massie. Colouring cement, concrete, etc. 1648. Jan. 20.

IX.—Complete Specifications

12,711 (1926). Lindemann. Making mortars and cements. (252,210.)

*32,251 (1926). Schantz. Preserving wood etc. (264,473.)

*891 and 3 (1927). Soc. Anon. La Trinidad. Manufacture of bituminous or tarry emulsions. (264,496-7.)

X.—Applications

Artner. Production of platinum contact bodies etc. 1492. Jan. 18. (Ger., 15.2.26.)

Bennett and Hadfield. Electrodeposition of metals. 1922. Jan. 22.

Buddens. Reducing ores etc. 1508. Jan. 18. (Ger., 20.1.26.)

Croese. Treatment of ores. 1716. Jan. 20.

Lawes. Alloy for galvanising. 1865. Jan. 21.

Marks (American Smelting & Refining Co.). Apparatus for dezinizing lead. 1869. Jan. 21.

Mond (Metallbank und Metallurgische Ges.). Roasting fine sulphide ores etc. 1821. Jan. 21.

X.—Complete Specifications

19,803 (1925). N. V. Philips' Gloeilampenfabr. Precipitating metals on an incandescent body. (249,067.)

25,774 (1925). Boorer, Britten, and District Chemical Co., Ltd. Fluxes for welding. (264,238.)

19,408 (1926). Krupp Grusonwerk. Treating tin-containing ores and metallurgical products. (256,634.)

21,148 (1926). Bracq. *See* VII.

21,834 (1926). Kelly. Alloys. (264,414.)

*7431 (1926). Clausson & Co. Electrodeposition of chromium and its alloys. (264,442.)

*22,249 (1926). Dwight and Lloyd Metallurgical Co. Sintering-machines. (264,450.)

*1278 (1927). Kropf. Alloys of high melting-point. (264,528.)

XI.—Applications

A.-G. Brown,* Boveri, & Cie. Electric furnaces for heating gases. 1701. Jan. 20. (Ger., 22.1.26.)

Aletter and Strasser. Electric accumulators. 1418. Jan. 17. (Ger., 16.1.26.)

Bennett and Hadfield. 1922. *See* X.

Bia and de Bielze. Manufacture of plastic dielectric substances. 1416. Jan. 17.

D.P. Battery Co., Ltd., Drake, and Waddell. Storage-battery cells. 1538. Jan. 18. Galvanic batteries. 1600. Jan. 19.

Internat. General Electric Co. Electric arc furnaces. 1737. Jan. 20. (Ger., 20.1.26.)

Krebs. 1850. *See* VII

XI.—Complete Specifications

23,227 (1925). Linebarger. Electric storage batteries. (264,205.)

26,504 (1925) and 1693 (1926). Wade (N. V. Philips' Gloeilampenfabr.). Introducing potassium or caesium or rubidium into electric discharge tubes. (264,258.)

1210 (1926). Haddan. Electric accumulators. (264,318.)

11,864 (1926). Norske Akt. for Elektrokem. Ind. Electrodes for electric furnaces. (252,153.)

*7431 (1926). Clausson & Co. *See* X.

*1418 (1927). Aletter and Strasser. Accumulators. (264,539.)

XIII.—Applications

Carpmael (L.-G. Farbenind.). Manufacture of white oil paints from lithopone etc. 1852. Jan. 21.

Hercules Powder Co. Manufacture of resins. 1983. Jan. 22.

Tardan. 1885. *See* VII.

Taylor. Paints, distempers, etc. 1682. Jan. 20.

XIII.—Complete Specifications

25,503 (1925). Carpmael (F. Bayer und Co.). Manufacture of lithopone. (264,223.)

*31,381 (1926). L.-G. Farbenind. *See* XX.

*742 (1927). Franke. Production of red lead paints. (264,492.)

XIV.—Application

Nishida and Shimada. 1980. *See* II.

XIV.—Complete Specifications

22,918 (1925). General Rubber Co. Manufacture of rubberised material. (250.167.)

25,239 (1925). A.-G. Metzeler and Co. Dyeing india-rubber etc. (241.214.)

XV.—Complete Specification

32,449 (1925). Sheard. Treatment of hides and skins. (264.302.)

XVI.—Applications

Adelantado. Manufacture of phosphate fertilisers. 1419. Jan. 17. (Spain, 19.8.26.)

Stockholms Superfosfat Fabriks. Treating phosphates etc. 1876. Jan. 21. (Sweden, 23.1.26.)

XVII.—Complete Specification

26,637 (1925). Harrison. Production of carbohydrate compounds. (264.261.)

XVIII.—Applications

North. 1592. *See* XIX

Sak. Producing compressed yeast etc. 1498. Jan. 18.

XVIII. Complete Specification

14,071 (1926). Distilleries des Deux-Sèvres. *See* XX.

XIX.—Applications

McGougan. Preserving foods etc. 1590. Jan. 19.

North. Manufacture of beverages. 1592. Jan. 19.

Northeutt. Food product. 1705. Jan. 20.

XIX. Complete Specifications

25,605 (1925). Wesener. Treating grain. (263.213.)

28,827 (1925). Christensen. Manufacture of powdered or dried milk products. (244.728.)

XX.—Applications

Boehringer Sohn. Preparing acetylene for anaesthetising purposes. 1338. Jan. 17. (Ger., 25.1.26.)

Dicker (Rheinische Kampfer Fabrik). Production of inactive menthol. 1339 and 1356. Jan. 17.

Hoffmann-La Roche & Co. Manufacture of a glucoside. 1695. Jan. 20. (Ger., 13.2.26.)

L.-G. Farbenind. 1364. *See* II. 1627. *See* II.

L.-G. Farbenind. Manufacture of keto alcohols. 1399. Jan. 17. (Ger., 19.1.26.)

Imray (L.-G. Farbenind.). Manufacture of unsaturated aldehydes etc. 1611. Jan. 19.

Naaf et Cie. Increasing yield of civetone from civet. 1766. Jan. 20. (Switz., 17.3.26.)

• Soc. Chim. Usines du Rhône. Treating acetic acid. 1601. Jan. 19. (Fr., 26.2.26.)

Wilson. Extracting active principles from endocrine glands. 1603. Jan. 19.

XX. Complete Specifications

14,071 (1926). Distilleries des Deux-Sèvres. Simultaneous dehydration and purifying of alcohol. (253.128.)

*31,381 (1926). L.-G. Farbenind. Manufacture of condensation products of urea and formaldehyde. (264.466.)

*979 (1927). Chem. Fabr. vorm. Schering. Manufacture of new chlorido compounds of alpha-aminopyridine and its derivatives. (264.508.)

XXI.—Application

Thornton. Film material for multi-colour transparencies. 1680. Jan. 20.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Steel blooms, mild steel angles

(A.X. 4149 and A.X. 4150). *Belgium*: Steel (79). *British India*: Foundry coke, moist white lead (South Indian Railway Co., Ltd., 91, Petty France, Westminster, S.W.1). *Canada*: Fireclay (B.X. 3168 and 3180). *Germany*: Oil cakes (83). *Italy*: Leather (86). *Norway*: Metal pipes (88); Iron and steel, metals (89); Coal, coke (90). *Poland*: Tin, nickel, copper, mercury (91). *Turkey*: Iron, black and galvanised sheets (A.X. 4159).

Magnesium Compositions

The Magnesium Flooring Materials Association, 'an organisation which is entirely technical and non-trading, has issued a booklet setting forth the advantages of magnesium compositions for flooring and similar work. The booklet gives an interesting general account of the materials required for magnesium oxychloride flooring, and illustrates the many and growing uses to which it is put. Copies of the booklet can be obtained from the Association (at 106, Fenchurch Street, London), and correspondence is invited from those interested in the subject. It is proposed to publish, from time to time, data for the assistance of users of magnesium flooring.

PUBLICATIONS RECEIVED

A COMPREHENSIVE TREATISE ON INORGANIC AND THEORETICAL CHEMISTRY. By J. W. Mellor, D.Sc. Vol. VII. Ti, Zr, Hf, Th, Ge, Sn, Pb, Inert Gases. Pp. x + 977. London: Longmans, Green & Co., Ltd., 1927. Price 63s. net.

METEOROLOGICAL OFFICE, AIR MINISTRY. ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION. Report on Observations in the Year ending March 31, 1926. Forming the 12th Report of the Committee for the investigation of Atmospheric Pollution. M.O.290. Pp. 52. H.M. Stationery Office, 1926. Price 6s. 6d. net.

REPORT OF TESTS BY THE DIRECTOR OF FUEL RESEARCH ON THE FREEMAN MULTIPLE RETORT OF THE BRITISH OIL AND FUEL CONSERVATION, LTD., WILLESDEN. Tests carried out June to November, 1925. Department of Scientific and Industrial Research. Pp. vi + 35. H.M. Stationery Office, 1926. Price 1s. net.

THERMODYNAMICS AND CHEMISTRY. By F. H. Macdougall, M.A., Ph.D. Second edition. Pp. iii + 414. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 27s. 6d. net.

THE PRODUCTION OF COTTON. By G. H. Collings, B.Sc., M.Sc., Ph.D. The Wiley Agricultural Series, edited by J. G. Lipman, B.Sc., A.M., Ph.D., D.Sc. Pp. xi + 256. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 17s. 6d. net.

SECOND YEAR COLLEGE CHEMISTRY. By W. H. Chapin. Second edition, revised. Pp. xiii + 366. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 15s. net.

FIRST PRINCIPLES OF CHEMISTRY. By F. W. Dootson, M.A., Sc.D., and A. J. Berry, M.A. Pp. vi + 339. Cambridge: The University Press, 1927. Price 6s.

TRATTATO DI CHIMICA GENERALE ED APPLICATA ALL'INDUSTRIA. Vol. II. Chimica Organica. Parte Prima. By Prof. E. Molinari. Fourth edition, revised and enlarged with the collaboration of Prof. G. Bargellini. Pp. xxiii + 660. Milan: U. Hoepli, 1927. Price 45 lire.

CHEMISCHE TECHNOLOGIE DER ORGANISCHEN VERBINDUNGEN. Edited by Dr. R. O. Herzog. Second new and enlarged edition. Pp. xii + 997. Heidelberg: Carl Winter, 1927. Price, paper 66 m., bound 70 m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, FEBRUARY 11, 1927.

No. 6

EDITORIAL

Publicity in Industry

WE have read recently two interesting pamphlets, one on "The importance of publicity in industrial accounts," by Mr. Norman Duthie, a well-known Glasgow accountant, the other on "The facts of industry," prepared by a committee consisting of Lord Astor, Prof. Bowley, a London professor of statistics, Mr. Harold Brown, a solicitor in the City with much experience, Mr. J. T. Brownlie, the well-known Trades Unionist, Mr. W. L. Hitchens, chairman of Cammell Laird & Co., Mr. F. Hodges, the Miners' Secretary, Mr. Layton, the editor of the *Economist*, Mr. Kenneth Lee, the chairman of Tootal, Broadhurst & Co., Sir William McLintock, the accountant, Mr. J. J. Mallon, now Warden of Toynbee Hall, and for many years a close student of sweating, unemployment, and such matters, Mr. Pugh, the Labour leader, Mr. Seeborn Rowntree, and Mr. H. B. Usher. Some of these gentlemen we happen to know personally; the others are well known by name and reputation: they form a committee representing many varieties of industrial activity, and it is not easy to think of any of them whose opinions are not entitled to careful consideration. So far as our own experience goes we find ourselves in accord with much which has been stated in these two pamphlets. Mr. Duthie's paper appeared in the *Accountants' Magazine* for December last; the committee's "Facts of Industry" is published by Macmillans, and costs one shilling. We can state that these two pamphlets should be widely read. In discussing them in these columns we find ourselves in a singular position; most of our readers desire information on new points of industrial chemistry; these pamphlets have nothing to do with chemistry, but are of great interest to the chemical industry; there is hardly any journal in the world which has so great a difference in the intellectual tastes of its readers as this, and we have therefore no hesitation in publishing, or

commenting upon, matters of pure and applied chemistry, and also such matters of accountancy, company law, economics, and commerce as are dealt with in the committee's report. The broad principles can be understood by us all. It is argued by the writers we refer to that the statistics of the industries of this country should be accessible to both employers and employed, in order that the economic facts in the industry should be understood by both for their joint benefit, and for improving their mutual trust, and should be accessible to the trading and industrial community as a whole, so as to avoid, or at least mitigate, the violent fluctuations which now exist, and should also be available, to a greater extent than now prevails, for the benefit of the investing public. The statistics of this country at the present time are late in appearing, incomplete, and often misleading. Take the balance sheets and profit, and loss accounts of many of our most prosperous companies as an instance; prudence is believed to compel many such companies to conceal a considerable proportion of their profits, and while the population as a whole is so ignorant of finance this may be true, but there is no doubt that a really intelligent public would realise the necessity for storing up capital in a business, and it would not be necessary to conceal the fact: the community can only become intelligent in this respect as the result of knowledge, and for this knowledge greater statistical publicity is essential. The boards of many companies are afraid of publishing the full measure of their profits in prosperous times because they know that exceptional prosperity is always brief, that their business will continually want more and more capital, and that many of their shareholders do not so firmly believe these facts as the directors themselves. A business which distributes 100% of its profits is on the road to ruin; even 80% of its profits is too much. Those concerns which are normally profitable, and are content to pay away to the shareholders from 50 to 60% of their profits may, after a few years, look

forward with confidence to a continuance of their business, and to prosperity for their employees and their shareholders. An intelligent public will know this, and we are of opinion that it is the duty of each industry to train up its own public to understand such matters, and that generally speaking and with due reservations the fuller information is made known the better for all concerned. The committee makes out a good *prima facie* case for a belief that part of the violence of the trade fluctuations is due to the ignorance of the public on the statistical position. We are all inclined to buy on a rising market and to postpone buying on a falling market, and in this way we let sentiment promote the boom and unduly aggravate the slump. There are important considerations also to urge in connexion with industrial unrest, but these can be better read in the documents we are discussing than abstracted here. The chemical industry is one of the largest in this country, one of the most enlightened, and one in which statistics of costs and output are most promptly and accurately obtained by individual concerns. The Society of Chemical Industry has an Engineering Group and a Fuel Section; will it some day have a section devoted to the economics of the chemical industry? The scientific examination of these would be of great interest. It may be thought that the economics of the chemical industry might be safely left to the Association of British Chemical Manufacturers. If there is any truth in the statement so often made in these columns and elsewhere that many chemists engaged in industry would be wise to interest themselves in the business side of life as well as the scientific, then it is desirable that these financial matters should be studied by chemists also, and not exclusively by manufacturers.

Synthetic Dyestuffs

In a few years it will be unnecessary to have such a heading: all dyestuffs will be synthetic: we are sorry, we like to think of the indigo plantations, of madder, of lichens, of saffron and logwood. Our likes and dislikes have very little to do with the question; any place where power is fairly cheap and where chemists are plentiful will suffice for the manufacture of the dyestuffs of the future. The raw materials carbon, oxygen, hydrogen, and nitrogen are available everywhere: they are so plentiful that we need not consider them at all: skilled and accurate chemists, experienced in research, are necessary for the dyestuff industry, both in studying their manufacture and their use; while they are busy in their manufacture, they can hardly help making discoveries of new pharmaceutical products, new fine chemicals, new solvents and many other new substances, a few of which are valuable and the majority valueless. There is an enormous quantity of elementary research going on in our Universities and elsewhere: after a certain amount of this education, for it is hardly anything more, the chemist is drawn into the best, almost the only, opening for him, the dyestuff industry, and there he discovers new scents, new photographic chemicals, and perhaps new dyestuffs. Perkin was trying to make quinine, when he discovered mauve: those who try to

make new dyestuffs may discover anything. Just as our universities are the training ground for pure chemistry, so are the dyestuff manufactories the training grounds for applied chemistry. It is here, in the main, we must look for the applied chemistry of the future. Neither post-graduate courses, nor lavish Government grants, nor voluminous text-books and journals can compensate for the lack of this industry. It is a pity that the industry is so handicapped as it is: it makes perhaps 1500 different kinds of dyes, half of which are probably unnecessary: if 750 varieties only were made, it would be better for the industry, but a rigid self-denying ordinance would be necessary to prevent this number growing week by week. It takes a long time and costs a great deal of money to introduce a new chemical into use on so large a scale as to become profitable, and a great deal of capital has been locked up in this way, some of which will never reap an adequate harvest, although it has not been entirely wasted. The fact that the dyestuff industry is essential to the progress of applied chemistry, and the fact that much capital is locked up in the present, in the confident belief that it will yield dividends in the future, are considerations which cannot be disregarded when we reflect upon the supply and demand of the world in relation to aniline dyes. We will state the essential figures and leave our readers to solve the puzzle, and if they are so fortunate as to be able to peruse the Monograph on the Chemical Industry, prepared by the A.B.C.M., they will find indeed a little guidance, but yet ample opportunity for reflection and speculation. The production of dyes in Germany is about 70,000 tons a year, the capacity of their works anything from 160,000 to 250,000 tons: we shall not be far wrong if we say that their production is about 35% of their capacity; the production in the United States is about 30,000 tons a year, the capacity about 57,000: production is about 53% of capacity; in Great Britain the capacity is about 40,000 tons, the production about 17,000 tons, say, 42% of the capacity; in France, the capacity is about 22,000 tons, the production, say, 16,000 tons, say, 72%; in Switzerland the capacity is about 16,000 tons, the production about 11,000, say, 70%. If we turn to the countries which import dyes, we find that the imports are as follows:—China, about 30,000 tons; India about 8000; Russia about 3600; Japan about 3100, and the United States about 2600 tons a year. There seems very little likelihood that the production of dyes in the five great producing countries will increase by, say, 30% in the next few years, and this increase at least is needed to put the existing works on to an economic basis. The problem urgently deserves consideration by the leaders of the chemical industry in the five countries we have mentioned; it is worthy of note that international conversations have already taken place, and in some instances chemical manufacturers have made important agreements with each other. We fully expect that so obvious and serious a problem has not been forgotten by the leaders of the industry. No great country can afford to scrap its dyestuff industry, no great country will desire to have a capacity far in excess of the probable demand. What solution will be found we can only guess.

THE PRODUCTION OF POWER FROM TOWN'S REFUSE*

By J. W. REBER, M.I.Chem.E., and ANDREW SCOTT

Thirty years ago it would have been difficult to convince those responsible for refuse disposal of the possibility of power production from town's refuse. Although the power derived from a modern destructor is a valuable commercial asset, it must be kept in mind that the incineration of refuse is primarily a hygienic necessity. In many existing destructor plants the power obtained is just sufficient to cover the requirements of the plant itself, for driving blowers, clinker crushers, mortar mills, etc. These destructors represent the earlier type of design, and were undoubtedly a step in the right direction from a sanitary point of view. It will be shown, however, that with plants of improved design a considerable amount of power can be produced to-day by the complete incineration of town's refuse. It is evident that with fuels of low calorific value, such as refuse, more attention must be given to the scientific design of the destructor, in order to obtain a high efficiency and to make the plant a commercial success.

NATURE OF REFUSE

The nature of the refuse varies to a very great extent in the various towns throughout the country. This applies also to the composition of the refuse in the various localities of the same town. Large shopping centres supply a much greater percentage of paper, straw and light debris than is usually obtained from private houses. Further, the composition varies to a smaller or greater degree during the seasons of the year. Spring and summer refuse will contain a much larger percentage of vegetable matter, whereas the winter refuse contains a much higher percentage of combustible matter such as coal, coke, etc. Trade refuse differs with the industries in the neighbourhood. The average composition of dry refuse in Britain may be taken to be approximately as follows:—

Fuel, consisting of cinders, partly-burnt and unburned coal and coke, etc. ...	25	35%
Dust	30—40	%
Debris, bottles, china, etc.	10—12	%
Tins, metals, etc.	1—2	%
Light refuse or tailings, made up of vegetable refuse, paper, rags, and light trade refuse	10—12	%

The Engineers' Year Book of 1913 gives the result of an analytical examination of the London refuse, being the average of 1000 cartloads, as follows:—

Coal, coke, breeze and cinders	26.05	%
Ash	47.00	%
Dust and dirt	9.78	%
Papers, straw, fibrous material and vegetable matter	13.15	%
Rags	0.40	%
Bones and offal	0.37	%
Bottles, glass and crockery	2.57	%
Metals	0.68	%

* Read at a Joint Meeting of the Fuel Section, the Bristol Section and the Chemical Engineering Group of the Society of Chemical Industry on Feb. 3, 1927.

The amount of refuse collected in the London area is about 1,500,000 tons for a population of 4.5 millions, or approximately one-third of a ton per head per annum. For towns with a smaller population, say, up to 250,000, the amount of refuse is about 300 to 400 lb. per annum per head. As an average figure for Britain, 450 lb. per annum per head should be approximately correct.

COLLECTION AND DISPOSAL OF REFUSE

The collection of town's refuse is accomplished by horse-drawn vans, motor lorries and electrically-driven vehicles. In many cases, in fact in most cases, the vehicles are of the open type, which does not represent the most hygienic method of collection.

After collection, the actual method of disposal of the refuse varies again for various towns and localities. The question of disposal has to be considered from the following points of view:—

1. Most advantageous and expeditious.
2. Cheapest and most hygienic.
3. That most suitable to local conditions.

At the present time the following methods of disposal are employed:—

1. Dumping on waste land into old clay pits, quarries, etc.
2. Tipping into the sea.
3. Pulverisation for use as manure.
4. Complete separation for salvage purposes.
5. Incineration as a whole in destructors.
6. Partial separation and incineration.

1. *Tipping on Land.*—A considerable portion of the refuse in this country is disposed of by dumping on land. Years ago, when rates for cartage, bargeing, etc. were as low as 1s. 6d. to 2s. 6d. per ton, there was an economical justification for dumping. From a sanitary point of view there never was and never will be the slightest justification for this method of refuse disposal. Refuse tips infect the surrounding country with disease-spreading pestilential odours, and are, according to the reports of Medical Officers of Health, the happy breeding grounds for flies and rats, infesting the houses in the vicinity. In America, where a greater variety of methods of disposal have been tried than in this country, it is now recognised that incineration is the only correct solution of refuse disposal. A biting criticism of tipping, and similar methods of disposal by Dr. Heder, Medical Officer of Health in the United States, is given below:—

"Unquestionably, gentlemen, the proper plant for garbage disposal is to destroy it by fire, and not to try to utilise it for feeding swine, hauling it out and burying it, or making any attempt at reduction. We do not want to pollute the atmosphere of the suburban portion of our city with the stench which emanates from hog-pens and from the stuff which is hauled there, a good part of which the hogs themselves will not eat. . . . Such, in my opinion, is a menace to the public health of any neighbourhood, and is not only unsatisfactory, but disgusting."

Another aspect of the refuse tipping question is the carting cost. The present economic conditions and increasing costs of transport have raised the cost of

disposal in some towns to the alarming figure of about 10s. per ton, and as high as 20s. per ton, including expenses for collection. In the administrative County of London we believe that about 80% of the total refuse is dumped at an approximate cost of £2,000 per day.

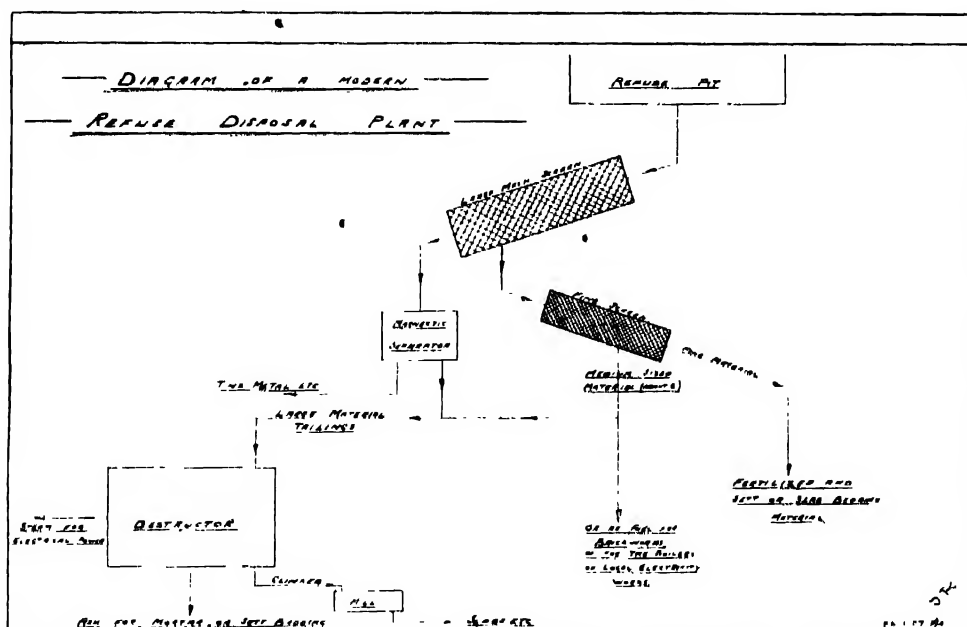
Mr. W. J. Steele, A.M.I.C.E., the then Deputy City Engineer of Bristol, in his paper read before the Association of Cleansing Superintendents of Great Britain, at the Bristol Conference, June, 1903, on "Some methods of utilising town's refuse," presented some very interesting figures, of which an abstract is given below:

"During the year ending March 25, 1903, 85,911 tons of refuse were collected, or 1 ton for every four persons. Of this quantity, 33,149 tons were treated at the destructor, the remainder being tipped. Had the whole of the refuse been treated at the destructor, the total difference in cost over the cost of tipping would have been £3,500—equivalent to a halfpenny rate."

Without going further into this method of refuse disposal, it may safely be stated that this system does not solve the problem from a sanitary or financial point of view.

3. *Pulverisation.*—This method of disposal consists of pulverising the refuse for manure. Except in very remote cases, this has not been found to be a profitable or successful method—unprofitable on account of the transport and handling charges, and unsuccessful as the refuse still maintains the whole of its organic qualities.

4. *Separation for salvage.*—This consists of the complete separation of the refuse, partly by hand and partly by mechanical means, with the object of disposing by sale of everything of market value, such as paper, tins and metals, rags, bottles, pottery ware, etc. The residue is dumped on the land. This solution of disposal is highly unsanitary, and it is questionable whether in any individual case it has proved a commercial proposition.



2. *Refuse tipping at sea.*—This method is chiefly resorted to in seaport towns which do not possess destructor plants, and in other cases, where suitable river or canal connexion is available, the refuse is sent down to the seaport from inland towns. In such seaports a good-sized barge, into which the refuse is tipped, is moored in the harbour. Very often a depot is installed as well at which the refuse is stored if the barges cannot proceed to sea owing to unfavourable weather. The refuse from these depots has to be shovelled into the tipping trucks, which again are run out on the wharf and tipped into the barge. This additional handling of the material increases considerably the cost of refuse disposal. It has been proved that quantities of refuse dumped at sea are returned to the beaches and foreshores in the vicinity. Experiments carried out in America have shown that the refuse must be taken approximately 60 miles out to sea to ensure its non-return on the incoming tide, which again involves heavy expense.

5. *Incineration without separation.*—From a hygienic aspect alone, the complete incineration of town's refuse, without any separation by hand or mechanical means, would be the ideal solution of refuse disposal. Practically all the earlier types of destructors were operated on these lines. However, most of the designs of these destructors were weak. Apart from the fact that the refuse was not burned down completely to a hard and innocuous clinker, the obnoxious fumes escaping from the chimney raised a strong public prejudice against refuse destructors; what clinker was obtained from these plants, also, had no commercial value.

With the introduction of high-temperature destructors of modern design, wherein mechanical charging and clinkering are generally adopted, a good, serviceable, hard clinker is obtained, as well as a higher evaporation per ton of refuse burnt. The improved quality of the clinker proves it to be a valuable by-product, and in many cases auxiliary plants are installed consisting of clinker crushing and screening plant, mortar mills, slab- and

block-making machines, tar macadam plants, etc. Apart from supplying the requirements of the municipality concerned, the sale of the surplus clinker products gives a useful return to be set against capital and standing charges.

In many cases it is found, however, to be of advantage to screen out the fine dust and to eliminate as far as possible all tins and metals, the latter especially in view of the utilisation of the clinker as a by-product. This represents the type of plant described in the following paragraph.

6. *Partial separation and incineration.*—Partial separation consists of screening the refuse and eliminating the tins, metals, etc. The number of gradings in the screening operation vary in accordance with the extent to which separation is required, and may be anything from two to four. In many cases the dust alone is screened out. A further separation of tins and metals is carried out by hand on picking belts, or by a magnetic separator attached to the end of the screen. A typical layout of the separating operation of a partial separation and incineration plant is shown on the diagram attached. The diagram in this case illustrates the separation of fine dust and large screenings only (see p. 120)

A more complete separation plant and one which finds considerable favour is as follows:—The refuse is discharged from the collecting vehicles into a receiving hopper, from which it is mechanically fed to a revolving screen. The screen in this case is of three mesh: No. 1 for the fine dust, No. 2 for the cinders, breeze and coke, and No. 3 for brickbats, broken crockery, bottles, etc. The rejects or the larger material, on leaving the screen, pass through a magnetic separator for the elimination of tins, metals, etc. After leaving the magnetic separator, the large material is conveyed on to a picking belt, where all materials such as paper, rags, bones, bottles or anything else it is desired to salvage are either hand picked or collected by mechanical means. The residue, commonly called "tailings," is then conveyed onwards to the charging floor of the destructor or incinerator. The fine dust screened out of the refuse may be used as a fertiliser or for mixing with clay in brick manufacture, or, in many cases, it is used for bedding sett and paving slabs. The medium-sized screenings, which consist for the most part of cinders, coke and spent coal, are in many cases sold as fuel to brickworks or to the local electricity works, to be used as fuel on their existing boiler plants. As an alternative, this material may be mixed again with tailings and burnt in the destructor furnaces. The largest screenings, which as a rule consist chiefly of brickbats, stones, broken crockery, etc., are generally ground up for mortar used for concrete aggregate or hard core filling. The tins recovered by the magnetic separator are pressed into bales by hydraulic pressure and despatched to the de-tinning works.

Time and space does not permit any further description of the various auxiliary plant requirements of refuse disposal works. Reference must be made, however, to the very important question of transport or conveyance of refuse within the plant itself. An installation provided with an efficient furnace, but supplied with a

wrongly designed or inefficient conveyor or refuse-handling plant may condemn the plant as a whole from the commercial point of view. The same will hold good for the reverse conditions. The design of the refuse-handling plant, which is entirely an engineering problem of transport, is therefore just as important as the solution of efficient incineration, which must be considered purely from a heat recovery aspect.

CALORIFIC VALUE OF REFUSE

As already stated, the composition of the refuse varies greatly. It is evident, therefore, that any variation in the composition of the refuse will actually affect its calorific value. A further factor which influences the nett calorific value is the moisture content of the refuse. Refuse of the same calorific value on a dry basis, will obviously give different nett calorific values with different moisture contents. The moisture consists partly of hygroscopic or normal moisture and partly of adherent moisture. A fair amount of vegetable matter in the refuse will give a high amount of hygroscopic moisture, although in appearance the material would seem to be fairly dry. The adherent or adventitious moisture depends to a great extent on the system of collection of the refuse—whether in open or closed vehicles, the manner in which the refuse is stored by the householder, whether in open or closed dust bins, weather conditions, etc. Winter refuse will show a higher calorific value than spring and summer refuse, and contains a larger percentage of breeze and cinders. The nett calorific value may vary from 1500 to 5000 B.Th.U. per lb., and in some cases it may rise as high as 6000 B.Th.U.

The calorific value of the material as supplied to the furnace varies again in accordance with the method of separation of the incoming refuse. For example, the calorific value is increased by screening out the dust. Tests carried out on the Continent resulted in an increase of the calorific value to the extent of 23% by eliminating 25% of the material in the form of fine dust; and with 35% dust elimination the increase in the heating value was as much as 40%. The calorific value can also be considerably increased by suitable protection of the material against the weather during the period of collection, as well as screening out the dust as far as it is economically possible. The nature of the refuse and its varying composition make it very difficult to determine its calorific value correctly over a long period as a basis for a scientific test or heat balance on a destructor plant.

MECHANICAL AND CHEMICAL ANALYSIS

A mechanical or physical analysis of refuse is adopted to determine the quantities and proportions of vegetable matter, cinders, clinker, ashes, paper, wood, straw, rags, metal, dust, etc., and can be used to calculate the approximate calorific value of the refuse.

The difficulties met with in the accurate determination of the calorific value of the refuse apply also to the chemical analysis. Although from a scientific point of view a knowledge of the calorific value and the chemical analysis of the refuse is desirable to determine the correct design of the plant, the variations in the composition

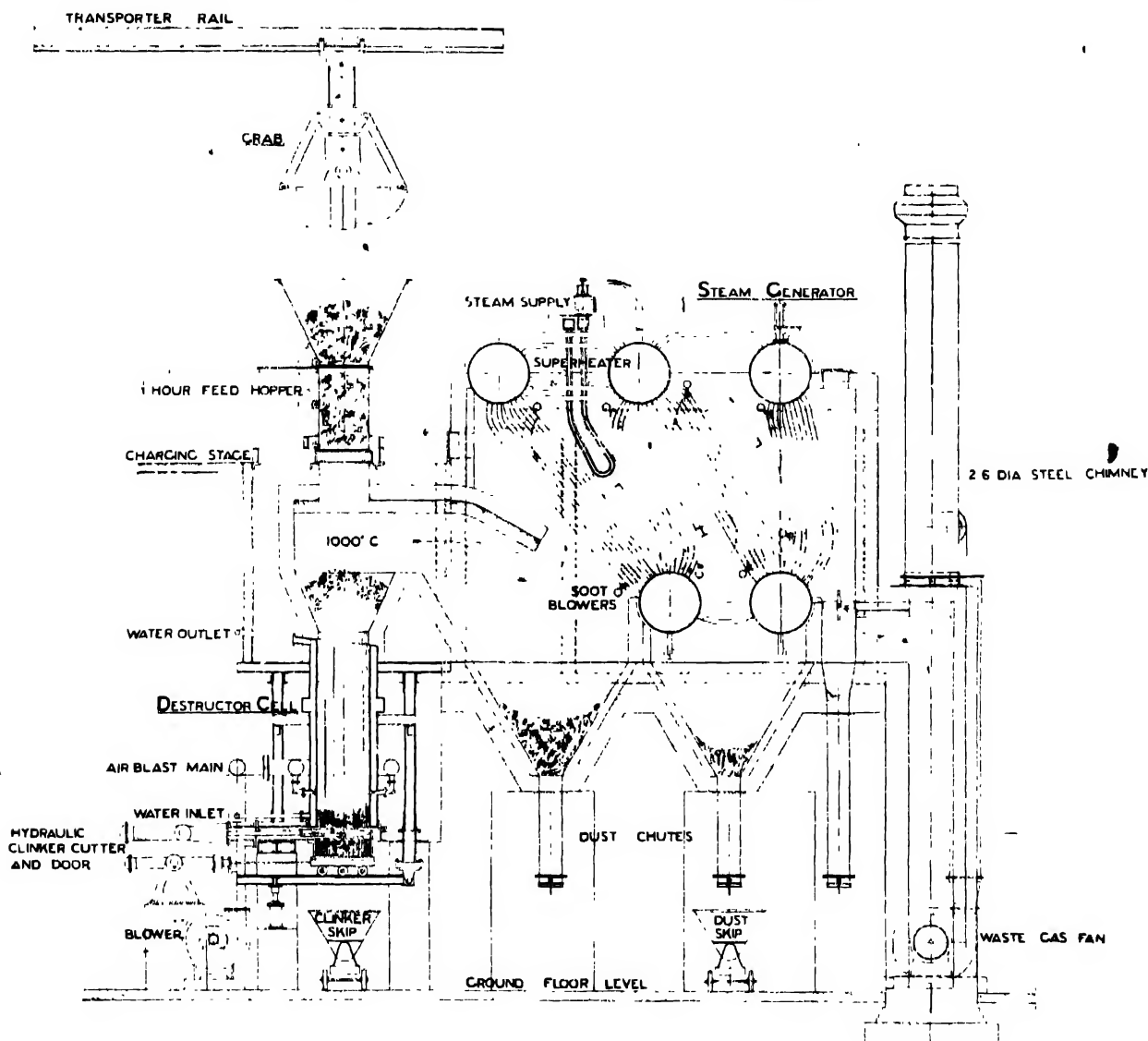
of the refuse are so great that a considerable allowance must be made in the data upon which the design is based.

EVOLUTION IN THE DESIGN OF DESTRUCTORS

The earlier designs of destructors consisted of brick furnaces, generally fitted with flat grates which were worked on natural draught; as a rule no endeavour was made to make use of the heat from combustion.

later years, when the design had been considerably improved, these plants still met with a good deal of opposition and adverse criticism.

A progressive step was made by the introduction of artificial draught, which enabled a steam boiler to be included in the installation. The artificial draught consisted of a pressure fan delivering air to the furnaces at anything up to 4 in. water gauge. In many cases steam jets were employed in place of blowers.



In these earlier designs the refuse was hand-fed into the furnaces by means of shovels, and the clinker, which was generally of a very poor quality, was extracted by hand.

Apart from the arduous labour involved in the working of these furnaces, the combustion was slow and incomplete, resulting in considerable trouble owing to the emission of fumes and dust from the chimneys.

These conditions naturally did not tend to make the refuse destructor a popular installation, and even in

At this stage the refuse destructor became a steam-raising plant, but the amount of steam generated was seldom more than just enough to drive the fans, feed pumps and auxiliary plant connected with the destructor. These plants were still hand-charged and hand-clinkered, but the methods of charging were altered.

At this period there were the three following distinct methods of hand-charging.

(a) Front-feed, where the refuse was shovelled into the furnace from the front just above the floor level,

the clinker being extracted by the same door similar to the general type of coal-fired boilers.

(b) Back feed, where the refuse was shovelled into the furnace through a special charging door situated at the back and at a higher level than the grate.

(c) Top feed, where the storage hopper was situated over the furnace arches and the refuse was hand-raked through openings in the arches.

The next development in the design of refuse destructors came about by the introduction of pre-heated air for combustion, the drying-hearth, diversions from the ordinary flat grate and improved charging and clinkering devices. With these improvements in design, the refuse destructor then became a much more efficient steam-raising plant, capable of supplying power for other purposes than its own requirements. The clinker was improved in quality and became of certain commercial value. As a result of these developments refuse destructors are doing valuable work to-day. They are working in conjunction with electrical generating stations, sewage-pumping stations, etc., where coal was used prior to the installation of the destructors, and in many cases are generating, from refuse only, the whole of the steam power required.

As a deviation from the usual practice of complete combustion, refuse destructors have also been designed and built on the gas producer principle. This producer gas, generally called "vegetable gas," is used for firing steam boilers and for driving certain types of gas engines.

From this stage, the design of refuse incinerators has not made much further progress until within the last few years, when with the introduction of the shaft furnace, completely water-cooled and fitted with positive mechanical charging and clinkering devices, we arrive at the very latest and most efficient design. The following description and particulars concerning this most up-to-date installation will be of interest.

The destructor consists of a circular steel water-jacketed shaft furnace, surmounted by a refractory brick combustion chamber. The refuse is fed into the furnace from an overhead hopper through a mechanically-operated door. The hopper is fed by a grab hoist, or conveyor, or other suitable means, according to the general layout of the plant. The requisite combustion air supply for the blast is delivered by means of a high-pressure blower, through a number of tuyères, placed circumferentially at the lower part of the steel jacket. Owing to the high pressure of the blast, a very high temperature of combustion is obtained in the furnace. The clinker consequently is fused and cut off at intervals from 30 to 60 minutes by means of a hydraulically-operated knife, which also forms a closure of the furnace base, whilst another lower hydraulically-operated door is opened to discharge the block of clinker cut off. The duration of a clinker operation is less than one minute. The clinker is cut away at some distance from the zone of maximum temperature, the drop in the sensible heat of the clinker being utilised for pre-heating the incoming air. The water supply for the cell jacket is maintained from an overhead tank, the supply for which again can be taken conveniently from the hot well of

the generating plant. The cooling water leaving the jacket is used as feed water for the boiler. The combustion gases leave the furnace at a temperature of from 1000-1200° C., and pass forward to the boiler, which is of the water-tube type, and is specially designed for this type of plant. Two dust chambers situated below the boiler, collect most of the dust brought over by the gases from the furnace. A final dust collector is placed on the discharge side of the waste gas fan, before the waste gases are delivered into the atmosphere by the chimney. Soot blowers are installed to keep the surfaces of the boiler tubes free from dust. These blowers are essential to ensure maximum efficiency in a plant of this nature. Each furnace or cell is capable of burning 24 tons of refuse per day. The clinker produced is of excellent quality, and is a suitable material for the manufacture of artificial paving stones, etc.

The amount of steam raised per ton of refuse varies naturally with the calorific value of the material burnt. For average town refuse having an average calorific value of 3000-4000 B.Th.U. per lb., approximately 1.5 to 2 lb. of steam can be raised per lb. of refuse on this modern type of Woodall Duckham refuse destructor. With a turbo-generating plant, based on a steam consumption of 17 lb. of steam per kw., it is possible to generate 150 to 200 kw. on the switchboard per ton of refuse burnt. The power requirements of a modern plant, including grab hoist or crane, screens, magnetic separators, conveyors, blowers, hydraulic and circulating pumps, clinker and mortar mills, etc., amount to about 30 kw. per ton of refuse burnt, leaving a considerable surplus of electrical energy for other purposes. One first call on this power would probably be the charging of electric accumulators for driving the refuse-collecting vehicles. Further advantages of this shaft furnace incinerator are lower labour costs, maximum burning capacity with minimum ground space, and a complete absence of dust and fumes from the chimney. A diagrammatic layout of this type of destructor is given in the attached drawing (see p. 122).

Town's refuse is potential power. A town with a carefully-operated system of refuse collection and a well-designed modern refuse destructor should be able to raise power far in excess of that required for the refuse disposal plant. A large city with a population of 1,000,000 inhabitants should be able to obtain from its refuse 25,000,000 kw.-hrs. per annum, after liberal allowance for all power purposes required for collection and disposal. The value of this electrical energy represents over £100,000 per annum.

AMMONIUM SULPHATE IN JAPAN

The Japanese output of ammonium sulphate in 1925 amounted to 130,000 tons, but the annual production is expected to reach double that figure shortly as some of the largest manufacturers are greatly increasing the capacity of their plants. The demand for ammonium sulphate in Japan has increased from 120,000 tons in 1914 to 330,000 tons in 1925, and will, it is estimated, reach 400,000 tons in 1926. This increase is due to the shortage of bean cake, hitherto largely used as a nitrogenous fertiliser in Japan.

SOCIETY OF CHEMICAL INDUSTRY

• OFFICIAL NOTICES

TAR CONFERENCE PAPERS

The papers that were presented before the Manchester Tar Conference in November last have now been published in bound form at the price of 2s. 6d., post free.

Copies can be obtained from the General Secretary of the Society of Chemical Industry, Central House, Finsbury Square, London, E.C.2, and orders should be accompanied by the appropriate remittance.

CONGRESS OF CHEMISTS HANDBOOK

This Handbook, which has been prepared by the Committee of the Congress under the Editorship of Mr. W. H. Coleman, contains, in addition to a full programme of the meetings, an account of some of the more important chemical and allied industries in and around London. A useful map of Central London accompanies it. A copy of the book was presented to every member attending the Congress, but a considerable number of copies is still on hand, and the General Secretary will be pleased to send one to any member who was not present at the Congress, on receiving his name and address, with 6d. in stamps to cover the postage.

AMERICAN SECTION

The Perkin Medal meeting of the American Section of Society of Chemical Industry was held on Friday evening, January 14, 1927, in Rumford Hall of the Chemists' Club, as a joint meeting with the New York Section of the American Chemical Society, New York Section of the American Electrochemical Society, and American Section of the Société de Chimie Industrielle. The meeting began at 8.15 with Dr. L. V. Redman in the chair.

Dr. Redman opened the meeting by reading telegrams from several friends of Dr. Teeple, including a particularly interesting one from the staff of the plant of the American Trona Corporation. He then introduced Prof. L. M. Dennis, of Cornell University, who told of the thorough foundation which the Medallist had obtained at that University, where he took his Doctorate. Prof. Dennis paid particular tribute to the teaching ability of the Medallist.

In the absence of Dr. C. H. Herty, his paper was read by Dr. Ellwood Hendrick. Dr. Herty pointed out that many of the lines of work with which Dr. Teeple has been connected are so strictly confidential that they could not be made available. But there is a wealth of record of achievement ample to testify to Dr. Teeple's remarkable versatility, his activities covering the manufacture of sulphuric acid, of special chemicals: the design of plants for the manufacture of nitric and hydrochloric acids; and the production of caustic soda and potash, chlorine and permanganate. Again, we see him at work in the field of enzymes and ferments, whilst various problems connected with the production of tartaric acid and its salts demanded for a time his constant attention. Next there is noted active participation in problems connected with the distillation of hardwoods, and for many years he gave himself unreservedly to the complicated chapters connected with the utilisation of pine wood,

both by destructive distillation and by extraction of its resinous content. In this latter work he was led to study thoroughly a new product which appeared at the distilleries where steam-distilled wood spirits of turpentine was prepared. By careful study of this product, pine oil, he found its chief constituent to be a *lævo* modification of alpha-terpineol, little dreaming at that time how great a role this new product was to play in flotation processes for the utilisation of low-grade ores.

Surely no man would ever dare to consider himself a foremost expert in so many and such varied lines, and yet in all of these Dr. Teeple has given service which has been ranked of the greatest value. What is the explanation? It seems to me to be this: He equipped himself with a sound general training in chemistry, covering organic, inorganic and physical chemistry. To this he added a natural gift for engineering, and then he topped it all with an abundance of common sense and a desire to play the game fair and square.

With such equipment, it is not difficult to see his method of attack upon any problem presented to him. It is well illustrated in the case of his work on decolorising carbons. When an unsuccessful process for the manufacture of this material was brought to him he did not try to patch up an inefficient machine, but deliberately set to work to study thoroughly all of the underlying fundamental scientific principles. With the new point of view gained by such studies, and with his naturally cautious temperament, small scale operations were attempted and errors discovered before they were too costly, and finally full scale operation was launched.

The years during which this varied line of work was being prosecuted were character building years also, and so, with the confidence begotten through successful work under such varied conditions, he was found prepared to undertake that great work which was uppermost in the minds of the Committee of Award, the potash and borax development at Searles Lake, California. How many of us would have dared to undertake the handling of a problem which at the time seemed such a forlorn hope? Millions of dollars had been invested in a multitude of changed plant methods, all of which succeeded in making an entirely inadequate quantity of a product which was of altogether insufficient purity. Whatever was to be done had to be carried out in a desert, the last place in the world one would select as a spot for a great chemical plant, and at that far removed from the chief points of consumption of its products. More than that, with the cessation of the war and the renewal of imports from Germany, and the hostility of fertiliser consumers to any tariff on potash, he was faced with the necessity of putting a product on the market in open competition with one of the most powerful, best organised, so-called world monopolies.

But Dr. Teeple did undertake the job, with the courage which those of us who have been thrown closely in contact with him know so well as his outstanding characteristic. How did he proceed about the work? Exactly along the lines we have already discussed. For at the very outset, after organizing his research staff, he came to grips with the scientific questions involved, and utilising that great blessing which Willard Gibbs gave to industry, he began a series of equilibrium

studies on the systems involving sodium chloride, sulphate, carbonate, bicarbonate and tetraborate, and potassium chloride and sulphate, these salts being the constituents of the brines which were drawn from Searles Lake. His problem was to separate the potassium chloride and borax, and to prepare each of these in marketable forms. These equilibrium studies, still in progress, have enabled the location already of seven quadruple points, fourteen triple points, ten double points, and eight single points. With the light gained from these studies he has been able to avoid much useless experimentation, and to get a grasp upon the whole problem which allows safe prophecy as to the outcome of modifications of present methods.

The particular problem which gave his research staff most concern was to avoid the formation of glaserite, $\text{Na}_2\text{SO}_4 \cdot 3\text{K}_2\text{SO}_4$. The solution of this problem resulted from the discovery by Mr. Burke of the research staff of a true double salt, $\text{Na}_2(\text{CO}_3 \cdot 2\text{Na}_2\text{SO}_4)$, which had not been previously described in the literature, and which was named *burkeite*. The knowledge of the existence of this double salt, together with the equilibrium studies made, pointed out the way by which the sodium sulphate could be separated from the solution as burkeite, and not as glaserite, and the potash be kept in solution and concentrated to saturation. However, there was still the problem of freeing the potassium chloride from borax. This was solved by the discovery that pure KCl would separate without a particle of borax if the hot solution was cooled rapidly and quietly to about 30°. The mother liquor from this product, on being agitated and without further cooling, deposited borax with but a small trace of KCl, and that could easily be removed. With this accomplished the way was made clear for converting a serious liability, the borax, into a most valuable asset, so that the plant is now operating for the marketing of both of these products, each of a high degree of purity.

One of the most striking engineering difficulties that had to be met was the strong tendency of the material in the evaporators to foam. This had to be overcome. A test sample made up of the pure salts corresponding in composition to the brines to be evaporated showed no evidence of this foam. He therefore concluded that the material must be organic, and here, for the time being, Dr. Teeple's natural traits seemed to desert him. Experiments involving oxidation, reduction, chlorination, electrolysis etc. all were tried with unsatisfactory results. Remedies were found, such as the use of decolorising carbon, or bone-black, but this was too expensive. The use of a film of oil was tried. While successful in stopping the foaming it brought about conditions which necessitated constant replacements, and therefore this had to be discarded. Various modifications of a mechanical nature were tried, but nothing with real satisfaction. Then Dr. Teeple came to himself again, and started out upon a systematic research to determine what the organic substance was, and its origin. A careful survey of the desert vegetation in the neighbourhood of Searles Lake showed that along with the usual desert sage and cactus was a creosote bush (*Larrea mexicana*), whose leaves were covered with a heavy coating which when extracted caused an intensive

foaming of the synthetic brine corresponding to that of the natural brine. This gummy material was washed down during the light rainfalls, and was carried into the salt deposits. A study of the material showed it to be certain resins and saponins. With this knowledge in hand, the method of attack was clear. Again the fundamental method of attack triumphed.

I know of no more fitting testimonial to the genuine success of Dr. Teeple's work at Searles Lake than the fact that within the last year the owners of the plant, who had already invested such large sums in a losing operation, were led without hesitation to invest still further amounts in order to enable the doubling of the capacity of the plant along the lines Dr. Teeple and his associates have so thoroughly worked out.

While the pessimist and the clever propagandist have been continuously asserting that an American potash industry was an impossibility, Dr. Teeple has been quietly, but efficiently, building up such an industry in our midst, and on such a sound basis that we may feel assured of its perpetuation. My own thought in closing is that, with the very recent discovery of important potash deposits in Texas and New Mexico, we cannot help a feeling of confidence that the complicated problems which will arise in connexion with their utilisation will find their solution through the work of men of the type of John E. Teeple and his associates.

Dr. Wm. H. Nichols, Senior Past President of the Society, made the presentation of the medal with a few suitable remarks.

Dr. Teeple candidly admitted that he was "fussed," by all the tributes to him which had been earned by his organisation. In his address on the topic, Expansion or Growth (cf. CHEM. & IND., January 28, p. 73), he contrasted the conditions necessary for development of a research project with those of the machine type of operation. He emphasised the importance of selection and handling of the men concerned, and attributed the success of the potash development to the ability of numerous men who had each given their best efforts. He showed pictures of a number of the leaders in the work, pictures of the plant and Searles Lake, and an outline of the composition of the raw materials.

The meeting closed at 10.15 p.m. One hundred and fifty members and guests attended the dinner before the meeting, and 300 were present at the presentation.

JOINT MEETING OF THE FUEL SECTION AND THE YORKSHIRE SECTION

A joint meeting of these sections will be held in the Queen's Hotel, Leeds, on February 28. Papers will be submitted for discussion in the probable order and timing as shown below.

Afternoon Session commencing at 2.30 p.m.—Chairman—Professor A. Smithells, C.M.G., D.Sc., F.R.S. (Chairman of the Fuel Section).

(1) "The Influence of Atmosphere and Temperature upon the Scaling of Steel." Part I.—Scaling by Air, Water Vapour, and Carbon Dioxide. By C. B. Marson and Prof. J. W. Cobb. Part II.—Prevention of Scaling by Hydrogen and Carbon Monoxide. By H. T. Angus and Prof. J. W. Cobb.

Synopsis.—A great loss of metal results from the scaling of steel during the reheating necessary in manufacturing processes. The rate of scaling is affected by the composition of furnace atmospheres, the proportion of oxygen, carbon dioxide, steam, of carbon monoxide, hydrogen, and other reducing gases. The composition of the furnace atmosphere is governed by the composition of the fuel. The paper deals with an experimental investigation of the problem which is also fundamental to any discussion of the production or elimination of smoke in the steel or engineering industries.

(2) "A Thermal Study of the Process of Manufacture of Water-gas." By Dr. A. Parker.

Synopsis.—From the data procured during an investigation of the process of manufacture of blue water-gas under conditions typical of British practice a thermal account has been constructed. The total heat supplied to the generator, in the form of coke, steam and air, is accounted for by the heat removed as water gas, steam, blast products, ashes, etc. The construction of this thermal account is described. A suggested scheme for separate thermal analyses of the air blow periods and steaming periods is discussed, and a new scheme is proposed.

4.30 p.m. Interval for tea.

Evening Session commencing at 5 p.m.—Chairman B. A. Burrell, F.I.C. (Chairman of the Yorkshire Section).

(1) "A Study of Coke Formation." By R. A. Mott.

Synopsis. A study of coke formation based on an examination of 17 coals varying in carbon content from over 90 to less than 80%, and including anthracite, strongly-caking, weakly-caking, and non-caking coals. The factors considered are pore formation, "binding" action, and swelling power. A theory of coking is developed. The relation between chemical analysis, swelling power and coking power is discussed.

(2) "Coke in Relation to some of its Industrial and Domestic Uses." By H. Hollings.

Synopsis.—Experiments upon the interaction between various types of coke and carbon dioxide will be described. The properties of coke which are desired in certain applications of the fuel are discussed with particular reference to: (a) The reactivity of coke towards carbon dioxide during the blow period of water-gas manufacture. (b) The influence of combustibility upon the ease of control of closed furnaces. The experiments to be described in this connexion elucidate some of the different experiences with furnaces of different sizes.

(3) "The Behaviour of Cokes in the Open Grate." By Margaret F. Bligh and H. J. Hodsman.

Synopsis.—The paper deals with the combustion of carbonised fuels and coal in open grate. Quantitative observations on typical carbonised fuels are recorded, and also conclusions as to the properties of a smokeless fuel which conduces to a high radiant efficiency in the grate.

Preprints of papers may be obtained from the Honorary Secretaries of the Sections. Early applications are desirable.

Members and others desirous of joining in an informal

dinner at the Queen's Hotel after the meeting are requested to send in their names to Prof. N. M. Comber, The University, Leeds.

Those desirous of obtaining more detailed information respecting the experimental work carried out at the Fuel Laboratories of the University of Leeds are cordially invited to visit the Department itself. The University may be reached by any tramcar bound for Headingley, Lawnswood, Hyde Park or Victoria Road.

The Fuel Section has been established so that the Society's treatment of this branch of chemical technology might be co-ordinated. It is hoped that all members who are interested in fuel topics will become enrolled. Those desirous of doing so should apply to the General Secretary. Annual subscription, 5s.

MANCHESTER SECTION

A joint meeting with the local section of the Oil and Colour Chemists' Association was held at the Textile Institute, Manchester, on February 4. Mr. J. B. Shaw presided over a large attendance.

A paper entitled: "The constants of colour—hue, purity, and luminosity," was read by Mr. Charles W. Gamble, O.B.E., M.Sc.Tech.

Mr. Gamble said that light was a retinal disturbance followed by vision, and unless there was such disturbance there was no light. The mixed sensation of whiteness was well-known in the broad band of colours termed the continuous spectrum. Brightness, or luminosity, of these colours was a matter of amplitude. Colour was not the same thing to all men: to one person the dying fire at the end of a carbon rod might appear red, to another greenish-grey.

A beam of light passed through a tank of clean, distilled water, was scarcely visible until suitable reflectors of glass were placed in the water, whereupon the light was clearly scattered in all directions. Upon mixing a mastic solution of resin in alcohol in the water the resin grains dispersed and scattered light. By increasing the quantity of resin grains the light varied from white to yellow and then to orange. A certain amount of interest attached to this experiment because it represented a very important natural phenomenon. What actually took place was a selective reflection or scattering. Lord Rayleigh had demonstrated that whenever light passed through a turbid medium it was scattered, and with, say, a pencil of white light the scattering which took place was inversely proportional to the fourth power of the wave-length. An increase in the number of particles gave a longer wave-length.

Lustre was not quite the same thing as sheen, although somewhat similar in character. Lustre occurred when small elements of differing reflective power were associated together, such, for instance, as a fabric woven with alternate lines of mercerised cotton and ordinary cotton, wool and silk, and silk and cotton.

Long experience, said Mr. Gamble, had taught him how difficult it was to eradicate the impression that when white light fell upon a material termed red it was not a case of that substance turning white light into red. All colour in nature came from white light, and when it was stated that a particular material had colour, what

was implied was a kind of depreciation, or another form of the same kind of sunlight. The particles of a body absorbed some radiations and rejected others, and if energy was absorbed either there must be a rise in temperature or a chemical change; in the vast majority of cases it was the former. The resulting appearance was determined by the physical condition of the absorbing body. With reflected light there was always a certain amount of unchanged white light which paled the colour. The colour produced by transmission of white light through a transparent body was always richer than when white light fell upon the surface of an absorbing body.

The surface of gold normally appeared to be yellow. When a small amount of light penetrated into the surface particles of the metal it presented a beautiful bluish-green appearance. This effect, termed dichroism, was also particularly perceptible in the wing-cases of certain beetles.

There were three constants of colour—hue, luminosity or purity. Hue was the colour itself. Luminosity or purity meant freedom from admixture with white light. The luminosity of a colour might be measured either by its relative whiteness compared with white light before it passed through the dispersing arrangement in the spectroscope, or by the more common practice of measuring the luminosity of different regions of the spectrum taken at the brightest. Yellows were always brighter than reds; reds were always brighter than blues.

It was interesting to know what amount of white might be added to a colour. If white was added to any colour to the extent of 75 times the brightness of the colour itself, the colour sensation disappeared, though this was not an exact amount for all colours. More white could be mixed with orange without any effect being perceived than with green, and still more with blue.

It had been postulated that there were in the retina three distinct sets of nerve fibres capable of transmitting light (colours). In darkness, these sets of fibres were at rest and there was no sensation of colour.

A question was once asked in a London University examination which many candidates failed to answer. It almost ranked with the celebrated question: "Why does a diamond cut glass?" The question was:

What is the colour of brown paper? The answer was: "A degraded orange," or, in some cases, "A degraded yellow."

It was far easier to observe fine detail by monochromatic light than by heterochromatic light. The effect of a variation of illumination was shown by Mr. Gamble in the case of two fabrics. In daylight one of them matched very well as a moss green; with the tungsten light it was brown. The second matched a fabric dyed blue with indigo; with the tungsten light it was dull red.

In his reply to the discussion which followed the reading of the paper, Mr. Gamble stated that the "Tintometer" was an extraordinarily valuable instrument, and its use did not require any very great skill beyond the ability to match colours.

OTTAWA SECTION

Mr. A. E. MacRae presided over a well-attended meeting on January 19, at which Mr. A. L. Davidson read a paper on yeast.

Historically, yeast has been known for ages; medicinally, it was prescribed by Hippocrates, and later by Dioscorides. The use of yeast as a food was given great impetus by the war. In Germany it would appear that yeasts were developed which used all their food material for reproduction, no alcohol being produced. Such yeasts were utilised as food for both human beings and cattle. On the side of the Allies, yeast was used by British troops in the form of an extract, de-bittered and flavoured, and it proved very efficacious therapeutically, as well as being nutritive.

In considering the cultivation of yeast as a future source of food, stress was laid on the wonderful rate of growth; overnight it will increase 50 to 70 fold under proper conditions, and this with little cost for labour. Contrast this with the time and labour necessary to raise crops or animals for food.

From the nuclein of yeast nucleic acid is obtained and combined with silver, calcium or sodium. The compounds thus formed show marked bactericidal action on injection, together with a large increase of leucocytes, and are not irritating.

CALENDAR OF FORTHCOMING EVENTS

- Feb. 14. CERAMIC SOCIETY, North Staffordshire Technical College, Stoke-on-Trent, at 7.30 p.m. (1) "The discoloration of clays during firing," by J. Konarzewski and A. E. J. Vickers. (2) "Researches on the theory of fine grinding," Part VI, by Dr. G. Martin; Part VII, by Dr. G. Martin, F. B. Turner and F. Linstead, and Part VIII, by Dr. G. Martin, W. Watson and E. Bowes.
- Feb. 14. INSTITUTE OF BREWING, *London Section*. Engineers' Club, Coventry Street, W., 7.45 p.m. Discussion on "Fermenting vessels" to be opened by E. B. Collier, A. Cotching, R. J. B. Storey, and L. E. Simpkins.
- Feb. 14. INSTITUTE OF METALS, *Scottish Local Section*. 39, Elmbank Crescent, Glasgow, at 7.30 p.m. "Notes on aluminium alloys," by D. R. Tullis.
- Feb. 14. INSTITUTE OF CHEMISTRY, *Manchester and District Section*. "Electronic theories of valency in organic chemistry," by Prof. R. Robinson.
- Feb. 14. SOCIETY OF CHEMICAL INDUSTRY AND THE INSTITUTE OF CHEMISTRY. *Joint meeting of the Edinburgh and East of Scotland Sections*. The Pharmaceutical Hall, 36, York Place, Edinburgh, at 8 p.m. "The use of the microscope in qualitative analysis," by B. D. W. Luff.
- Feb. 14. ROYAL SCOTTISH SOCIETY OF ARTS, 117, George Street, Edinburgh, at 8 p.m. "Application of coal and oil to marine propulsion," by A. Scott Younger (Keith Lecture). Also on Feb. 28 and March 14.
- Feb. 15. SOCIETY OF CHEMICAL INDUSTRY, *Glasgow Section*. 39, Elmbank Crescent, Glasgow, at 7 p.m. Joint Meeting with the Institution of the Rubber Industry. (1) "The milling of rubber," by B. D. Porritt. (2) "The hardness testing of vulcanised rubber," by T. R. Dawson. (3) "A demonstration of a new Piezo-micrometer," by J. T. Strachan.

CHEMICAL SOCIETY

Feb. 15. HULL CHEMICAL AND ENGINEERING SOCIETY. Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m. "Air conditioning and air conditioning plant," by E. G. T. Hill.

Feb. 16. INSTITUTE OF CHEMISTRY, *London and South Eastern Counties Section*. The Third Annual Dance. Hotel Russell, Russell Square, W.C.1, at 7.30 for 7.45 p.m.

Feb. 16. SOCIETY OF CHEMICAL INDUSTRY, *Yorkshire Section*. Joint meeting with the Society of Glass Technology, The University, St. George's Square, Sheffield, at 2.30 p.m. The Sheffield Metallurgical Association, Sheffield Section of the Institute of Metals and the Sheffield Society of Engineers and Metallurgists will also take part. General discussion on silicate analysis. (1) "A critical survey of methods for the analysis of the simpler glasses," by W. H. Withey. (2) "Notes on methods used in the analysis of glasses," by A. Dimbleby. (3) "The analysis of refractories," by W. J. Rees, and (4) "Notes on the analysis of silicate slags," by T. P. Colclough.

Feb. 17. CHEMICAL SOCIETY, *Ordinary Scientific Meeting*, Burlington House, Piccadilly, W.1, at 8 p.m. (1) "The production of fog in the neutralisation of alkali with hydrogen halides," by H. O. Askew. (2) "Constituents of *Myoporium laetum* Forst. (The "Ngaio.") Part II Hydrogenation of ngaione and ngaol, and dehydration of ngaol," by F. H. McDowell.

Feb. 18. INSTITUTE OF BREWING, *Scottish Section*. Caledonian Station Hotel, Edinburgh. Annual Dinner.

Feb. 18. SOCIETY OF DYERS AND COLOURISTS, *Manchester Section*. 36, George Street, Manchester, at 7 p.m. "A picture of the structure of the cotton fibre as an aid to the interpretation of some phenomena," by F. P. Slater.

Feb. 18. SOCIETY OF CHEMICAL INDUSTRY, *Glasgow Section*. 39, Elmbank Crescent, Glasgow, at 7 p.m. Fuel Lecture.

Feb. 18. SOCIETY OF CHEMICAL INDUSTRY, *Liverpool Section*. The University, Liverpool at 6 p.m. "Fuels for internal-combustion engines," by Col. Sir F. L. Nathan.

Feb. 18. SOCIETY OF CHEMICAL INDUSTRY, *South Wales Section*. Joint Dinner with the South Wales Sections of the Institute of Chemistry and the Institute of Metals. Thomas' Café, High Street, Swansea, at 7 p.m.

Feb. 19. BIRMINGHAM METALLURGICAL SOCIETY. Girls' High School, Dudley, at 7 p.m. "Blast furnace practice," by R. P. Bethell.

Feb. 23. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. "Insulin and its manufacture," by F. H. Carr, C.B.E. Dr. Henry Dale, C.B.E., M.D., F.R.S., will preside.

Feb. 28. SOCIETY OF CHEMICAL INDUSTRY. *Joint meeting of the Yorkshire Section and the Fuel Section*. Queen's Hotel, Leeds, at 2.30 p.m. (See further particulars on p. 125.)

Mar. 9 and 10. INSTITUTE OF METALS. Annual General Meeting. (For full particulars see CHEM. & IND., 1927, p. 106.)

Mar. 14. INSTITUTE OF CHEMISTRY, *Leeds Area Local Section*. "The chemist in the food industry," by B. G. McLellan. (Postponed from Feb. 14.)

At a meeting held on February 3, the President, Professor H. Brereton Baker, C.B.E., F.R.S., occupying the Chair, Dr. J. W. Baker presented the following two papers:—

The nature of the alternating effect in carbon chains. Part XIV. The directive action of some groups of the form $-CR'R''\cdot CO\cdot R$ in aromatic substitution. [With C. K. Ingold.]

ETHYL phenylacetate and ethyl phenylmalonate on nitration in nitric acid (*d* 1.5) at or below 0° give respectively 9% and 20% of the *m*-derivative. These results are taken to show the occurrence of a permanent fractional dipole in the carbonyl group similar to, but weaker than, the permanent integral dipole present in semi-polar double linkings.

The nature of the alternating effect in carbon chains. Part XVII. The directive action of the groups $-CH_2\cdot CH_2NO_2$, $-CH\cdot CHNO_2$, and $-C(NO_2)\cdot CH$ in aromatic substitution. [With I. S. Wilson.]

α -NITRO- β -PHENYLETHANE on nitration yields 13% of *meta*, whilst with ω -nitrostyrene only 2% is formed. These results indicate that, in these cases, contrary to the general assumption, the propagation of the effect due to the positive charge on the nitro-group occurs less readily in a conjugated side-chain than in a saturated chain of equal length. It is suggested that this is probably due to the neutralisation of the effect in passing through the field of the double linking, and not to the predominating *op*-orienting influence of the latter, since *p*-nitrobenzylidene-phenylnitromethane $Ph^1(NO_2)\cdot CH\cdot C_6H_4NO_2$ yields 20% of the *meta*-isomeride on nitration.

Dr. A. Ferguson then summarised the following three papers:—

The Storch equation, a general dilution formula and the validity of the law of mass action at limiting dilutions. [With I. Vogel.]

GRAPHICAL methods of testing the Storch dilution formula in its primitive and in a generalised form, and of determining the constants of the equations are described. In all the cases tested the equation in one of its forms is valid over a wide range of concentration. The constants so determined do not support the view that Ostwald's dilution formula is always followed at low concentrations.

The calculation of the equivalent conductivity of aqueous solutions of strong electrolytes at infinite dilution. Part II. Application to data at 0°, 18° and 25°. [With I. Vogel.]

A CRITICAL review of the methods previously proposed for the calculation of the conductivity at infinite dilution of strong electrolytes is given, and it is concluded that the most trustworthy is that already suggested by the authors (*Phil. Mag.*, 1925, 50, 971). The method has been applied to data at 0°, 18° and 25°, and new tables of mobilities at these temperatures constructed.

The calculation of the equivalent conductivity of aqueous solutions of strong electrolytes at infinite dilution. Part III. The mobilities of the hydrogen and the hydroxyl ions. [With I. Vogel.]

The value of the conductivity at infinite dilution for hydrochloric acid at 25°, calculated by the author's method, yields a most probable value for the mobility of the hydrogen ion of 340.05 at 25°. Kraus and Parker's value of 349.89 is criticised. The mobility of the hydroxyl ion at 18° is similarly computed from the conductivity at infinite dilution of sodium hydroxide to be 175.4. This value differs appreciably from that deduced by Raikes, Yorke and Ewart (*J.*, 1926, 630), probably on account of their use of the square root formula of Kohlrausch for the computation of the conductivity at infinite dilution.

Prof. J. C. Philip, whilst admitting that the authors had found a very satisfactory mathematical representation of conductivity values, emphasised that the values of the coefficients varied with the electrolyte and with the temperature. Hence the problem of finding an expression which would be of accurate universal application was still unsolved. The speaker further suggested that the authors had, perhaps, dismissed rather too lightly the careful experimental work of Weiland.

Dr. N. V. Sidgwick said that by the introduction of a variable "constant" and a variable power the results would naturally correspond closely with the experimental values; the function might then even allow for variations, e.g. for variations due to the presence of impurities in dilute solutions. Dr. Sidgwick preferred to employ an equation which roughly represented all the data.

Replying, Dr. Ferguson said that some slight misapprehension appeared to exist concerning the precise amount of mathematical magic used. The method did not assume even the form of the equation $\Lambda_0 = \Lambda + Bc^n$. That form was tested by the method, and the value of n deduced from the rectilinear graph followed automatically. If n were not independent of the nature of the electrolyte, but varied regularly from substance to substance, that variation represented a physical fact, which should be taken into account in any comprehensive theory of electrolytes, weak or strong.

BIOCHEMICAL SOCIETY

A meeting was held on February 7, at the Lister Institute of Preventive Medicine, when the following papers were read:—

"A new type of alkali lignin," by C. Dorée and E. C. Barton Wright. By the action of 4% caustic soda at 10 atm. pressure for 1 hr. on purified spruce wood, a new type of lignin has been obtained for which the name metalignin is proposed. This lignin has the formula $C_{20}H_{20}O_8$, molecular weight 356. It melts at 186° C. and is soluble in a range of organic solvents, differing in these respects from lignins previously described. Evidence for the presence of one hydroxyl-, two methoxyl- and two carbonyl-groupings was obtained. Metalignin agrees in composition with the α -lignin of Klason (1920) isolated as sulphonic acid from bisulphite liquors. The method of alkali resolution used

does not, as has been claimed (Mehta, 1925), give a quantitative separation of lignin."

"Observations on the purification and properties of insulin," by F. Dickens, E. C. Dodds, W. Lawson and N. F. MacLagan. The action of various protein precipitants has been studied and, applying the work of Wasteneys and Borsook to the fractionation of insulin, it has been shown that all the activity can be precipitated by adding trichloroacetic acid to an insulin solution to make the concentration up to 2%. According to these workers this would prove that insulin is a protein, or metaprotein, but it is shown that this is by no means conclusive when applied to insulin. A precipitation by 2% trichloroacetic acid effects purification, and a method is described whereby trichloroacetic acid precipitate can be dissolved in acid, re-precipitated by the addition of saturated sodium chloride, and finally converted to hydrochloride. When iso-electric precipitates of insulin are washed with neutral salts a considerable portion of the inactive material dissolves. This principle has been made use of to effect still further purification, employing neutral potassium oxalate, which is a weak buffer, to effect in the first place an iso-electric precipitate, and in the second place to hold in solution inactive fractions. The trichloroacetic acid and oxalate processes have been combined to give a complete purification process. An almost quantitative recovery of the insulin is obtained by this method. A description is given of the properties of insulin of various degrees of activity from 1.5 mg. to 0.014 mg. per international unit respectively, including full analyses by van Slyke's method, together with various qualitative reactions. From a study of the results it is impossible to state definitely to what class of protein or fission product insulin belongs.

"A labile form of organic phosphorus in the gastrocnemius of the frog," by P. Eggleton and M. G. Eggleton. The gastrocnemius of the frog contains an organic phosphorus compound which is hydrolysed very rapidly by solutions of mineral acid, giving rise to inorganic phosphate. The values obtained for the inorganic phosphate by such methods as Embden's or Briggs' are for this reason grossly misleading. This interfering compound ("phosphagen") is stable in neutral or slightly alkaline solution, and therefore allows of estimation of inorganic phosphate by the Bell Doisy or magnesium mixture methods. The inorganic phosphate content of the resting muscle is about 25 mg. of P per 100 g. In fatigue it may rise to 60; in heat rigor to more than 100. The "phosphagen" content is about 50 to 60 (as mg. of P per 100 g.), and can be lowered by fatigue as far as 10. In heat rigor it may disappear completely. Incubation of the minced muscle in sodium bicarbonate buffer causes the disappearance of "phosphagen" in the presence or absence of fluoride, but in the former case the disappearance is not due to hydrolysis, since no inorganic phosphate appears. The heart muscle of the frog contains very little "phosphagen" (about 5 mg. of P per 100 g.), and in the plain muscle of the stomach none has been detected. "Phosphagen" appears to be intimately connected with the special functions of skeletal muscle.

"Methylated derivatives of hexosediphosphoric acid," by W. T. J. Morgan. Attempts to prepare methylated

derivatives of hexosediphosphoric acid by methylation with methyl iodide and silver oxide have been made, using (1) the sodium and barium salts of the acid, (2) the free hexosediphosphoric acid in aqueous methyl alcohol, but in both cases the result was unsatisfactory. By using a solution of the acid in anhydrous methyl alcohol a fully methylated derivative was obtained, although in poor yield. It was therefore decided to convert the hexosediphosphoric acid into the methyl hexoside by Fischer's method in order to protect the reducing group from oxidation in subsequent methylation. Two isomeric barium methylhexosidediphosphates have been obtained, and have been separated by fractional crystallisation of their brucine salts from 50% alcohol, and fractional precipitation of their barium salts from aqueous solution by alcohol. The less soluble brucine salt yields the more soluble barium salt $[\alpha]_D^{25} = 8.7$.

The specific rotation of the isomeric barium salt is $[\alpha]_D^{25} = 8.2$. Neither isomer is hydrolysed ^{Hg Green} _{Hg Green} inulin.

which is in agreement with the supposition that fructose is the hexose part of the molecule. Analyses of the salts agree with $C_6H_{10}O_4(OCH_3)(PO_4Ba)_2$, thus it seems probable that the compounds are the α and β methylhexosidediphosphates. During methylation a small amount of a non-reducing-mono-methylhexosemono-phosphoric acid was produced. Analyses of the barium salt agree with $C_6H_{10}O_4(OCH_3)(PO_4Ba)$. The further methylation of these hexosides is in progress.

"Proteins of the cerebro-spinal fluid," by L. F. Hewitt. Determinations have been made of the various protein fractions of normal and pathological cerebro-spinal fluids by modifying the Wu method of plasma protein analysis. An accurate determination of the total protein content may be made using 2 c.c. of fluid. Normally the fluid contains about 0.03% of proteins, the albumin:globulin ratio being 7:1, and the greater part of the globulin fraction being pseudoglobulin. In many diseases the total protein content of the fluid is increased. In cases of tabes dorsalis, meningitis and encephalitis lethargica, not only is the protein content raised, but the proportion of globulins is increased, the albumin:globulin ratio being in the neighbourhood of 3.5:1. In general parietic patients the total protein content is considerably raised, and the proportion of globulins is uniquely high, the albumin:globulin ratio having the extremely low value of 1.4:1. A typical analysis of a general parietic fluid shows the albumin 2.5 times normal, the pseudoglobulin 9 times normal, and the euglobulin 30 times normal. The mechanism of this relative increase in the least diffusible euglobulin fraction is not explained. The power of fluids to precipitate colloidal gold appears to depend on the lowness of the albumin:globulin ratio.

"Demonstration of nitrogen technique for use with small animals," by M. H. Roscoe. The metabolism cage used was that described by Ackroyd and Hopkins. The faeces and urine separator was that of Gross and Connell. To prevent scattering of food this was given as a liquid paste. The cage, funnel and separator were washed daily with distilled water. A sufficient amount of nitrogen was obtained if two animals were used for periods of not less than four days. The method has

been tested for loss of nitrogen as ammonia, but no appreciable loss can be demonstrated.

"Meyerhof's theory of alcoholic fermentation," by Arthur Harden. In a recent account of his views on alcoholic fermentation by yeast, Meyerhof states that he has found that hexosidiphosphates can be converted into carbon dioxide and alcohol by the yeast enzyme in the absence of the coenzyme. This view differs from that of Harden and Young, who consider that the hexosidiphosphate is first hydrolysed to a hexose and a phosphate and that fermentation then occurs in the normal way in the presence of the coenzyme. The author has repeated the experiments which were made along with Young and has again been able to obtain preparations of washed permanent yeast which have practically no action on pure hexosephosphate, but ferment it in presence of the coenzyme. He therefore cannot agree with Meyerhof's proposed modification of Harden and Young's equation in this respect.

"The effect of the reaction on the osmotic pressure of serum proteins." By John Marrack and Leslie Hewitt. If the proteins of serum form ionised salts with bases, it should be possible to demonstrate an osmotic pressure due to the Donnan effect, above that due to the protein molecules alone. With 7.0% of protein this excess osmotic pressure should equal 16 cm. of water at 30° and p_H 8.2, and 3 cm. at p_H 6.6. This excess pressure at any p_H would vary as the square of the protein concentration, and thus account for the lack of proportion between osmotic pressure and protein concentration found by Verney. The authors found no difference between the osmotic pressures of serum proteins at p_H 6.6 and 8.2. The simplest explanation of this is that the compound of protein and base is only slightly ionised. However, we have found that the relation between the diffusible ions in the protein solution and that against which it was dialysed agrees with what should be found according to Donnan's principle if this compound were highly ionised.

The following papers were also read:—"The lipins of yeast," by I. S. MacLean and C. G. Daubney;—"On the nature of provitamin D," by O. Rosenheim and T. A. Webster.

SOCIETY OF PUBLIC ANALYSTS

An ordinary meeting was held on February 2, Mr. E. Richards Bolton, the president, being in the chair.

Certificates were read for the first time in favour of Messrs. W. G. Carey, W. F. Elvidge, L. S. Fraser, F. P. Hornby, G. R. Lynch, E. C. Martin, and G. G. Philip.

Certificates were read for the second time in favour of Messrs. S. Greenberg, F. C. Ray, and G. C. Matthews.

Mr. S. G. Burgess was duly elected a Member.

The following papers were read and discussed:—

"Arsenic in printing ink," by T. Hedley Barry. Most of the printing ink pigments contain arsenic, and it is possible to classify them into three groups on the basis of the amounts of arsenic present. It is shown that a limit of one part of arsenic in 50,000 of the ink pigment should satisfy the most stringent requirements of health authorities, but this mode of expression is unsatisfactory,

and it would be preferable to fix a limit of arsenic per unit area of the printed paper or wrapping.

"The immersion refractometer and its value in the analysis of milk," by G. D. Elsdon, B.Sc., F.I.C., and J. R. Stubbs, M.Sc., F.I.C. In view of the importance which certain police courts, especially in the North of England, have attached to the application of the refractometric test in milk analysis, the authors have investigated the test. Part I of the paper is an examination of the Zeiss immersion refractometer from the point of view of its use for milk. In Part II experiments are quoted to show that the refraction of a milk serum apparently changes with two factors—the percentage of solids-not-fat and the acidity of the milk. The decreased refraction due to added water may be entirely masked by the souring of the milk: in fact, up to 10% of added water might be entirely overlooked in this way. Examination of about one thousand mixed milks, shows that the average refraction for milk serum, when the copper sulphate method is used, is about 38.3 scale divisions in the case of commercially fresh milks. The conclusion is drawn that the method offers no advantage over the usual determinations, and that it has certain drawbacks peculiarly its own.

"Irish moss mucilage and a method for its determination," by Paul Haas, D.Sc., and Barbara Russell-Wells. Irish moss or carrageen mucilage consists of a mixture of two etheral sulphates. These can be determined by precipitation with benzidine chloride and titration of the washed precipitate with standard sodium hydroxide solution. Free sulphates, if present, are first precipitated by adding excess of barium chloride. The method can be used for the determination of carrageen mucilage in the presence of gelatin, gum arabic, agar-agar, and fruit pectins.

ROYAL SOCIETY OF ARTS

On February 2, Mr. N. Evers, B.Sc., read a paper on "Chemistry and the supply of drugs." Mr. F. W. Gamble presided.

After tracing the early history of the application of chemistry to the supply of drugs, Mr. Evers said that the earliest attempts to modify the structure of natural products so as to produce a modified therapeutic effect were made on the alkaloids. Cotarnine was first made in 1844, whilst apomorphine, made in 1869, was probably the first instance in which an organic compound whose structure has been modified by chemical methods was used in medicine. Homatropine was discovered in 1880, and is a parallel example.

During the latter part of the pre-war period new synthetic drugs were appearing in great numbers. The war put a sudden stop to them, and created the necessity of manufacturing the few that were really indispensable in this country; incidentally the war taught us how many of them we could do without, and numbers of them have never returned to the market. The result has been that several of the more important are still made in this country, and as far as quality is concerned can hold their own, generally speaking, with the products of foreign factories.

Chemistry enters into the supply of drugs in several ways:—(1) The isolation of the active principles of

natural drugs. (2) The elucidation of the constitution of naturally-occurring compounds. (3) The synthesis of naturally-occurring compounds. (4) The preparation of drugs by the modification of the structure of naturally-occurring compounds with change in physiological action. (5) The preparation of synthetic drugs. (6) The preparation of inorganic drugs and chemicals in a state of purity. (7) The analytical control of the supply of drugs. (8) The preparation of drugs in suitable forms for administration.

The isolation of active principles includes compounds of widely-varying chemical character, such as alkaloids, glucosides and hormones. Generally speaking, the preparation of alkaloids from plant material is a simple matter. The determination of their constitution, however, is a much more difficult problem, and even to-day the structure of some of the best known, such as morphine, strychnine, and emetine, is still undecided. Many alkaloids have been synthesised. No alkaloid, however, has yet been prepared synthetically on a commercial scale at a price at which it can compete with the natural product. When we come to deal with glucosides we are faced with a much more difficult problem. Instead of dealing with readily crystallisable compounds which form numerous crystalline salts and compounds, as the alkaloids are, we are handling compounds which are not easily crystallised, which form few derivatives. They are usually present in very small proportion in plants. It often happens, too, that several glucosides of similar properties occur in the same plant. Their separation and the determination of their composition is, therefore, a matter of great difficulty. Some progress has, however, been made recently in this direction, and has disclosed the important fact that there probably exists a close relationship between the members of the group of glucosides known as the heart poisons.

The isolation of the hormones presents us with an even more difficult problem than that of the glucosides. The active principles are often present in extremely minute amounts; they are unstable and easily decomposed by heat or chemical action. The history of adrenalin[®] may be taken as a typical example. As far back as 1894 Oliver and Schäfer remarked the effect of an extract of suprarenal glands. From this time a preparation of the suprarenal gland was used to some extent in medicine, and several attempts were made to isolate the active principle until Takamine, in 1901, was successful. Pure adrenaline prepared from suprarenal gland then replaced the gland extracts, and following the synthesis of adrenaline, which was accomplished by Stolz in 1903, the synthetic product was finally placed on the market. It will be seen that three stages are involved: (i) the use of a crude extract; (ii) the use of the pure active principle prepared from the animal; and (iii) the use of the synthetic product. The active principle of the thyroid gland, thyroxine, is the only other hormone in which the three stages are anything like complete.

Insulin, the pituitary hormone, the parathyroid hormone, and the ovarian hormone are still in the first of the stages mentioned above, and although insulin has been prepared in a highly active condition, it does not appear that a definite chemical compound has yet been obtained.

Mr. Evers next discussed the vitamins and the preparation of derivatives of naturally occurring compounds (e.g., diacetylmorphine, homatropine, hydrastinine, etc.), and then passed on to consider the synthesis of compounds containing a group essential for a characteristic physiological action. Reference was made to the hypnotics of the barbitone or veronal type, the antipyretics phenacetin, antipyrin and aspirin, the antiseptics, and the organic derivatives of arsenic, antimony, mercury and bismuth.

But while these new drugs have roused new problems, the advances in chemical and physical science have enabled us to tackle problems connected with the older drugs. Only a few years ago the preparations of ergot on the market showed great uncertainty in their activity, but chemical and physiological investigation has so improved the methods of manufacture that now physiologically standardised liquid extract of ergot can be safely relied upon.

Not the least of the problems of the manufacturing druggist is concerned with the keeping properties of pharmaceutical preparations. Many of the old and popular preparations are made from formulae which were devised in the days when they were made in small quantities. When one comes to use the same formulae for making large batches of material to be distributed, not only in this country, but all over the world, and to be stored under all sorts of conditions of heat and cold, it is perhaps not surprising that troubles occur. Many of these early formulae were devised without any thought of the possible chemical reactions which might occur in them. It would require a brave chemist to suggest a formula containing both calcium hypophosphite and sodium citrate, but quite a number of formulae contain both—sometimes calcium citrate deposits, sometimes it does not, according to the temperature. It would require even more courage in the light of present knowledge to suggest a preparation containing pepsin in alkaline solution, but several such formulae are in use in spite of the fact that after a short time no pepsin remains.

The analytical control of the supply of drugs has developed extensively in recent years. To-day practically every drug that the pharmacist or medical man receives, provided it is from a firm of repute, has been checked by analytical methods before he receives it; not only is the finished product checked, but the raw materials have been checked by analysis, possibly two or even three times.

The variety of the materials used in pharmaceutical preparations is very great: a large pharmaceutical firm may easily have 1000 or more different drugs, chemicals, and their preparations, which have to be regularly examined. The analytical work, therefore, is much more complicated than in a laboratory when only a few preparations are tested. The research department, too, has a corresponding breadth of range. It must be prepared to tackle any question at a moment's notice. It must be in close touch with the latest researches in physiology and wide awake to the most recent methods in biochemistry.

We are now entering on a period which is perhaps the beginning of a change which will result in the complete shifting of the centre of gravity of the drug position. The introduction of the hormones is the beginning of a more rational use of drugs, but its extension will raise

more and more intricate problems for the chemist. The progress of chemotherapy will necessitate the synthesis of compounds of increasing complexity. The extension of the tendencies of modern therapeutics will require increasing co-operation between pharmacologists, physiologists and chemists, between our universities and research institutions and chemical manufacturers. The medical profession must be protected, and the public must be protected against the introduction of new drugs with exaggerated statements as to their efficacy. It is easy to imagine what would have happened after the discovery of insulin had the Medical Research Council not stepped in and ensured that the product was properly manufactured and carefully standardised. Variations in activity would undoubtedly have brought insulin into such disrepute that its value to-day would be greatly restricted, even if it had come into general use at all. The Therapeutic Substances Act, when it comes into force, should provide effective safeguards in this direction.

In spite of the change in our chemical industry brought about by the war, we are still woefully deficient in our production of synthetic drugs. The amount of research in this field in this country is small indeed, compared with the importance of the subject. This is not due to a lack of chemists: there are many able chemists in this country ready, were there only the opportunities, to use their knowledge in a branch of chemistry which is, after all, the one most likely to lead to results of lasting benefit to mankind.

INSTITUTE OF CHEMISTRY

At a meeting of the Leeds Area Section on January 24, Prof. J. W. Cobb, C.B.E., spoke on "The training of a fuel chemist." A summary of the lecture follows.

The conviction that our fuel supplies must be used efficiently and economically is becoming more firmly and generally established, with the result that probably no branch of chemistry provides better opportunities for the right type of man than fuel. These opportunities come, in the first instance, in connexion with the established carbonisation industries. The gas industry depends upon scientific practice both as to its main products, its by-products, and the proper utilisation of gas, coke, and tar when they are obtained. The development of the gas industry depends on a scientifically trained personnel more than any other single factor, and the coke oven industry is in a similar position. Moreover, the need for economy in fuel utilisation, the demands for liquid fuel, particularly motor spirit, the awakening of the public conscience to the evils arising from smoke, all make for the intervention of the scientifically trained fuel technologist.

The training necessary has to meet many requirements, and, if it is to be effective without requiring an inordinately long time, a careful selection has to be made of subject matter. It would be easy to say that such a training should include courses that would mean, in essence, the superposed training of a chemist, a physicist, and an engineer in a University, followed by works experience. Such a scheme, of course, is quite impracticable, and in any case would prove stultifying by inculcating too exclusively the attitude of the acquirer of knowledge and not sufficient of the necessary readiness

for independent action and making the best use of knowledge already acquired, which is characteristic of the best type of practical man.

The course in fuel or gas engineering as given by the University of Leeds may be used simply as a peg on which to hang further explanation of what is meant by the necessary selection which has to be exercised in framing the course of a fuel technologist. The lecture courses in the first year are given up entirely to chemistry, physics, and mathematics, with an introductory course in general engineering and a short course (one hour per week) in fuel. The second year develops chemistry and engineering further, and begins to deal with such special branches of physics and chemistry as come from the consideration of the properties of gases, thermal efficiencies, calorimetry, and pyrometry all of fundamental importance to the fuel technologist. The third year may be varied, but is substantially given up to the more specialised subjects of carbonisation, fuel, and gas engineering. Laboratory work during these three years is for the first half in chemistry in the chemical engineering and physical laboratories, and the second half in the fuel laboratories, where the special technique of the fuel chemist is learned in connexion with furnaces, refractory materials, pyrometry, calorimetry, gas analysis, the methods of testing gas appliances, and the like. Touch with the most modern practice is maintained by short lecture courses given on such subjects as coke oven practice, gas works' practice, distribution, benzole recovery, by outside lecturers engaged in those branches of work. Practice in exposition by the students is obtained at a weekly colloquium where new processes or researches are explained by the students themselves. Some work experience is obtained by the students during the long vacation by arrangement with gas works, coke oven plants, producer gas plants, although the first vacation course is usually spent at a general engineering works.

This three years' course leads to a degree or a diploma.

The fourth year course consists in carrying out under supervision some piece of allotted research work, and is really a training in research methods. That leads by thesis to an honours degree. At the end of three years the successful student is ready to take a works' post in the fuel industries, with a knowledge of the principles underlying the use of fuel and of the laboratory technique employed in fuel work, and with a knowledge of industrial processes which is useful from the beginning and completed by experience.

It can be maintained with confidence that a man so trained is likely to make good.

The fourth year training is not suitable for every student, and is only recommended for those who have some aptitude for research. When taken, however, it is particularly valuable, as experience has shown.

Such is the training in the Fuel Department of the University of Leeds. In the other Universities which set out to train fuel chemists the practice is somewhat different. At London, for example, the fuel training is entirely post-graduate, following upon the completion of a full degree course in science.

The fully qualified fuel chemist is now in great demand. His work is of an interesting character, while his opportunities are great, and likely to be greater.

CORRESPONDENCE

"MEASURING THE SIZE OF PARTICLES"

SIR, - In CHEMISTRY AND INDUSTRY of January 28, 1927, I notice a paper on "A method of measuring the size of particles."

In this paper the authors appear to base the whole method upon a principle which is contrary to all the ordinarily accepted laws of hydromechanics. They assume that the difference in pressure at two points in a liquid containing suspended particles is dependent upon the mass of the particles present in the liquid between the points. This is certainly not justified by ordinary experiment, and to convince myself of its inaccuracy I constructed a similar apparatus to theirs, only I substituted a solid mass of lead hung by a fine wire for the suspended powder. The level of the liquid in the two connected tubes was noted, both when the lead was placed above the connecting tube and below it. Not the slightest difference in the level of the liquid could be detected in the two cases. According to the authors, since the mean density of the mixture above the connecting tube was about twice as much in one case as in the other, there should have been a large change in level in the side tube.

The difficulty is in this case to explain the source of the variation in level observed by the authors. As, however, it only amounted to a few tenths of a millimetre, and required a considerable optical magnification for its measurement, it was probably caused by changes in temperature, which would alter both the volumes of the various parts of the apparatus and of the liquid and powder, and also the capillary corrections (which do not appear to have been taken notice of) sufficiently to account for the small movements observed.

T. H. LITTLEWOOD

PERSONAL AND OTHER ITEMS

The Government have nominated Sir Arthur Balfour, Sir A. Norman Hill, Mr. W. T. Layton, Sir Max Muspratt, and Mr. Arthur Pugh to attend the International Economic Conference at Geneva in May under the auspices of the League of Nations. They will not in any way bind the Government, and will not be qualified to act as spokesmen of an official policy.

The object of the International Economic Conference which has been summoned by the Council of the League of Nations to meet at Geneva on May 4 is to organise a general consultation in the course of which the various programmes and doctrines may be freely exposed without the freedom of discussion being restricted by any immediate necessity to transform the conclusions of the Conference into international engagements. Many documents have been prepared for the Conference, including an important memorandum on the chemical industry, which will be published by Constable and Co., Ltd., in March.

The Medal of the Institution of Mining Engineers has been awarded to Sir John Cadman in recognition of his distinguished services to the Institution and in the general advancement of mining engineering.

The Minister of Transport has appointed Sir James Devonshire, Mr. Frank Hodges, Sir James Lithgow, Alderman W. Walker, Sir Duncan Watson, Mr. W. K. Whigham, and Brevet-Col. the Hon. Vernon Willey to the seven places on the Central Electricity Board under the chairmanship of Sir Andrew Duncan.

Mr. W. J. S. Naunton, M.Sc., has been awarded the degree of Ph.D. in science by the University of London.

Dr. R. Raper, Dr. R. D. Haworth, and Dr. L. A. Sayce have been appointed lecturers in chemistry at Armstrong College, Newcastle-on-Tyne.

The prize of £30 from the Gordon Wigan fund for an investigation in chemistry has been awarded to Mr. W. A. Waters, B.A. (Caus).

Mr. R. K. Callow, B.A., B.Sc., has been elected to a senior scholarship at Christ Church, Oxford, for research in organic chemistry.

Plans are being made for the celebration of the centenary of Lister in London by a committee consisting of representatives of the Royal Society, the medical and surgical institutions, the Universities and other institutions interested. The executive committee includes Prof. Sir Ernest Rutherford, Sir Charles Sherrington, and Dr. H. H. Dale.

Dr. R. Adams, head of the Department of Chemistry at the University of Illinois, has been chosen as the recipient of the William H. Nichols Medal for 1927, on the basis of his work on "Acids of Chaubmoogra Oil and Related Compounds." The presentation of the medal will take place at a meeting of the New York Section, American Chemical Society, on March 11.

Mr. C. H. Crane, president of the St. Joseph Lead Company, has been re-elected president of the Mining and Metallurgical Society of America.

Dr. H. R. Kruyt, professor of physical chemistry at the University of Utrecht, will be the guest of honour at the Fifth National Colloid Symposium, which is to be held at the University of Michigan, June 22 to 24. Dr. Kruyt will remain in Ann Arbor during the Summer Session of the University and will give special courses in colloid chemistry.

Prof. A. A. Noyes, a past president of the American Chemical Society, and professor of physical chemistry at the Gates Chemical Laboratory of the California Institute of Technology, Pasadena, was elected president of the American Association for the Advancement of Science at Philadelphia during the last convention. Roger Adams, one of the most prominent members of the American Chemical Society and chairman of the department of chemistry of the University of Illinois, was elected chairman of Section C of the same organisation.

The King of Italy, through the Italian Ambassador at Washington, has conferred the Order of Officer of the Crown of Italy upon Dr. C. L. Parsons, Dr. H. E. Howe and Mr. A. Seidell, in recognition of their activities in promoting international good-will through the medium of chemistry.

The late Lord Bearsted, founder of the Shell Company, left unsettled estate valued, provisionally, at £4,000,000.

The late Mr. C. A. Johnstone, of Whaley Bridge, manufacturing pharmaceutical chemist, left £22,006 (net personalty, £21,823.)

The death has occurred, at the age of 72, of Mr. Thomas Murdoch, a prominent figure in the bleaching industry.

The late Mr. E. S. Moore, J.P., founder of the Midland Vinegar Co. (now H.P. Sauce, Ltd.), left £615,769, with net personalty £609,760.

The death is announced, at the age of 85, of Mr. John Varley, a director of the Neuchatel Asphalte Co.

Fuel Problems

An important joint meeting of the Fuel Section and the Yorkshire Section has been arranged to take place at Leeds on February 28, when subjects such as the scaling of steel, the manufacture of water-gas, coke formation, coke in relation to its uses, and the combustion of cokes will be discussed in comprehensive papers. A full notice of the meeting will be found on page 125

Ephedrine

Considerable interest has been aroused by recent reports upon the use of the alkaloid, ephedrine ($C_{10}H_{15}ON$) and its salts in the treatment of asthma, for low-blood pressure in pneumonia, and so on. Ephedrine and its salts are stated to resemble adrenalin in character and action, but possess the advantage that they produce a more persistent effect, whether administered orally or hypodermically. Through the courtesy of the British Drug Houses, Ltd., we have received samples of B.D.H. ephedrine hydrochloride put up in $\frac{1}{2}$ gr. (0.032 g.) tablets for oral administration, as well as in ampoules for hypodermic use in the strength of $\frac{1}{2}$ gr. per cubic centimetre. This alkaloid has been made in the laboratories of the British Drug Houses for some months past, and the firm is now manufacturing the pure hydrochloride on a commercial scale from the Chinese plant, Ma Huang (*Ephedra vulgaris*).

Presentation to Mr. John Allan

A pleasant function took place at the Mitre Hotel, Manchester, on Wednesday evening, February 9, when Mr. John Allan was presented with a gold cigarette case by his many friends who were former students at the College of Technology attending his oils and fats classes. Mr. Allan had been associated with the college for over 30 years. The inscription upon the cigarette case was as follows:—

Presented to John Allan, Esq., as a token of respect and esteem by his friends, members of his classes in oils and fats at the College of Technology, Manchester, February 9, 1927.

The presentation was the result of a very earnest desire to show appreciation of the work of Mr. Allan and a token of regret at the severance of his connection with the college, rendered necessary by his increasing business interests. The presentation was made by Mr. L. Guy Radcliffe, M.Sc., the Chairman of the Manchester Section of the Society of Chemical Industry.

Helium or Helion?

In a letter published in *Nature* of February 5, Dr. J. Newton Friend invites opinions as to the desirability

of changing the name of element No. 2 from helium to helion. This element, writes Dr. Friend, was christened at a time (1865) when its existence was recognised on the strength of the D_3 line in the chromosphere, and when, in view of the proximity of this line to the D lines of sodium, it appeared not improbable that it was a metal. Now that helium has been isolated and even solidified, we know that it is typically non-metallic like argon and the other inert gases, and now placed in group 0 of the periodic system. Its present name, therefore, is anomalous.

International Coal Conference

The published proceedings of the International Conference on Bituminous Coal held under the auspices of the Carnegie Institute of Technology from November 15 to 18, 1926, will be available sometime during February or March, according to an announcement from the Carnegie Institute of Technology. The book will contain the full reports of about 43 papers read at the conference, the discussions, and the list of delegates. Orders for copies of the published proceedings should be sent to Arthur C. Jewett, Director of the College of Industries, Carnegie Institute of Technology, Pittsburgh, Pa. The price is \$7.00 a copy.

Pulp and Paper in Canada

The Crown-Willamette Paper Co. of San Francisco is to build one of the largest pulp plants in the world on Vancouver Island. The plant will cost £10,000,000, and will have a capacity of 1000 tons a day. Power is to be obtained from the Campbell River Falls.

Laboratory First-Aid Chart

In order to minimise the consequences of laboratory accidents, the Committee on Safety and Safeguards of the Department of Chemistry of the College of the City of New York has prepared a list of procedures for the treatment of victims of such accidents. This list considers the ordinary injuries likely to be met with in laboratories, and gives detailed directions for the treatment of poisoning by various materials used by workers with chemicals. The chart is to be published by the Fischer Scientific Co., Pittsburgh.

Chilean Nitrate

It is understood that two German producers, with quotas of about 4,500,000 quintals, and the Anglo-Chilean Nitrate Corporation, which is believed to have been offered a quota of about 4,250,000 quintals, have given notice to the Producers' Association of their intention to withdraw from the present system of controlled selling at June 30, 1927. As this withdrawal represents about 16% of the Associated Producers, the withdrawal of another 4% of the associates would, according to Messrs. Aikman (London), Ltd., make free selling practically certain.

Potash Discovery in the United States

The U.S. Department of the Interior announces the discovery of potash beds in Eddy County, New Mexico, thick enough, rich enough, and near enough to the surface to be mined, if the extent of the beds and the conditions affecting marketing are favourable. Ten groups of beds of commercial interest have been discovered by core tests. Polyhalite is the most

abundant potash mineral, but four beds of sylvite and a bed of langbeinite (with associated kainite and halite) are potentially workable.

A New Cracking Process

The U.S. Bureau of Mines announces that two members of its staff, Messrs. C. P. Bowie and M. J. Gavin, have invented a new cracking process which, it is claimed, should greatly extend the life of the oilfields of the United States, because, unlike other processes, it is applicable to heavy oils, oil shales, oil sands and tars. With present methods, petroleum fields are abandoned whilst still containing large proportions of oil, a waste which, states the New York correspondent of *The Times*, should be largely prevented by the new process.

The U.S. Glass Industry

The control of the Libbey-Owens Sheet Glass Co., of Toledo, Ohio, has been acquired by a group including the Somet-Solvay Co. of Belgium and certain financial interests. The Libbey-Owens company owns considerable interests in other glass-making concerns, including the Compagnie Internationale pour la Fabrication Mécanique du Verre, which was organised to develop the Libbey-Owens process in Europe, and operates a factory at Moll, in Belgium.

The Fixed-Nitrogen Industry

It is announced that the I.-G. has begun a lawsuit against the Gewerkschaft der Steinkohlenzeche Mont Cenis for alleged infringement of the Haber-Bosch patents owned by the I.-G. for the synthesis of ammonia. At present the capacity of the Mont Cenis process (cf. CHEM. AND IND., Feb. 4, p. 109) is believed to be roughly 1000 tons of fixed nitrogen annually, but the necessary hydrogen is recovered from coke-oven gas more cheaply than by the I.-G., the plant owned by the Rombacher Hüttenwerke and produced by the Linde Eismaschinen company being used. It is noteworthy that the basic Haber-Bosch patent expires in 1928.

The German Dye Trust

Much interest has been aroused by the introduction of the new compound fertiliser "Nitrophoska" by the I.-G., as the question of the supply of both phosphates and potash becomes important. Certain low-grade deposits of phosphate rock are available in Germany, and if this could be utilised instead of imported phosphate a definite advance would be made. Apart from phosphate, however, the success of the new fertiliser will depend upon the attitude of the Potash Syndicate, which, it is believed, is unwilling either to allow the I.-G. to sell "Nitrophoska" abroad in competition with potash fertilisers or to submit to dictation from the I.-G.

The I.-G. has acquired 50% of the shares of a Spanish company, the Fabricación Nacional de Colorantes y Explosivos, which was formed to render Spain independent of foreign supplies of dyes and explosives.

Rumours have been prevalent in Berlin of negotiations between the I.-G. and the General Electric Company for the formation of a German-American combine.

A large factory is being built by the I.-G. at Merseburg for the manufacture of synthetic liquid fuel from lignite at the rate of 120,000 tons yearly, and a new nitrate factory is being built close by, whilst the capacity of the ammonia works is to be increased by at least 50%.

REVIEWS

A STUDENT'S MANUAL OF ORGANIC CHEMICAL ANALYSIS, QUALITATIVE AND QUANTITATIVE. By Prof. J. F. THORPE, C.B.E., D.Sc., F.R.S., and MARTHA ANNIE WHITELEY, O.B.E., D.Sc. Re-issue with an Appendix on new methods of organic analysis, by H. T. MEULEN and J. HESLINGA. Pp. x+250. London: Longmans, Green & Co., Ltd., 1926. Price 9s. net.

The first seven divisions of this book, which deal with detection of elements, purification, ultimate analysis, reactions of commoner compounds, detection and estimation of radicals and systematic examination and the ultimate analysis of organic compounds by micro-analytical methods, are an unaltered re-issue of a volume reviewed in *CHEMISTRY AND INDUSTRY* of May 1, 1926, and need not be further referred to. There has now been added, however, a second Appendix on "New methods of organic analysis," by H. Ter Meulen and J. Heslinger. Some of these methods were demonstrated at the meeting of the British Association in 1926; and this collection of the contents of a number of papers by these authors should prove very convenient to chemists whose work requires special methods.

Carbon, hydrogen and nitrogen are estimated by combustion, manganese dioxide being used as an oxidising agent; the method being modified to suit substances containing halogen, sulphur or nitrogen. The direct estimation of oxygen in different classes of compounds, as well as the estimation of nitrogen by hydrogenation are described. Similarly the method of estimation of sulphur by hydrogenation, with a special colorimetric method for very small quantities, is described; as also the estimation of sulphur in petroleum products by combustion; the estimation of chlorine, bromine and iodine, both by hydrogenation, and by combustion with iron oxide. The estimation of arsenic by heating an organic compound containing the element in a current of hydrogen, the arsenic being ultimately weighed as such, is also given, as well as a somewhat similar one for the estimation of mercury.

These novel methods of analysis should prove very interesting as well as suggestive to any engaged in this branch of chemical work. T. S. PATTERSON

PRACTICAL COLLOID CHEMISTRY. By WOLFGANG OSTWALD, with the collaboration of DR. P. WOLSKI and DR. A. KUHN. Translated by J. N. Kugelmass, M.D., Ph.D., and T. K. Cleveland, Ph.D. Pp. xvi + 191. London: Methuen & Co., Ltd., 1926. Price: 7s. 6d.

The first German edition of this well-known "Praktikum" appeared in 1920, since when it has been re-issued several times, and also been translated into French. The number of experiments has now grown to 183, and in performing them the student is introduced to the special technique of colloid chemistry. Naturally, in such a small space it is not possible for the instructions to be very detailed—a distinct disadvantage to the beginner, who does not take the precautions which experience renders almost subconscious; but to the

student working under supervision and to the teacher with little time at his disposal for the rehearsal of exercises, the abundance and variety of material is a great advantage. The whole field of colloid chemistry is covered with a thoroughness and impartiality which reflect the wide interest and enthusiasm of Prof. Ostwald for the science which owes so much to him.

The book, indeed, is so valuable that it is a pity it is so badly translated. It is, perhaps, optimistic to hope for sound English style in a laboratory manual of this kind, but the language should at least be intelligible, and the statements of fact correspond to those in the original. Even Thomas Graham would hardly recognise the method given for the preparation of a ferric hydroxide sol attributed to him: "To a half saturated solution of FeCl_3 add gradually a 2N $(\text{NH}_4)_2\text{CO}_3$ solution until the resulting precipitate continues to dissolve on stirring. Dialyse preferably by warming." Again, as an introduction to the "so-called ultramicroscopic phenomena," the following cryptic statement is given: "According to the theory of microscopy, particles appearing geometrically similar are greater than the wave-length of light to which they are exposed", while the summary of the properties of colloidal particles given on page 186 should deceive all but the very elect. Besides the many curious misrepresentations of which the above are typical, there are a few errors which one can attribute to the printer. There is no index, though a full table of contents fulfils some of its functions.

P. C. L. THORNE

THE DISPENSATORY OF THE UNITED STATES OF AMERICA. Twenty-first edition, thoroughly revised, largely re-written and based upon the 10th revision of the U.S. Pharmacopœia, National Formulary, 5th edition, and the British Pharmacopœia, 1914. By H. C. WOOD, JR., M.D., C. H. LA WALL, Ph.M., D.Sc., Ph.D., H. W. YOUNGKEN, Ph.M., Ph.D., J. F. ANDERSON, M.D., and I. GRIFFITH, Ph.M. Pp. xxx+1792. London: J. B. Lippincott Co., 1926. Price 65s. net.

This book was first published in 1833, and in the course of its ninety-four years of existence has seen five eminent editors retire from the task of keeping it up-to-date. Its primary function is to provide the English-speaking pharmacist with all the information he requires about drugs, and particularly those recognised in the pharmacopœias of Great Britain and the United States. At one time the United States was the sole source of supply of such literature, but in 1907 the Pharmaceutical Society of Great Britain became a competing producer with the British Pharmaceutical Codex, which is described in the sub-title as an Imperial Dispensatory. While such books appeal mainly to pharmacists, medical men and public analysts, they are also of interest to chemists engaged in the investigation of plants and their constituents, for it so happens that much of our knowledge of this branch of chemistry has arisen directly or indirectly from the use of plants in medicine.

The monographs in this new edition of the *Dispensatory* keep the needs of these various classes of readers

well in view. They give on the whole a fair, accurate and readable statement of our present knowledge of drugs. They might sometimes be more useful by being more critical, and they contain a few statements whose accuracy is traditional rather than real. In a book covering such a wide range as that of ancient and modern drugs, minor defects such as these are inevitable, and anyone possessing special information will have no difficulty in finding points for comment in the monographs in which he is specially interested. Thus the monograph on aconite is probably good enough for ordinary purposes, but it says nothing about the important work done recently on Japanese aconites, and states wrongly that *Aconitum palmatum* contains atisine, quoting a reference in support of this which relates not to *A. palmatum* but to *A. heterophyllum*. The information given regarding Persian and Indian opiums could have been usefully supplemented in many ways by someone acquainted with the literature available on these subjects in Great Britain and India. It would probably be difficult to find a medical man in England to confirm the statement that chaulmoogra oil is very widely used in this country as a counter-irritant.

The reviewer would not willingly do anything to discourage the editors from inserting information about many of the useless things that have been, and for that matter still are, used as drugs, but some of these things might be given shorter shrift and the space saved, used for fuller information regarding more important products. For example, it does not seem reasonable in the twentieth century to devote nearly three pages to what the editors themselves regard as a discredited drug, sarsaparilla, and only one to insulin.

Most of the recently introduced drugs are referred to, but the use of suspensions of metallic bismuth for the treatment of syphilis seems to have escaped attention, for it is stated that "bismuth is not used in medicine in an uncombined state."

The book has been carefully edited on the whole, and is well indexed. For its size it is remarkably cheap, especially when compared with some technical books issued recently in this country. The editors are to be congratulated on the successful accomplishment of a difficult and onerous task.

T. A. HENRY

NEW CONCEPTIONS IN COLLOIDAL CHEMISTRY. By HERBERT FREUNDLICH, Ph.D. Pp. viii + 147. London: Methuen & Co., Ltd., 1926. Price: 6s.

The German edition of this collection of lectures was reviewed by the present writer in this JOURNAL during last year (see p. 629); it is very convenient to have an English version. It forms a supplement to the other works of Prof. Freundlich which have now been translated, and it must be confessed that this volume, prepared by the author himself, compares very favourably with translations made by others. A few of the page headings do not clearly convey the contents of the chapters, but apart from this and a few other minor matters, the conception and execution of the book call for nothing but praise.

P. C. L. T.

COMPANY NEWS

GAS LIGHT & COKE CO., LTD.

The 220th ordinary general meeting was held on February 4, Sir David Milne-Watson (the Governor of the Company) presiding. He expressed regret at the resignation of Mr. Godlee from his directorship, owing to ill-health. The directors did not propose to fill the vacancy. Mr. Henry Woodall had been elected as Deputy-Governor in place of Mr. Godlee. The past year had been a most difficult one for all the industries of the country. In anticipation of the possibility of a coal stoppage occurring, the company had accumulated good supplies of coal at its works, and when the coal strike started there was a stock equal to two months' normal consumption. With this supply, and by increasing the make of carburetted water-gas, the company was able to carry on for some time beyond the two months, but as it became more and more apparent that the stoppage was going to be a long one, it was forced to buy foreign coal, which, at one time, rose to as much as 90s. per ton. Although the strike ended on November 30, it was not until the middle of December that the company received its first supplies of contract English coal, the fields from which it mainly received its coal - namely, Durham and Yorkshire - being among the last in which work was resumed. In the depth of winter the company used nearly 70,000 tons of coal a week. It was found necessary to increase the price of gas from September by 0.2d. per therm. or 1d. per 1,000 cb. ft., and again in October by 1d. per therm. or 5d. per 1,000 cb. ft., followed almost immediately by another increase of 1d. per therm. From March next the price will be reduced by 1.4d. per therm. or 7d. per 1,000 cb. ft., and it was hoped that by the end of the year the price would be normal. The coal stoppage had cost the company an extra £2,400,000 for coal, against which £500,000 would be got back in increased prices of coke and other residuals, leaving a net burden of £1,900,000. The chairman then referred to the accounts (cf. CHEM. AND IND., Feb. 4, 1927, p. 110). The revenue received from sulphate of ammonia was about £28,000 less than in 1925, due to the lower price received from the product, brought about by the over-production of nitrogen in the world. He did not see any prospect of a change for the better in the position as regards prices. During the year the company raised £1,642,770 5% redeemable debenture stock at 97½% for the purpose of expanding the business. At the end of 1925 it applied to the Board of Trade for an increase in the standard price of gas, and, after an inquiry, the standard price was raised from 11d. to 11.4d. per therm. The company had also promoted a Bill, which received the Royal Assent in August last, by which the borrowing powers of the company were increased by over £4,000,000 and a minimum dividend had been obtained of 5% in respect of the ordinary stock. Referring briefly to the Electricity Bill, the chairman said that if gas undertakings did their duty by the public and saw that the supply of gas was always satisfactory, there would be little to fear from the shareholders' point of view as to the future. In July last their Majesties the King and Queen visited the Beckton works of the company to inaugurate the new coal-handling plant,

which is the largest coal unloading plant in the world, and is capable of dealing with 2000 tons an hour. The President of the Board of Trade, Sir Philip Cunliffe-Lister, and Lady Cunliffe-Lister, inaugurated the new coal-handling plant at Fulham, where a wharf has been constructed at which coal is unloaded from the company's own steamers. Two ships were already running there, and a third was being built. A very large economy was effected by bringing coal up the Thames by steamer direct to Fulham and not having to transfer the coal to barges at Beckton. The company was also indebted to Sir George Hume, chairman of the London County Council, for opening the new premises at Nine Elms—called Watson House—to be used as training shops for fitting gas apparatus. The amalgamation with the Brentford Gas Co. was completed on January 1, 1926, and steps were being taken to improve the supply of gas generally in the Brentford district. With regard to the general industrial position, there was no doubt that the events of the past year had dealt a very serious blow to the trade of the country, and innumerable associations and societies were being formed with the object of promoting peace and goodwill in industry, but it was desirable for each business to try to solve the problem for itself. The company had successfully done its best to secure industrial peace. In 1909 its co-partnership scheme was started, and there were now 11,500 co-partners holding over £600,000 of the company's ordinary stock. At the conclusion of the chairman's address, Mr. Henry Woodall (deputy-governor) mentioned that this was the first time the Governor had addressed the meeting under his new title of Sir David Milne-Watson, and said how much appreciated this honour was, not only by Sir David's many friends, but by the gas industry generally and by the staff and workmen.

COMMERCIAL GAS CO., LTD.

The accounts for 1926 show a profit of £132,041, plus £39,436 brought forward, compared with a profit of £139,810 for 1925. After payment of the various dividends for the June half-year, there remained £93,722. Dividends have been recommended for the December half-year at the rates of £5 6s. 8d. % per annum on the 1% stock and £5 3s. 4d. % per annum on the 3½% stock, both less tax. Notwithstanding the prolonged coal stoppage, the supply of gas in the company's area was fully maintained as regards quality and pressure. Owing to pressure of other engagements, the Hon. Kenneth Mackay has found it necessary to resign his seat on the Board, and Dr. Charles Carpenter, C.B.E., M.Inst.C.E., has been elected to the vacant directorship.

PINCHIN, JOHNSON & CO., LTD.

This well-known firm of varnish, colour, paint and enamel manufacturers, have entered into an agreement whereby the business of the old-established and highly successful paint and varnish firm of Docker Bros., of London and Birmingham, will be associated with them as from January 1, 1927. The business of Docker Bros. will be carried on as a separate concern, under the chairmanship of Mr. Docker. The directors feel that the association of interest will be of the greatest benefit to the business, and anticipate a materially increased

earning capacity. The agreement provides for the issue of ordinary shares to the vendors of Docker Bros., and an extraordinary general meeting of the ordinary shareholders will be held to pass a resolution authorising the proposed increase of capital. The usual dividend has been declared by the company at the rate of 6½ % per annum, less tax, on the preference shares for the six months to December 31, payable on January 1, 1927.

UNITED ALKALI CO., LTD.

A dividend of 10% on the ordinary shares has been declared for the past year, being the same as for the previous year.

BRITISH PHOTOGRAPHIC INDUSTRIES, LTD.

A meeting has been held on February 9 to consider proposals for the reorganisation of the capital. The scheme involves the elimination of £266,667 of the present capital by writing down the nominal value of the ordinary shares from £1 to 6s. 8d. each. The preference shares will remain as at present, but the preference shareholders will be asked to cancel all arrears of dividends up to the end of last year, and in consideration to receive an allotment of two ordinary shares for every five preference shares held. Allowing for the allotment of 150,320 ordinary shares of 6s. 8d. to the preference shareholders, the net reduction in the issued capital will amount to £216,560, of which £110,586 is in respect of such items as goodwill, premium on shares, etc., and £21,000 stamp duty etc. The balance of £84,971 will be applied to writing down other assets of the subsidiary companies, and writing off all balances standing to the debit of profit and loss accounts of those companies. The share capital of the company will then be entirely represented by actual assets held by the subsidiary companies (which are wholly owned by the parent company), excepting only £65,000 goodwill. The directors consider that profits are now being earned sufficient to justify the payment of dividends, and the object of the scheme is to get rid of the accumulated losses of recent years, so that these profits may be available for dividend purposes.

ALLIED CHEMICAL AND DYE CORPORATION

This American corporation has organised the Semet-Solvay Engineering Corporation to operate the engineering and constructional departments of the Semet-Solvay Co. (a subsidiary) and the recently acquired Steere Engineering Co.

ASSOCIATED FIRECLAY CO., LTD.

A final dividend is proposed of 4%, free of tax, on the ordinary shares, making 8% for the year, carrying forward £11,358.

BEMBERG ARTIFICIAL SILK CO.

The net profit for the year to September 30, 1926, was 1,600,000 marks (about £80,000), out of which a dividend of 8% will be paid. New investments during the year amounted to 2,800,000 marks, and 1,670,000 marks were applied to different settlements. A new factory has commenced work in America, whilst two others in Germany will start work in the near future, the funds for these extensions having been secured in the form of a long term foreign loan of 6,200,000 marks.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit.—61 O.P.—Industrial, 2s. 5d.—2s. 70d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3¾d. per lb. ex whf. Lond. in owt. kegs.
 Salammiac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-owt. iron drums included.
 Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-owt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
 Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—2s. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 2d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 per ton. Scarce. Grey, £17 5s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£8 5s.—£10 per ton and upwards, according to grade and locality. Very scarce and fair demand.
 Iron Liquor.—1s. 6d. per gal. 32° Tw.; 1s. 2d. per gal. 24° Tw.
 Red Liquor.—10d.—11d. 16° Tw. per gal.
 Wood Creosote.—2s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 10d.—4s. per gal., 60% O.P. Solvent, 4s. per gal., 40% O.P.
 Wood Tar.—£4—£5 per ton and upwards, according to grade.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals, 6½d. per lb. Crude 60's, 1s. 8½d.—1s. 9½d. per gal.
 Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 1d. per gal. Pale, 95%, 1s. 10d.—2s. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 3d.—1s. 4d. per gal., ex works in tank wagons; Standard motor. 1s. 11d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 2d.—2s. 5d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 11½d. to 2s. 3d. per gal. Firm. Puñe, 2s. 2½d.—2s. 6d. per gal.
 Xylol.—2s. 3d.—2s. 6d. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal.
 Naphtha.—Crude, 9½d.—1s. 0½d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, 1s. 10d.—1s. 11d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s. per ton.
 Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—110s.—120s. per ton, f.o.b. according to district. Prices nominal.
 Pyridine.—90/140.—9s. 6d.—17s. per gal. Nominal. 90/190 —7s. 6d. per gal. Heavy.—7s.—70s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered price include packages except where otherwise stated.
 Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d.—4½d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 11d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£30 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4d.—2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 3½d. per lb. Less 5%. Market still weak.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d. 1s. 5d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 0½d. per lb. Less . Very firm market.
 Amidol.—9s. 6d. per lb. d/d.
 Acetanilide.—1s. 7d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Aspirin.—2s. 4d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 4d.—2s. 5d. per lb. Potassium.—1s. 11d.—2s. per lb. Sodium.—2s. 2d.—2s. 3d. per lb. All spot.
 Calcium Lactate.—1s. 4d.—1s. 5d. per lb.
 Chloral Hydrate.—3s. 3d.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—6s. 6d.—7s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 8d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green. 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £33 per ton net.
 Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.
 Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig. 6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 3d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—15s. 6d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. 9d.—4s. per lb.
 Phenazone.—5s. 9d.—6s. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 86s. per cwt., less 2½% for ton lots. Dearer.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferriyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—10s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6½d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s.—4s. 3d. per lb. spot.
 Saccharin.—55s. per lb.
 Salol.—3s.—3s. 3d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—77s. 6d.—82s. 6d. per cwt. net, according to quantity.

Sod. Salicylate.—Powder, 1s. 9 $\frac{1}{2}$ d.—1s. 10 $\frac{1}{2}$ d. per lb.; Crystal 1s. 10d.—1s. 11d. per lb.
 Sod. Sulphide.—Pure reocryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—10s. 6d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
 Thymol, Puriss.—11s. 9d.—13s. 9d. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
 Aubepine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—11s. per lb.
 Citronellol.—15s. per lb.
 Citral.—9s. 6d. per lb.
 Ethyl Cinnamate.—10s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—9s. 6d. per lb. Geraniol (*Palmarosa*).—19s. per lb.
 Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Shui Oil*) 12s. per lb.—(*ex Bois de Rose*) 16s. per lb.
 Linalyl Acetate.—(*ex Shui Oil*) 14s. 6d. per lb.—(*ex Bois de Rose*) 18s. per lb.
 Methyl Anthranilate.—9s. per lb.
 Methyl Benzoate.—4s. 6d. per lb.
 Musk Ketone.—36s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—11s. per lb.
 Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—19s. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—11s. 3d. per lb.
 Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb.
 Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 20s. 9d. per lb. Lemon.—9s. 6d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. per lb.
 Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 22s. per lb. Japanese, 8s. 9d. per lb.
 Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than April 2nd. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Feb. 17th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Baily and Noel, Centrifugal separators etc. 2058. Jan. 24.
 Davenport, and Sumner, Ltd. Lubricating compound. 2477. Jan. 28.
 Garland, Edge filtration. 2548. Jan. 28.
 Gas Light and Coke Co., Hollings, Pexton, and Voss. Adsorption treatment of fluids. 2264. Jan. 26.

Kunstharzfabrik Pollak. Working up powders into artificial compositions. 2594. Jan. 28. (Austria, 15.5.26.)
 Levy. Granules for absorption of gases. 2206. Jan. 25.
 Mabag Maschinen u. Apparatebau A.-G., and Neuss. Degasification of liquids etc. 2451. Jan. 27.
 Morcier. Condensation of vapours etc. 2270. Jan. 26. (Fr., 26.1.26.)
 Pike. Drying-apparatus etc. 2427. Jan. 26.
 Soc. Electro-Mécanique d'Appareillage pour l'Essence. Protective linings for tanks. 2590. Jan. 28. (Belg., 31.12.26.)
 Webster, Kilns. 2354. Jan. 27.
 Wildermann. Filter presses. 2026. Jan. 24.

II.—Complete Specifications

22,415 (1925). Neeley and Watkins. Preventing and removing scale and incrustation in boilers. (264,551.)
 25,202 (1925). Crowther. Furnaces. (264,500.)
 26,315 (1925). Hazeldon. Distillation plants. (264,501.)
 26,507 (1925). Silica Gel Corp. Adsorbing a gas or vapour from mixtures thereof. (257,879.)
 12,294 (1926). Patart. Carrying out gaseous catalytic reactions at high temperature and pressure. (252,362.)
 15,045 (1926). Nestlé and Anglo Swiss Condensed Milk Co. Atomising and desiccating liquids. (257,893.)
 18,139 (1926). Still and Kuhn. Distillation and like columns. (264,735.)
 31,062 (1926). Svensson and Norling. Centrifugal separating-machines. (264,777.)
 *975 (1927). Bojner and Pehrson. Heating the charge in rotary furnaces. (264,825.)
 *1544 (1927). Staatliche Porzellan-Manufaktur. Suction filters. (264,838.)
 *1657 (1927). Heppner. Absorbent materials for storing explosive combustion gases. (264,846.)
 *1769 (1927). I.-G. Farbenind. Converting insoluble substances into a state of aqueous solution or suspension. (264,800.)

II. Applications

Carpmael (I.-G. Farbenind.). Activation of carbon etc. 2103. Jan. 24.
 Chavanne. Gasification of solid fuels. 2313. Jan. 26.
 Denham, and Simon, Ltd. Grading coal. 2660. Jan. 29.
 Espes. Apparatus for detecting carbon monoxide. 2312. Jan. 26. (Fr., 26.1.26.)
 Gaertner. Converting coal into hydrocarbons. 2425. Jan. 27. (Ger., 18.2.26.)
 Hoyois. Washing coal etc. 2294. Jan. 26. (Belg., 26.1.26.)
 Johnson (I.-G. Farbenind.). Treatment of hydrocarbons with electric arcs. 2055. Jan. 24.
 Nastukoff. Treating petroleum. 2569. Jan. 28.
 Ramsay. Distillation of carbonaceous material. 2022. Jan. 29.
 Tormin. Carbonising coal. 2574. Jan. 28.

II.—Complete Specifications

20,808 (1925). Millard, Atkinson, Coulter, and South Western Engineering Corp. Distilling hydrocarbons etc. and fractionally condensing the vapours. (264,549.)
 30,505 (1925). Bollmann. See XII.
 5268 (1926). Petroleum Chemical Corp. Preparation and treatment of olefines. (248,375.)
 13,660 (1926). Barbier, Benard, & Turenne. Manufacture of oil gas. (260,215.)
 *28,894 (1926). Verein f. Chem. u. Metallurg. Produktion. Re-activating exhausted pulverulent decolorising charcoal. (264,799.)
 *1364 (1927). I.-G. Farbenind. Manufacture of unsaturated hydrocarbons. (264,827.)
 *1627 (1927). I.-G. Farbenind. Conversion of pressed hydrocarbons, in gas or vapour form, esp. for research into valuable compounds. (264,845.)
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 er and general factory

*1637 (1927). Heppner. *See* I.

*1746 (1927). Smit. Adsorption charcoal. (264,854.)

III.—Complete Specification

*892 (1927). Soc. Anon. La Trinidad. *See* IX.

IV. Applications

Brit. Dyestuffs Corp., Ltd., Chorley, Hollins, and Lippworth. Production of stable diazo compounds. 2556. Jan. 28.

Gegy A.-G. Dyestuffs. 2209. Jan. 26. (Ger., 28.1.26.)

L.-G. Farbenind. Manufacture of monodiazocompounds of 1:4-diamino-anthraquinone-mono- or di-sulphonic acids. 2047. Jan. 24. (Ger., 25.1.26.) Manufacture of phthaloyl 1:2:3-thionaphthene etc. 2186. Jan. 25. (Ger., 29.1.26.) Manufacture of isatins etc. 2553. Jan. 28. (Ger., 28.1.26.) Manufacture of dyestuffs. 2667. Jan. 29. (Ger., 29.1.26.)

Schmidt. 2081. *See* VI.

Scottish Dyes, Ltd., Drescher, and Thomas. Production of dyestuff intermediates. 2565. Jan. 28.

Scottish Dyes, Ltd., Hookey, and Thomas. Production of dyestuffs etc. 2661. Jan. 29.

IV.—Complete Specifications

20,808 (1925). Millard, Atkinson, Coulter, and South Western Engineering Corp. *See* II.

25,322 (1925). Johnson (Badische Anilin & Soda Fabrik). Manufacture of vat colouring matters of the anthraquinone series. (264,561.)

29,189 (1925). Johnson (Badische Anilin & Soda Fabrik). Manufacture of vat dyestuffs. (264,631.)

*2047 (1927). L.-G. Farbenind. Manufacture of monodiazocompounds of 1:4-diaminoanthraquinone-mono- or di-sulphonic acids. (261,879.)

V. Applications

Drepper. Manufacture of viscose solutions. 2004. Jan. 24.

Fawcett. Recovery of grease from wool washing liquors. 2321. Jan. 26.

Syntheta A.-G. Manufacture of artificial silk. 2413. Jan. 27. (Switz., 4.2.26.)

V.—Complete Specifications

26,369 (1925). Thorne. Bleaching cellulose pulp and similar fibrous materials. (264,596.)

26,378 (1925). Carbide & Carbon Chemicals Corp. *See* XX.

*31,264 (1926). L.-G. Farbenind. Production of fibre half-stuff. (264,803.)

VI.—Applications

British Alizarine Co., Ltd., Davies, Goodall, and Nichol. Dyeing wool etc. 1997. Jan. 24.

Schmidt. Production of aniline black etc. 2081. Jan. 24.

VI.—Complete Specification

26,369 (1925). Thorne. *See* V.

VII.—Applications

Rosenheim. Increasing base-interchange capacity of glauconite etc. 2452. Jan. 27. (Ger., 4.2.26.) Production of base-interchanging substances. 2453. Jan. 27. (Ger., 16.2.26.)

Rütgerswerke A.-G. Working up fluorides containing silicic acid. 2202. Jan. 25. (Ger., 31.5.26.)

Thiemann (L.-G. Farbenind.). Production of phosphorus. 2044. Jan. 24.

VII.—Complete Specifications

14,273 (1926). Roessler & Hasslacher Chem. Co. Manufacture of sodium monoxide. (264,724.)

14,572 (1926). Soc. d'Etudes Minières & Industrielles. Manufacture of ammonia. (253,540.)

*895 (1927). Aluminum Co. of America. Production of sodium aluminate. (264,823.)

*1606 (1927). Montecatini Soc. Gen. per l'Ind. Mineraria ed Agricola, and Klein. Manufacture of sulphuric acid. (264,840.)

*1850 (1927). Krebs. *See* XI.

*1876 (1927). Stockholms Superfosfat Fabriks Akt. *See* XVI.

VIII.—Complete Specifications

18,679 (1925). Jackson (Hartford-Empire Co.). Lehrs for annealing glassware. (264,446.)

7050 (1926). Hartford-Empire Co. Annealing of glassware. (250,201.)

*1845 (1927). British Thomson Houston Co., Ltd. Treating silica articles. (264,863.)

IX.—Applications

Lee and Wilson. Manufacture of cement. 2122. Jan. 25. Montan, Inc. Impregnating wood. 2309. Jan. 26. (U.S., 26.1.26.)

Pense. Production of artificial stone. 2620. Jan. 29.

Whitmore. Feeding slurry to rotary kilns etc. 2470. Jan. 28.

IX.—Complete Specifications

11,944 (1926). Cadré. Manufacture of cement. (264,711.)

*892 (1927). Soc. Anon. La Trinidad. Manufacture of asphaltic bituminous or tarry products. (264,822.)

X.—Applications

Hilger, Ltd., and Twyman. Heat treatment of metals. 2436. Jan. 27.

Kaiser Wilhelm Institut f. Eisenforschung. Purification of metals. 2431. Jan. 27. (Ger., 27.1.26.)

Summers. Metal alloys. 2430. Jan. 27.

X.—Complete Specifications

26,003 (1925). Harris. Treatment of impure molten metal. (244,421.)

26,274 (1925). Edser, Taplin, and Metals Production, Ltd. Heat treatment and concentration of ores. (264,584.)

32,214 (1925). Siemens & Halske A.-G. Increasing the ohmic resistance of pure iron (245,753.)

*20,776 (1926). Metals Protection Corp. Treatment of iron and steel. (264,788.)

*1508 (1927). Buddens. Reducing ores etc. (264,834.)

XI.—Applications

Bagota and Pogany. Galvanic cell. 2516. Jan. 28.

British Thomson-Houston Co., Ltd. Electric furnaces. 2663. Jan. 29. (U.S., 15.2.26.)

Campbell, and General Electric Co. Gas-filled photoelectric cells. 2079 and 2441. Jan. 24 and 27.

Gush and Gush. Electrolytic treatment of water. 2211. Jan. 25. Anode compartments for use with electrolytic systems. 2212. Jan. 25.

Johnson. 2055. *See* II.

M.-O. Valve Co., Ltd., and Thompson. Manufacture of oxide-coated cathodes. 2078 and 2444. Jan. 27.

Wildermann. Electric batteries. 2025. Jan. 24.

XI.—Complete Specifications

9951 (1926). Zubiria. Electric induction furnaces. (251,608.)

*1701 (1927). Brown, Boveri, et Cie. Electric furnaces for heating gases. (264,849.)

*1737 (1927). International Gen. Electric Co., Inc. Electrode operation in electric arc furnaces. (264,861.)

*1850 (1927). Krebs. Apparatus for electrolysis solutions of alkali chlorides. (264,865.)

XII.—Applications

Fawcett. 2324. *See* V.

L.-G. Farbenind. Extracting vegetable oils. 2429. Jan. 27. (Ger., 27.1.26.)

Krupp Grusonwerk. Treatment of oil-containing fruits. 2101. Jan. 25. (Ger., 4.3.26.)

XII.—Complete Specifications

30,505 (1925). Bollmann. Bleaching fatty oils, mineral oils, etc. (245,745.)

*30,407 (1924). Henkel & Cie. Manufacture of glycerin containing diglycerin and poor in polyglycerins. (264,800.)

XIII.—Applications

Hempel and Mürnseer. Fire- and acid-proof pigment. 2028. Jan. 24.

Kunstharzfabrik Pollak. 2594. See I.

McMinn. Anticorrosive paint for iron etc. 2524. Jan. 28.

XIII.—Complete Specification

26,618 (1925). Pottor, Crump, and Damard Lacquer Co., Ltd. Hardening phenol-urea-formaldehyde products. (264,601.)

XIV.—Applications

Anode Rubber Co. (Klein). Drying products of caoutchouc. 2216. Jan. 25.

Anode Rubber Co. (Klein, Szegvari, and Trumball). Production of caoutchouc articles from latex. 2215. Jan. 25.

Head. Treatment of raw rubber. 2602. Jan. 29.

XIV.—Complete Specifications

4301 (1926). Carpmal (I.-G. Farbenind.). Vulcanising rubber. (264,673.)

5759 (1926). Brit. Dyestuffs Corp., Gonschaws and Naunton. Use of the mono- and di-carbalkoxy-diaryltioureas as accelerators in the vulcanisation of rubber. (264,682.)

XVI.—Application

Rhenania-Kunheim Verein Chem. Fabr. Chemical manures. 2218. Jan. 25. (Ger., 1.2.26.)

XVI.—Complete Specification

*1876 (1927). Stockholms Superfosfat Fabriks Akt. Treating phosphates and fertilising products obtained thereby. (264,867.)

XVII.—Application

Sak. Producing compound yeast etc. 2300. Jan. 26.

XVIII.—Complete Specification

*27,378 (1926). Weber. Manufacture of yeast. (264,795.)

XIX.—Applications

Leech and Sherman. Treatment of air for preservation of foodstuffs etc. 2382. Jan. 27.

Matzka and Szydlowski. Preservation of animal carcasses. 2223. Jan. 26.

Otto and Vincent. Preserving foodstuffs etc. 2164. Jan. 25.

XX.—Applications

Marks (Rohm & Haas Co.). Organic compounds. 2089. Jan. 24.

Soc. Franç. de Catalyse Généralisée. Catalytic production of methyl alcohol. 2400. Jan. 27. (Fr., 9.2.26.)

XX.—Complete Specifications

26,378 (1925). Carbide & Carbon Chemicals Corp. Glycol ethers and cellulose-ester solvents. (255,406.)

31,515 (1925). Benzol-Verband Ges. Alcohol and its homologues, and mixtures containing the same. (257,881.)

4303 (1926). Carpmal (I.G. Farbenind. A.-G.). Manufacture of condensation products of substituted acroleins. (264,674.)

5268 (1926). Petroleum Chemical Corp. See II.

12,751 (1926). Zaidan Hojin Rikagaku Kenkyujo. Preparing maleic and succinic acid from furfural. (253,877.)

18,339 (1926). Roessler & Hasslacher Chem. Co. Production of esters from amide acid sulphates. (255,887.)

*25,400 (1926). Consort. f. Elektrochem. Ind. Manufacture of acetals. (264,791.)

*27,588 (1926). Poulenc Frères. Preparation of a concentrated and stable solution of 3-acetyl-amino-4-oxy-phenyl-uronic acid. (264,797.)

*31,430 (1926). Hoffmann-La Roche & Co. Manufacture of ureides of dialkyl- or arylalkyl-acetic acids. (264,804.)

*1338 (1927). Boehringer Sohn. Acetylene for anæsthetic purposes. (264,826.)

*1399 (1927). I.-G. Farbenind. Manufacture of keto-alcohols. (264,830.)

*1627 (1927). I.-G. Farbenind. See II.

XXI.—Application

Christensen. Coloured photographic pictures. 2293. Jan. 26.

XIII.—Applications

Gush and Gush. 2211—2. See XI.

Rosenheim. 2452—3. See VII.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Stainless table and nickel cutlery (99); Steel (A. 4175); Multitubular boiler (A.X. 4191); Porcelain insulators, insulating material (Commercial Bureau. Australia House, Strand, London, W.C.2, ref. 417). *Austria*: Raw materials and machinery for the drug, confectionery and perfumery trades, pharmaceutical chemicals, cosmetics, soap (107). *Belgium*: Tinplate (108). *Canada*: Gas-operated refrigerators (A.X. 4163); House-heating boilers (B.X. 3186); Chinaware, earthenware, paint, enamel, oil, varnish, polishes, iron and steel etc. catalogues (C.X. 2191). *Chile*: Galvanised iron sheets, brass, copper, lead, zinc (C.X. 2183). *Germany*: Road-making bituminous materials (115). *Greece*: Photographic goods, pharmaceutical products (116); Porcelain, earthenware, glassware (117). *Portugal*: Tinplate (121); *Portugal (Colonies)*: Pumps (122).

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during January, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 509, of which 453 were from merchants or importers. To these should be added 62 cases outstanding on December 31, making a total for the month of 571. These were dealt with as follows:—(Granted—496 (of which 435 were dealt with within 7 days of receipt); referred to British makers of similar products—58 (of which 47 were dealt with within 7 days of receipt); referred to Reparation Supplies available—6 (all dealt with within 2 days of receipt); outstanding on January 31, 1927—11. Of the total of 571 applications received, 488, or 85 per cent., were dealt with within 7 days of receipt.

Imperial Preference on Optical Goods

The Board of Trade has made a Regulation under the Safeguarding of Industries Act, 1921, to take effect on March 1, raising from 25% to 75% the minimum proportion of the value attributable to Empire labour necessary in order to qualify optical glass, elements and instruments consigned from and manufactured in Empire countries

for entry into Great Britain as goods of Empire manufacture. The goods affected include optical glass and optical elements, whether finished or not, microscopes, field and opera glasses, theodolites, sextants, spectrometers and other optical instruments, and component parts of the above.

Patents in Estonia

The Estonian Legislature has passed a law providing specially for the registration in Estonia of patents and trade marks belonging to British subjects which were registered in Russia before February 24, 1918. A copy of an English translation of the law may be seen in the Library of the Patent Office, Chancery Lane, London, W.C.2.

Dutch Trade in Artificial Silk

A considerable advance has been made by the Dutch artificial silk industry, exports having increased from 3,024,000 kg (16,511,000 florins) in 1925 to 5,544,000 kg (21,858,000 florins) in 1926. The weight of exports nearly doubled, though the value showed a smaller gain owing to the fall in prices. Exports were directed chiefly to the United States (1,699,000 kg), Germany (831,000 kg.), and Great Britain (542,000 kg.).

Plant

The first of its type to be installed in this country, a high-frequency electric furnace for the manufacture of special steel is to be supplied by the Electric Furnace Company, London, to Edgar Allen & Co., of Sheffield.

The Reading Gas Company has placed an order with the Woodall Duckham Vertical Retort and Oven Construction Co. (1920), Ltd., for a T.I.C. (lead bath) tar treatment plant, to deal with 18 to 20 tons of crude tar per 24 hours.

The Glasgow Corporation Gas Department has placed an order with the Woodall Duckham Vertical Retort and Oven Construction Co. (1920), Ltd., for a new carbonising plant to be erected at the Dawsholm Gas works. The value of the contract is approximately £245,000. The carbonising plant is to consist of 41 W. D. continuous vertical retorts, arranged in two benches each of 22 103-in. retorts, and 18 intermittent vertical chambers arranged in two benches each of 24 chambers. The installation will include coal and coke handling plant, a complete coal treatment plant, and three waste heat boilers.

Sodium Hydrosulphite

Messrs. J. B. Wilkinson, Dudley Hill Chemical Works, Bradford, announce that they are now manufacturing sodium hydrosulphite powder of a specially pure quality, which is specially suitable for use in the bleaching of sugar and other foodstuffs. This quality is, of course, suitable for all purposes for which hydrosulphite is required, whether in the bleaching of straw or gelatin, or in the application of vat dyes. Sulphites, bisulphites, sulphides, and chemicals for bleachers, dyers, and tanners, are amongst other products manufactured by this firm.

Synthetic Rubber in Russia

The Soviet Economic Council has decided to offer two prizes of £10,000 and £5,000 for the two best methods of producing synthetic rubber presented before January 1, 1928, together with a sample of the product.

PUBLICATIONS RECEIVED

JOINT COMMITTEE OF THE COKE OVEN MANAGERS' ASSOCIATION, INSTITUTION OF GAS ENGINEERS, AND SOCIETY OF CHEMICAL INDUSTRY (FUEL SECTION). *Tar Conference*. Manchester, November 26, 1926. Pp. 66. Price 2s. 6d., post free.

BRITISH CHEMICALS. THEIR MANUFACTURERS AND USES. Being the Official Directory of the Association of British Chemical Manufacturers for 1927. Pp. 286. London: Ernest Benn, Ltd., 1927. Price 10s. 6d. net.

LABORATORY EXPERIMENTS IN DAIRY CHEMISTRY. By L. S. Palmer, Ph.D. The Wiley Agricultural Series, edited by J. G. Lipman, B.Sc., A.M., Ph.D., D.Sc. Pp. xiii + 84. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 7s. 6d. net.

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JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW SERIES**

LONDON, FEBRUARY 18, 1927

No. 7

EDITORIAL

The British Industries Fair

AT this time one of the greatest needs of the nation is the promotion of its industry, there have been many times in the past when such a task formed no part of the duty of the nation, and was desired by no body of its citizens. We suppose that with the exception of a few extremists the whole of the population of these islands desires industrial peace and prosperity; they are now inseparable. If the former exists, the latter will follow as a matter of course. We shall not discuss the suggestions of those people, we might almost say those misguided people, who think the nation requires a further dose of industrial enmity and dislocation, of oratory instead of work, of breaking up of business instead of building up. This would savour of politics, and we must confine our observations to that less significant part, namely, the efforts that can be made to promote British industry, apart from the consideration of that vital question, industrial peace. The people who are outside an industry can do little to help those who are engaged in the industry, beyond supplying them with prompt and reliable information and giving them the opportunity of bringing the needs and wishes of the industry before the notice of the public. The Government furnishes a great mass of useful information about trade; the Department of Overseas Trade is continually diffusing news of the greatest value; our great banks maintain a news service about the world's trade which appears to be as reliable as is possible. Lloyd's Bank Monthly is a survey of international trade conditions which is well written and well printed, and always worth reading. There are probably many other such publications. The British Industries Fair demonstrates to the world the steady progress of our great industries; it tells the world what the manufacturer is making, and it tells the manufacturer what his competitors and his customers are making. We realise the Fair is a little fatiguing; there is so much to see, so much of interest. On the other hand, you can hardly be considered a well-informed man if you do not spend at least two or three hours there.

British Chemicals

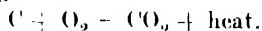
The best friend an industry can have is itself; Heaven helps those that help themselves. The mouthpiece—and, indeed, to a certain extent, the headpiece—of the

chemical industry is the Association of British Chemical Manufacturers. Who is the mouthpiece, and to a certain extent the headpiece, of the A.B.C.M. we have never enquired, and we were never good at guessing. But the A.B.C.M. is in the habit of doing its work quickly and doing it thoroughly, and as that is the main thing, we need not bother about the trimmings. The Association has, as usual, published early in the year its list of members and list of affiliated associations and a classified list, extending over 150 pages, of the chemical products made in this country with the names of the individual makers and of the most important of the uses of the respective products. If you wish to know who makes fluorescein, or formaldehyde, or fur bases, or other indispensable products, you will find it here. If you wish to know the nature and maker of ametox, bectar, duogen, oxzone or titox, turn to the list of proprietary and trade names in this volume. You need not trouble to look out glitto, izal, lysol, and solignum; you have only to look at the nearest hoarding or buy Punch. We have hunted through the list and only found one omission, and that is litharge; fortunately, we know a few makers of that commodity. The book is cheap, half a guinea only; the advertisements alone are worth the money. The book is published by Ernest Benn, Ltd. It is a handsome production; the paper, the type, the lordliness of the margins, the freedom from errors and omissions, make us envious. We ought not in fairness to give all the credit for its appearance to the A.B.C.M. or to Ernest Benn, Ltd. If you desire a good specimen of the best British printing, buy this book; it is printed in Edinburgh by R. & R. Clark, and they need not be ashamed of it. In fact, nobody concerned in the compilation or production of this volume need suffer from any false modesty. It is excellent.

King Coal

In the journals devoted to applied science which descend thickly upon us from America, France, Germany and Italy in particular, the discussion of coal problems continues with unabated vigour. We ourselves have devoted no little space to the matter, and have expressed our quiet satisfaction in the fact that British research stands high in the opinion of the world at large. We should, however, be throwing coal dust in the eyes of the smaller chemical manufacturer and general factory

manager if we were to condone his serious lack of attention to the best methods of burning coal under his boilers and recovering the maximum amount of heat possible. The Fuel Research Board and kindred organisations are engaged upon fundamental problems of coal winning and utilisation which will be ultimately solved, with consequent enormous savings to the nation. In the national coal account the pounds will, in a sense, look after themselves, but the pence must be saved by every consumer of coal. King Coal is a jealous autocrat who demands faithful service not only from his court favourites of the Fuel Research Station, but also from his every subject. He cries vengeance upon those who, still living in the nineteenth century, persist in regarding him in his erstwhile rôle of beggar at the gates of the Palace of Industry. But let us quit metaphor before we are taken to task by the severely practical chemist, and say quite bluntly that the chemical manufacturer often appears to be too engrossed in the study of complex reactions thoroughly to comprehend the apparently simple reaction



His boiler efficiency figures are often appallingly low, as a competent survey taken a few years ago shows, and as our more recent observations confirm. It can no longer be held that, even if the inefficiency of steam-raising plants be recognised, no one is at hand to supply better equipment. To-day the boiler plant manager is offered a score of combustion control devices such as carbon dioxide recorders, air control means, draught gauges, meters for solid, liquid or gas, and so forth, by means of which a full picture of the whole process of combustion and steam production may be continuously sketched. Highly efficient mechanical stokers, pulverised coal firing equipment, water-cooled walls and almost ideal refractories and heat-insulating materials represent only a few of the successes of the modern combustion engineer, who is expected to guarantee a heat recovery figure of around ninety per cent. Water-softening technique, too, has so advanced that it is almost a crime to allow scale-forming salts to pass into the steam boiler. There is indeed a way open to all owners of boiler plant to save coal, but all too frequently the will appears to be absent.

Air Preheaters and Steam Accumulators

The newer and larger chemical factories and the more modern electric power stations are showing the way to fuel economy by full utilisation. We are aware that it is easy to instal modern steam-raising plant in a new factory, but even where already existing plant stands in the account books at a considerable figure it is often ultimately profitable to "scrap" the old plant, for the economies resulting from the working of modern replacements are frequently sufficient to repay the capital loss and show in addition a margin of profit upon the new expense incurred. Moreover, where steam accumulators and air preheaters are put down, no sacrifice of old boiler plant need be made on this account. For example, although air preheaters may substitute economisers in certain instances, we know of cases where such heat-recovery apparatus has been added to an apparently complete plant consisting of boilers, superheaters and economisers. The principle of air pre-

heating demands little description. The gaseous products of the combustion of coal under boilers pass to the stack without having given up all their sensible heat so that the incoming air for the combustion zone may be preheated by heat interchange with the stack gases. In a particular instance which has come under our notice, the ingoing air was heated from normal temperature to about 115° C., the stack gases being correspondingly cooled from 240° C. to 150° C. The advantages to be gained, too, are clear. The recovery of sensible heat, otherwise wasted, increases the over-all fuel efficiency by 5-10% and working pressures are raised. There is often an increase in the initial combustion of the fuel without danger of the escape of heavy hydrocarbons to the flues. With the actual types of plant already installed in this country and abroad we have no occasion to deal at the moment. Suffice it to say that mechanical difficulties have been largely overcome, heat interchange values advanced and general simplification of working attained. Steam accumulators may well be fitted to plant from which, at one time, peak loads are demanded, and from which, at other times, steam is wasted. Steam accumulators or storage tanks are, therefore, of particular service in works where the steam demand is erratic, and may be likened to central station electrical storage batteries or regarded as a fly wheel on the steam line. An accumulator is a well-lagged, large cylindrical tank one recently installed in this country measuring 47 ft. by 13 ft. and having a storage capacity of 20,000 lb. of steam into which excess steam produced at any given time is passed, to be returned later during periods of extra demand. Boiler furnaces may thus be worked at an ascertainable even rate, with consequent economy in fuel consumption. The practical application of the thermodynamical principle that the condensation and evaporation of water are reversible is thus realised. Exhaust or excess steam enters the accumulator, and is bubbled up through the water therein through distributor pipes. The steam thoroughly agitates the water and brings it up to the equilibrium temperature. In other words, the temperature of the water eventually corresponds to that of water boiling under a pressure equal to that of the entering steam. At times of high steam demand the pressure in the steam lines drops and steam passes out from the accumulator, whilst more steam is produced by evaporation of the water, now no longer in equilibrium with the general system. The reversible condensation and evaporation process continues automatically, the valving arrangements having now-a-days been almost perfected and, so far as our knowledge goes, modern accumulators are simple and reliable pieces of plant. British-made steam accumulators are being more and more used in this country which, in the past, has not adapted itself so readily as many others to new fuel-saving devices. The clumsy-looking monstrous cylinders growing up in the none too beautiful landscape of a chemical works give no joy to the æsthetic sense, but they do save steam. The Gullivers amongst our combustion engineers must smile a little at the recollection of the lilliputian steam storage tanks fitted to explosives works' locomotives, but they may also smile happily in the service they are rendering King Coal.

THE CHEMIST—HIS PLACE IN THE VARNISH INDUSTRY*

By L. HAMBROCK

The varnish business, like many other long-established industries, has only in recent years awakened to the importance of chemistry in aiding it to solve its problems. These problems are indeed large in number. The manufactured materials enter into many branches of work. Often they are used as important intermediates. Hence it behoves the varnish maker to maintain his finished products at strictly uniform composition, both physical and chemical.

I shall enumerate some of the operations into which our products enter as important intermediates. First, and probably the largest field, is that of the manufacture of enamels, paints and railway and other car finishing materials. Then also, the printing ink manufacturer uses large quantities of our products. In the publication of the *Saturday Evening Post*, the Curtis Publication Company uses annually inks containing, among other things, nearly two thousand barrels of special varnish products. Then we have the manufacturers of insulating materials who consume many thousands of barrels of varnish annually. In each of the instances cited the materials used are of very definite physical, as well as chemical, composition. And to have any of them made up so as to fall short of their particular requirements would be a serious matter indeed to the manufacturer who uses them. Time does not permit or I could name many other important intermediate uses of our products.

How, then, has the chemist been able to fill an important part in this industry? The answer is obvious. Owing to his training he is properly qualified not only intimately to study the raw materials used, but also quickly to grasp the underlying principles of manufacture. These are, of course, the essential steps to the study of finished products and when he has arrived at that point the chemist will have found much interesting work before him. His path is indeed not a specially pleasant one, for the work is hard, and there is much ground to be covered and much experience to be acquired before he is able to make headway on his own initiative. The so-called secrets of the business are still closely guarded, and confidence is indeed hard to gain.

Before we enter into this subject any further, let me tell you what varnish is. It is usually a liquid material, but there are a few special cases when it is required in a semi-liquid or even a plastic condition. It may be classified under two general heads, namely, spirit varnishes and oleo-resinous varnishes. Spirit varnishes differ from the latter class in that they dry upon application through the evaporation of the solvents contained in them. A solution of 3-4 lb. of shellac dissolved in 1 gallon of alcohol would make a representative varnish of this class. The more recently developed nitro-cellulose lacquers as they are properly named, also belong to this class. Spirit varnishes dry quickly and adapt themselves to inside finishing requirements. With the

development of the lacquers, chemical compounds have been developed so that they give very durable service when used for exterior purposes. Hence the more recently developed methods for the finishing of motor cars and other outside uses. Oleo-resinous varnishes, on the other hand, depend not only on the evaporation of the solvents to make them dry, but they depend also upon the oxidation of the vegetable oils contained in them to complete the process of drying.

You will appreciate that we have entered a field that offers an important place to the chemist. Having first learned something of the methods of manufacture, he becomes interested in the raw materials used. These materials are too great in number for me to touch on more than the most important, and at the same time the most interesting, ones used. They are as follows:—

The copals and rosins, employed to give hardness, brilliancy and other desirable properties, according to the requirements of the varnish, are as follows:—Kauri, congo, manilla, pontianac, which are found in New Zealand, Central Africa, South America and other distant points. Then we have the soluble rosins such as damar from Batavia and Singapore. Shellac finds its way over the entire world from India, and there are the East India rosins. Gilsonite is mined in Utah, whilst the best asphalts are found in Trinidad. Linseed oil comes to us either as seed or oil from Russia, the Argentine, U.S.A. and Canada. China wood oil, or tung oil, as it is more properly named, is shipped from the interior of China. Turpentine is distilled and shipped from the Southern States, while the mineral substitutes come from the U.S.A. and Mexico. Large quantities of the crude materials from which very good substitute solvents are made are shipped in tank steamers from Mexico.

With so many complex raw materials to deal with, the chemist finds plenty of interesting and important work before him. When he commences to gather the chemical and physical data required to enable him to determine purity and other desired features in this mass of complex organic, as well as inorganic materials, he will need to rely on much original work. He cannot hope to find much written data concerning the materials at hand. This is not quite so true to-day, however, as it was a few years ago. Much work has been done and published, but it is not easily accessible. It may interest you to hear a few of the details concerning the nature and special properties of some of the more important materials.

First the copals. They are fossilised exudation of trees, and the outstanding desired quality is their hardness. Amber from which pipe stems are made is a very hard copal, and was used when found more plentifully for varnish-making purposes. Copals in their natural state are insoluble in vegetable oils, and are of no use for varnish manufacture unless preheated or fused until a loss of 10—25% by weight has taken place. In the proper fused condition they are soluble in oils, and may readily be incorporated with oils and other materials. Each grade and kind of copal requires a different method of handling before the best results can be obtained. In many cases they are fused to what the varnish maker

* Paper read on Oct. 19, 1925, before the Montreal Section.

terms a physical end point, and a slight deviation, one way or the other, will cause the copal to be either insoluble or just completely soluble in the oil added. In good varnish making, this experience is indeed open to a lot of hard work.

The choice of the most suitable copals does not lend itself to much chemical work for the varnish maker. There are so many different kinds, and so many grades of each, that suitability depends entirely upon practical experience obtained through working with them. I will give you an example. I have before me two gradings of kauri copal: one a pale grade, while the other is rather dark. The dark grading, however, is much harder than the pale grade, and is suited to the manufacture of rubbing and polishing varnishes. The pale grade is better suited to the manufacture of railway and other high-grade exterior finishing varnishes. I have thought that a melting-point determination would be of value, but after many trials the results were so inconsistent, that I found such a determination unreliable and of no value from a varnish maker's point of view. To show you the possibilities of chemical work, I will cite an instance where, for certain reasons, it was desired to have the acid number of a completed varnish as low as possible. Kauri gum was used, and the acid value of the kauri in its natural state was found to be 72, i.e., 72 mg. of caustic potash was required to neutralise the free acid when the powdered copal was refluxed in a bath of neutralised alcohol and benzol. The copal was fused, and when fusion was completed, a sample was taken and the acid value was found to be reduced to 56. At this point various neutralising agents, among them calcium carbonate, zinc oxide and glycerin were used alone and in various combinations. By making the necessary checks in the laboratory, the desired degree of neutralisation was determined and the factors entering into it were properly recorded, so that in this particular instance a very much desired varnish was produced and the entire working was determined by means of chemistry. I have pointed to this one instance merely to show how it was possible, in a concrete way, to apply chemical control to such a complex material as copal. Further, the reaction of the varnish copals when admixed in varnish solution with various pigments with which they are used as intermediates, lends itself to much important work for the varnish chemist.

The next class of raw materials is the drying oils. The bulk of the drying oils used consist of linseed and china wood oil. The function of drying oils in varnish is to impart elasticity, flowing and application properties. Linseed oil is used more particularly in outside finishing varnishes, grinding varnishes in paint and linoleum, as well as oilcloth manufacture. The work of developing the qualities desired of linseed oil used in high-grade finishing varnishes has been a difficult task, at least for some of us. Linseed oil, properly prepared for such use, must have every trace of impurity removed. The acid value, or free fatty acid content, must be kept within accurate control. Certain minute quantities of semi-soluble waxes which find their way into the oil through foreign grass seeds gathered with the flax seed from which the oil is crushed, must be entirely removed. Other factors to be determined are the gravity, the iodine

number, which is an index of the drying qualities of the oil, the saponification number, a means of detecting a mineral oil if present, for mineral oils are not saponifiable, and also the free acid content, an important index to the manner in which the oil has been refined.

In drying, linseed oil as well as all other drying oils absorb oxygen from the air, and in doing so passes from a soluble liquid state to an insoluble plastic condition, and retains much of its original elasticity and also possesses an added desired toughness. These properties give linseed oil its value, when properly combined with selected copals, in the finished products. Still further the oil may be blown in bulk with air under slightly raised temperature, in which condition the oil absorbs oxygen rapidly, thus not only increasing the viscosity, but the drying ability also. Blown oils require but small quantities of dryers to hasten their final drying time. Kettle-boiled oils require much larger quantities of dryer. As these dryers, or metallic catalysers, all tend to turn the dried film dark in colour, the advantage of blown oils for any purposes may be readily appreciated.

In checking oxidised oils it is desirable to make determinations of viscosity, acid number, iodine and saponification numbers as well as the specific gravity. It will be found that as the oil continues to become oxidised the gravity and viscosity increase, whereas the other chemical figures decrease. The chemist is at a distinct advantage for he can keep the oil so treated within close control. The total amount by weight of oxygen which an oxidised pure linseed oil will absorb when completely oxidised represents an increase of between 16-18% over the original weight. The unsaturated bonds are then satisfied, and the oil is completely oxidised or expanded.

An intensely interesting material is china wood or tung oil. It is obtained from a seed grown on two species of tree, which grow in the south, central and western parts of China and blossom in the spring. The fruit ripens in the early fall, and is gathered before entirely ripened. The seeds, five to seven in number, are somewhat similar to Brazil nuts, but only one-third the size. The fruit, after being gathered, is placed in open iron pans and roasted just sufficiently to make them burst open. The seeds are then extracted, placed in a stone trough and ground. The ground mass is then further heated by a steaming process, and is then made up with straw into suitable size, and is pressed into cake in primitive oil presses made from hollowed logs. The yield of oil is about 40%: apparently 12% of oil is lost through inefficient methods of handling. The total annual output of this oil averages 700,000 piculs, a picul being equal to 133½ lb. Of this oil, U.S.A. and Canada import approximately 80%.

China wood oil resembles linseed oil in colour, but it has a much greater viscosity as well as a characteristic odour. Carefully refined linseed oils bleach practically water white when brought to a temperature of 525° F. China wood oil under similar conditions does not bleach. This factor is used in detecting adulterations in china wood oil. In its natural state china wood oil absorbs a maximum of 12-14% of its weight of oxygen. However, instead of drying in a clear film, the film of dried raw china wood oil is frosted and crystallised

throughout. In this condition, except in a few very special cases such as for frosted glass effects, china wood oil for varnish-making purposes is practically useless. When heated to a certain temperature the raw oil loses this characteristic drying feature, and if allowed to air dry, preferably with the addition of dryers in small amount, the oil will dry in a clear, hard and lustrous film. In this condition it has many of the properties of hard copals combined with linseed oil. In addition, the treated dried china wood oil film is extremely waterproof and weather-resisting.

China wood oil thus treated has this very extraordinary characteristic that instead of very gradually becoming more viscous as is the case with heat-treated linseed and other drying or semi-drying oils, china wood oil very quickly passes from a hot liquid state to a polymerised or solidified state. In this condition the oil becomes insoluble in varnish solvents, and is rendered again practically useless for varnish-making purposes. To find the best methods of manipulation of this oil in order to make it workable and still retain the desired features of the oil has been an endless study on the part of both the varnish maker and the chemist.

And here, as is the case with linseed oil, the chemist has much work of interest before him. Due to the early gross adulteration of the oil (it has been adulterated with soya bean, tea oil and other oriental oils), means had to be devised to check the purity of this oil. Heat tests under strict control were found to give the best indication of the purity of china wood oil. Strictly pure oil when heated, 100 g. at 287° C. for 6-6½ minutes in an open pan and kept constantly stirred, will solidify into a hard, pale, amber-coloured mass. If the oil is adulterated the time required for solidification will be retarded. An oil which requires 7½ to 8 minutes for solidification may be looked upon with suspicion. The actual time for solidification of pure oil after solidification commences equals but a few seconds. Adulterated oils solidify very slowly, depending, of course, on the degree of adulteration. An adulteration of 5% or over should not be left undetected. The chemical figures used in testing linseed oil are of equal importance in checking the purity of tung oil.

Lastly, we come to the solvents used. They are turpentine and mineral substitutes. The mineral substitutes are refined to a distillation range closely corresponding to that of turpentine. For many purposes they are just as satisfactory as turpentine itself. The usual procedure in testing them is for the chemist to carry out distillation and other desirable determinations. The presence of sulphur in substitutes must be avoided.

Thus the chemist plays an important part in the testing of finished products. Not only is this true for the manufacturer of varnish materials, but for those who are interested in the purchase of our products. Many of these finished materials are sold under specifications definitely designed through practical experience to meet certain needs and requirements. In this capacity the chemist has been an important factor in improvement of many materials, and in making it possible to keep these many products in a uniformly standard condition.

When all is said, we find the chemist the eyes of the work and an important factor in this branch of industry.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

ANNUAL GENERAL MEETING, July 4 to 8, 1927

ACCOMMODATION IN EDINBURGH.

Particulars of Hotels and University Hostels were given on page 105 of CHEMISTRY AND INDUSTRY for February 4.

In view of the fact that the available accommodation in Edinburgh for the week of the meetings is already largely booked, those who intend to stay at the North British Station Hotel (official headquarters of the Society during the meetings) or at one or other of the University Hostels are strongly recommended to arrange their accommodation *at once* through the Honorary Local Secretary of the Society, Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

Accommodation to be reserved at any of the other hotels should be arranged *without delay* direct with the manager of the hotel.

TAR CONFERENCE PAPERS

The papers that were presented before the Manchester Tar Conference in November last have now been published in bound form at the price of 2s. 6d., post free.

Copies can be obtained from the General Secretary of the Society of Chemical Industry, Central House, Finsbury Square, London, E.C.2, and orders should be accompanied by the appropriate remittance.

BRISTOL SECTION

A joint meeting was held with the Fuel Section and the Chemical Engineering Group on February 3. Mr. George Gray presided over an excellent attendance, including visitors from London and members of the Bristol Association of Engineers. Messrs. J. W. Reber, M.I.Chem.E., and A. Scott presented a paper on "The production of power from town's refuse" (cf. CHEM. & IND., Feb. 11, p. 119).

An excellent discussion followed the paper, in which Messrs. Marsden, Rogers, Scorer, Broughall, Robertson, Gee, Watson, Dr. Smith, and others took part. On the proposal of Prof. Francis, seconded by Mr. Bernard, a hearty vote of thanks to the readers of the paper was carried with acclamation.

In the afternoon a visit was paid to the Union Street Works of Messrs. J. S. Fry & Sons. The party was conducted by Mr. Read and his assistants, and a most pleasurable time was spent. Tea was partaken by the kind invitation of Messrs. Fry & Sons.

After the evening meeting a successful informal dinner was held at Messrs. Hort's restaurant.

LONDON SECTION

A meeting was held under the chairmanship of Mr. C. S. Garland in the Chemical Society's Rooms on February 7, when Dr. T. Slater-Price, F.R.S., delivered an address on "Photographic sensitivity."

Dr. Slater-Price first described the constitution of the photographic emulsion, and pointed out that not only did the particles vary greatly in size, but the size distribution varied with different emulsions. There were many ways of making emulsions, and so there was considerable variation in the characteristics of the

grains or particles. An ordinary photographic plate contained anything between 500 and 5,000,000 grains per square inch of surface, so it could be understood how difficult was the investigation of the photographic plate. Dr. Slater-Price then considered the characteristic of various emulsions for plates and papers (both printing-out and development), and gave an account of some of the more recent theories of the action of light in relation to crystal structure.

TORONTO SECTION

Owing to an unfortunate change made in his plans by Prof. Cohen, the December meeting had to be suddenly cancelled.

At the meeting held on January 26, with Mr. Benson in the chair, an address was delivered by Dr. W. Blum, of the Bureau of Standards, Washington, D.C., U.S.A., President of the American Electrochemical Society.

Dr. Blum spoke on the electro-deposition of metals, pointing out the industrial significance as a means of refining, but more particularly he dealt with polarisation. The static potential of a metal is the potential when no current is passing. For commercial purposes it is much more important to know conditions during the passage of the current; hence our interest in changes at the electrodes. The potential changes to a dynamic potential when the current flows, and the difference between this and the static potential is the polarisation. Polarisation during electro-deposition may govern largely the applied voltage necessary to bring about electrolysis at a certain rate. It influences the structure, purity, and distribution of the deposited metal. The purpose of a scientific study of such phenomena is to predict and avoid useless experimentation.

A very interesting method of measuring polarisation was shown. A rectangular cell containing an anode and cathode, with two gauze electrodes of the metal between them, equally spaced, permits the direct measurement of the anodic and cathodic polarisation by determining the voltage drop, when a current is flowing between the gauzes themselves, and between the gauzes and the anode and cathode.

Anything increasing the concentration of the metal ion at the cathode will decrease the polarisation. Addition of such substances as glue and gelatin increases polarisation and influences the structure of the deposit. The measurement of the p_H value of solutions has become a matter of routine in plating plants, and is a most practical means of control.

Throwing power is bound up with cathode polarisation, conductivity, and cathode efficiency. To produce good throwing power in general, an effort is made to make it difficult for the metal to get on the nearest part of the cathode. By means of a series of slides it was shown that all electro-deposited metals are crystalline in form. The nature of the deposit depends on the factors surrounding the growth of these crystals. In general, it is advisable that chemists who have any contact with the plating industry should know the science of the subject, so that they can direct experimental work along the proper lines.

In the discussion which followed, some interesting points were brought out, one being the difficulty in

plating chromium owing to its poor throwing power, and it was shown that this cannot be avoided in any simple way. The question of the tendency in jewelry manufacture to plate a white-metal alloy with chromium was mentioned to indicate that in this line of business the potential relative values of the metals might not be the only factor to be considered. A piece of brass plated with chromium would give the same effect. Platinum-plating of jewelry is a matter of some importance to the public, since it is quite impossible for the average person to estimate the actual value of many articles of this kind.

CALENDAR OF FORTHCOMING EVENTS

- Feb. 19. BIRMINGHAM METALLURGICAL SOCIETY, Girls' High School, Dudley, at 7 p.m. "Blast furnace practice," by R. P. Bethell.
- Feb. 22. ROYAL PHOTOGRAPHIC SOCIETY, *Scientific and Technical Group*. 35, Russell Square, W.C.1, at 7 p.m. (1) "Turbidimetry and grain size," by F. E. Renwick, and "The Ferguson density comparator," by W. B. Ferguson.
- Feb. 22. INSTITUTION OF THE RUBBER INDUSTRY, *Sales Section*. Engineers' Club, Coventry Street, W.1, at 8 p.m. "Export selling," by Sir W. Clark.
- Feb. 22. MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY. Ordinary meeting. 36, George Street, Manchester, at 5.30 p.m. "Recent advances in the theory of colloids," by D. C. Henry.
- Feb. 23. SOCIETY OF CHEMICAL INDUSTRY, *South Wales Section*. Technical College, Mount Pleasant, Swansea.
- Feb. 23. GLASGOW UNIVERSITY ALCHEMISTS' CLUB, at 7.30 p.m. "Problems of chemotherapy," by Prof. C. H. Browning.
- Feb. 23. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. "Insulin and its manufacture," by F. H. Carr, C.B.E. Dr. Henry H. Dale, C.B.E., M.D., F.R.S., will preside.
- Feb. 24. SOCIETY OF CHEMICAL INDUSTRY, *Nottingham Section*. Joint meeting with the Midlands Section of the Society of Dyers and Colourists. University College, Nottingham, at 7.30 p.m. "A new view of soluble vat dyestuffs," by C. Shaw.
- Feb. 24. INSTITUTION OF MINING AND METALLURGY. *General Meeting*. Burlington House, Piccadilly, W.1.
- Feb. 24. OIL AND COLOUR CHEMISTS' ASSOCIATION. Rooms of the National Federation of Paint Manufacturers, 8, St. Martin's Place, Trafalgar Square, London, W.C.2, at 8 p.m. "Further notes on the behaviour of phenolic resins," by A. A. Drummond.
- Feb. 24. INSTITUTE OF BREWING. *North of England Section*. Midland Hotel, Manchester. "Recent work on the preservative principles of hops," by Prof. F. L. Pyman.
- Feb. 24. INSTITUTE OF BREWING, *Midland Counties' Section*. White Horse Hotel, Congreve Street, Birmingham, at 7.30 p.m. "Relationship of ready-formed soluble carbohydrates in malt to extract," by H. E. Dryden.
- Feb. 28. SOCIETY OF CHEMICAL INDUSTRY. *Joint meeting of the Yorkshire Section and the Fuel Section*. Queen's Hotel, Leeds, at 2.30 p.m. (See further particulars on p. 125 of the issue for Feb. 11, and p. 153 of this issue.)

THE INSTITUTION OF CHEMICAL ENGINEERS

On March 9 and 10, 1927, the Institution of Chemical Engineers will hold a Conference, followed by the Fifth Annual Corporate Meeting and Annual Dinner on March 11.

The programme of events will be as follows: On Wednesday, March 9, the First Session of the Conference will commence in the Chemical Society's Rooms, at 5 p.m., Sir Alexander Gibb, G.B.E., C.B. (Vice-President), in the chair. Papers will be presented on "The production of dissolved acetylene and its application to lead burning," by W. C. Freeman, and "Lead as a constructional material in chemical engineering," by S. J. Tungay. At 6.45 p.m. an informal dinner will be held at Stewart's Restaurant. The Second Session will begin at 8 p.m. with the President, Sir Frederic L. Nathan, K.B.E., in the chair. Papers on "The function of the Schmiedel box in sulphuric acid manufacture," by H. J. Bush and A. Grounds, and "Some improvements in chamber sulphuric acid plant," by W. G. Mills, will be read.

On Thursday, March 10, a visit will be paid to the Fuel Research Station, East Greenwich, leaving at 12.30 p.m., and returning at 4.30 p.m. to Burlington House, where tea will be served. Applications to join this party, which is limited to 50, should be made immediately. Members should make their own arrangements for lunch. At 5 p.m. the First Session will commence under the chairmanship of the President, a paper on "Rubber as a constructional material in chemical engineering," being read by Mr. B. D. Porritt. Informal dinner will follow at 6.45 p.m. at Stewart's Restaurant, and the Second Session will open at 8 p.m., Sir Alexander Gibb, G.B.E., C.B., in the chair. A paper will be presented by Prof. F. C. Lea, on "The effect of heat on some of the properties of metals."

On Friday, March 11, the Fifth Annual Corporate Meeting of the Institution will take place at the Hotel Victoria, Northumberland Avenue, W.C. 2, at 11.30 a.m. At 12 noon the President's Address on "Some industrial developments and the chemical engineer" will be delivered, followed at 12.45 p.m., by informal lunch. At 2.30 a paper will be read by F. H. Rogers, on "The Cross cracking process and plant." In the evening at 7.30 for 8 p.m. the Annual Dinner will be held in the Oak Room of the Hotel Victoria, when the President, Sir Frederic Nathan, K.B.E., will preside. The Right Hon. Sir Herbert Samuel, G.C.B., G.B.E., the Presidents of kindred institutions and societies, and other distinguished guests will be present. The price of the tickets is 12s. 6d. each, exclusive of wines. Members are cordially invited to bring ladies.

The President of the Institution and Council extend a cordial invitation to all gentlemen interested to attend, or to be represented at the Conference.

ROYAL SOCIETY OF ARTS

Mr. A. Chaston Chapman, F.R.S., presided over the meeting on February 9, when Dr. E. F. Armstrong, F.R.S., read a fascinating paper on "The romance of the organic chemical industry."

Dr. Armstrong first showed the infinite variety of the achievements of the chemist in elaborating products which but a generation ago were mainly laboratory

curiosities, but are now, or are about to be, produced in such quantities and at such price that they enter largely into the comfort of every citizen. The example of chemical achievement chosen was the aliphatic alcohols, and Dr. Armstrong described the search for cheaper sources of ethyl alcohol, such as raw material not suitable for food, formaldehyde made from calcium carbide, and ethylene. Passing to methyl alcohol, it was shown that unlimited quantities were now made synthetically at a much reduced cost, so that the way was clear to cheaper formaldehyde, and, consequently, to cheaper indigo and synthetic resins, with, perhaps, many new and far-reaching applications of formaldehyde.

Butyl alcohol, once a laboratory product, was found to be an excellent solvent for nitrocellulose, and so its manufacture was developed by the fermentation process, by a modification of the pressure process for methyl alcohol, and from acetylene. Isopropyl alcohol was already made from the gases produced in cracking petroleum, and butyl alcohol would undoubtedly be made by the cracking process. Next came amyl alcohol, produced in a crude form by the distillery, and a substitute would undoubtedly be produced by the pressure process.

The chemist had thus gone a long way to replace the older methods of making these alcohols by fermentation of edible materials by methods based on coal or carbide, i.e., electric power from water, or on petroleum, as raw materials. They could thus be produced in any desired quantity and at prices which brought them within the reach of wide industrial application, such as the growing manufacture of nitrocellulose lacquers.

These alcohols were used mainly as acetates, and therefore it was necessary to consider acetic acid. For many years the chief source of acetic acid was grey acetate of lime produced in the destructive distillation of wood, but the quantities did not suffice for war requirements, and alternative processes were worked out. That involving the oxidation of acetaldehyde, prepared from acetylene by the use of a mercury catalyst, had been brought to a stage of great perfection by the Canadian Electro-Products Company, a British achievement of which we should all be very proud. Progress continued, however, and ethyl acetate, even when made from fermentation alcohol and carbide acetic acid, was menaced by ethyl acetate made direct from acetaldehyde by condensation in presence of aluminium ethoxide. Further, the possession of cheap acetaldehyde bristled with possibilities. The addition to it of hydrogen cyanide and subsequent hydrolysis would result in the synthesis of lactic acid, a method which was under study.

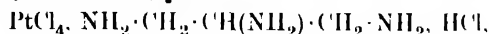
Again, phthalic acid, once a curiosity, had been made cheaply and easily by the catalytic oxidation of naphthalene; the result was it became a raw material for the production of vat-dyes, for the production of a lacquer, and an artificial resin of exceptional electrical properties.

Concluding, Dr. Armstrong pointed the moral of the never-ending necessity for the encouragement of research, research directed to finding how to accomplish new things, or even old things in a novel manner. It was not enough to copy the achievements of the foreigner, even if in so doing we could go further—new work must be encouraged, even at considerable cost, irrespective of any question of immediate financial return.

CORRESPONDENCE

A NOVEL TYPE OF OPTICALLY ACTIVE COMPLEX METALLIC SALT

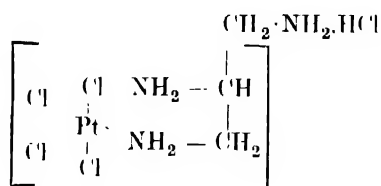
SIR,—Werner's conception of co-ordinated groups and of auxiliary valency has been extraordinarily useful in classifying and in elucidating the configurations of complex metallic compounds. Although many salts of this class, such as *tris*-ethylenediamine cobaltic chloride $[\text{Co}(\text{NH}_2\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{NH}_2)_3]\text{Cl}_3$, have been resolved into optically active components, no proof has hitherto been given that an auxiliary valency linking can render a carbon atom asymmetric. This interesting proposition has been now established by the further study of the recently described salt, tetrachloro-(triaminopropane monohydrochloride)-platinum.



obtained by the action of the $\alpha\beta\gamma$ -triaminopropane hydrochloride on chloroplatinic acid (Mann. Journ. Chem. Soc., 1926, 129, 2681).

In the new salt, the components, PtCl_4 and two of the NH_2 -groups with some of the associated carbon and hydrogen atoms, must lie inside the co-ordinated group, whilst the third NH_2 -group must protrude therefrom. It has now been found that the salt can be resolved into optically active components by the aid of silver *d*- and *l*-camphorsulphonate. The two salts, *l*-base *d*-acid and *d*-base *l*-acid, have thus been obtained in an optically pure state; the hydrochlorides regenerated from these salts give molecular rotations of -502° and $+501^\circ$ respectively for the mercury green line in aqueous solution at 15° .

It is therefore clear that the constitution of the hydrochlorides must be represented by the following formula—



In the above formula the enantiomorphism of configuration is associated with asymmetry of the middle or β -carbon atom of the triaminopropane molecule; this asymmetry arises from the attachment of the α - and β -amino-groups to the platinum atom by auxiliary valencies. This is the first case to be recorded in which asymmetry of a carbon atom results from the operation of auxiliary valencies.

The new type of molecular enantiomorphism now disclosed will no doubt appear among numerous complex metallic compounds, and, indeed, a complex copper salt analogous in constitution to the above platinum salt has been already prepared (*loc. cit.*). We are now engaged on the further investigation of these and other related compounds.

F. G. MANN
W. J. POPE

The Chemical Laboratory,
University of Cambridge. February 7

THE TESTING OF DISINFECTANTS

SIR,—We have perused with some interest the article in your issue of December 31 last on the testing of disinfectants by the Rideal-Walker method and the subsequent letters in regard to it. As originators of the test and as consultants who have tested practically every disinfectant on the market we feel disposed to make a few remarks on the subject.

It has also been our experience that certain other investigators are unable to obtain the correct coefficient value, but upon close investigation we have invariably found that they had not adhered closely to the published standard technique of the test. We may say further that coefficients above 20·22 for a coal-tar disinfectant have rarely been certified by us.

While recognising that the results obtained with broth standardised by different methods are of some theoretical scientific interest, we cannot help feeling that there have been many attempts in the past to create difficulties where they do not exist. In fact we can see no incontestable reason for neutralising the broth at boiling point using phenolphthalein, and we maintain that it is quite incorrect on general scientific grounds to dilute the broth before titration.

Both in this country and in America there have been a very considerable number of investigations on the question of the optimum or the most suitable p_H for the broth. All methods of adjusting the p_H of the broth are affected by the proteins, and this is true for the hydrogen electrode as well as for indicators. In the case of the hydrogen electrode poisoning due to adsorption of the proteins is so marked as to render the method difficult in the research laboratory and certainly impracticable for a routine method. The indicator method, although vitiated both by a salt and protein effect, is by far the most convenient, and when one indicator is used a definite p_H is always obtained, since the protein and salt content of the media do not vary, although the p_H may not be the true thermodynamic p_H .

Apparently Mr. Moore agrees that an indicator method is preferable. In actual practice, of course, phenolphthalein is used and the neutralisation is effected cold. The reaction of such a broth is p_H 7·6, a value in good agreement with that calculated from the limiting conditions of phenolphthalein and the salt effect, *i.e.*,

$$7\cdot80 - 0\cdot16 = 7\cdot64.$$

We have been using such a medium for many years, and have in our possession samples of disinfectants upwards of 20 years old. These we occasionally test for the sake of experiment and interest, and we have no difficulty in obtaining results well within the generally recognised limits of accuracy of the test.

Mr. Moore's positive recommendation appears to be to alter the p_H from 7·6 to 7·0. This could readily be done, of course, by using some other indicator, but Mr. Moore apparently forgets that by doing so we should be rendering an enormous amount of work incomparable without any very obvious gain in other directions.

Yours faithfully,
S. & E. K. RIDEAL & A. SCIVER

28, Victoria Street,
Westminster, S.W.

AN ABSORBENT FOR OXYGEN

SIR,—If Messrs. Hartschorn and Spencer have any information about the action of carbon monoxide on their chromous chloride—amalgamated zinc mixture, this would form a useful addition to their communication published on December 31 (p. 474 T).

An absorbent which will take up oxygen *rapidly* from mixtures with carbon monoxide would be very welcome for the analysis of the flue gases from boiler and other furnaces, especially an absorbent which so conveniently regenerates itself.

Yours faithfully,
H. F. TAYLOR

PERSONAL AND OTHER ITEMS

The Home Secretary has appointed Dr. G. Roche Lynch, M.B., to be Senior Official Analyst to the Home Office, in succession to the late Mr. John Webster. Since 1920 Dr. Lynch has held the appointment of Junior Official Analyst to the Home Office.

Prof. F. G. Banting has been awarded the Cameron prize of the University of Edinburgh in recognition of his investigations on insulin and on the treatment of diabetes.

Dr. Wilson Baker has resigned his post as lecturer in chemistry in the University of Manchester on his appointment to a demonstratorship at Oxford.

Mr. J. B. M. Herbert, B.Sc., has been appointed lecturer in chemistry in the University of Manchester.

The Sir John Cass Technical Institute is celebrating its 25th anniversary on February 21, when the Institute will be open for inspection. Exhibits and demonstrations will be given by students and manufacturers of scientific and other apparatus.

The late Prof. Sir William Tilden, F.R.S., left £6461, with net personalty £3315.

We regret to announce the death of Sir James Kennal, managing director of the well-known firm of engineers, Messrs. Babcock & Wilcox.

Fuel Problems

Attention is drawn to the joint meeting of the Fuel Section and the Yorkshire Section on February 28, at Leeds, of which the full programme was given in our last issue (CHEM. & IND., February 11, p. 125). It should be noted firstly that the paper on "Coke in relation to some of its industrial and domestic uses" is by Mr. H. Hollings, M.Sc., and Mr. N. E. Siderfin, M.Sc., and, secondly, that the papers will be published in the forthcoming (February 25) issue of the JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY, so that the notice regarding preprints is cancelled.

Cleansing White Waterproof Coats

In view of the difficulty of finding an efficient and harmless method of cleansing white waterproof coats, the *India-Rubber Journal* has decided to offer a prize of three guineas for the most satisfactory method submitted. The closing date for entries for the competition will be March 19, and all entries should be addressed to The Editor, *India-Rubber Journal*, 37 and 38, Shoe Lane, London, E.C.4, and marked on

the outside of the envelope "White Waterproofs." Entrants will be required to state over their signatures that there is not to their knowledge any proprietary right in the process which they recommend. Arrangements will be made by the Editor for the testing by trade experts of the various methods submitted and that adjudged best will be published in the *India-Rubber Journal*, with the least possible delay. In the event of no really satisfactory method being propounded, the prize money will be allocated to one of the trade association funds at the Editor's discretion.

COMPANY NEWS

SOUTH METROPOLITAN GAS CO., LTD.

The report for 1926 shows increased sales of gas, the revenue therefrom amounting to £3,307,135, compared with £3,019,673 for 1925, whilst by-products gave £1,109,606, as against £992,147. The cost of coal rose from £1,663,769 to £2,008,899, and the total expenditure from £3,954,712 to £4,400,185, leaving a net profit of £437,486, compared with £471,565. A withdrawal of £98,000 is made from the special purposes fund, and this, with interest received £1,989, and £8,144 brought in, makes available £545,620. Interest charges absorb £146,851, and a final dividend is proposed of $3\frac{1}{2}\%$, making 6% placing £66,099 to the co-partnership fund.

BORAX CONSOLIDATED, LTD.

The accounts for the year to September 30, 1926, show a net profit of £387,858, compared with £425,111 for the previous year. A final dividend has been recommended of 1s. 3d. per share ($6\frac{1}{4}\%$), less tax at 4s., on the deferred ordinary shares, making 10% for the year ended September 30, 1926, compared with a total dividend of $12\frac{1}{2}\%$ for the previous year. The various allocations have been maintained, and the carry forward increased from £196,629 to £219,022.

WALKERS, PARKER AND CO., LTD.

A final dividend has been declared for 1926 on the fully-paid ordinary shares of $7\frac{1}{2}\%$, plus a bonus of $1\frac{1}{4}\%$, making $11\frac{1}{4}\%$. The dividend on the 15s. paid ordinary shares will be at the same rate, or 1s. 3 $\frac{1}{4}$ d. per share.

ASSOCIATED FIRECLAY COMPANIES

The report for 1926 shows a net profit of £35,887, less income tax £5,804, leaving £30,083. A final dividend has been declared on the ordinary shares of 4% (free of tax), making 8%, leaving £11,358 to be carried forward.

BRADFORD DYERS' ASSOCIATION

The profits for the year ended December 31 last amounted to £550,714, compared with £680,940 for 1925 and £944,111 for 1924. With the balance brought forward, there is an available sum of £1,105,730, against £1,338,585. After providing for debenture interest and depreciation, a final dividend is recommended of 1s. per share on the ordinary capital, making 10%, less tax, for the year, compared with $13\frac{1}{2}\%$ for the previous year, leaving £480,630 to be carried forward.

JURGENS, LTD.

A dividend has been declared for the half-year to December 31, 1926, on the guaranteed 7% cumulative participating preference shares at 7% per annum, less tax at 4s. in £, payable on February 1.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime—£7 10s. per ton, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots. ●
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal., 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
Arsenic, Sulphide, Yellow.—2s. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 2d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithophone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
Sulphur Chloride.—4d. per lb., carboys extra.
Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
Vermilion, pale or deep.—5s. 3d. per lb.
Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 per ton. Scarce. Grey, £17 5s. per ton. Liquor, 9d. per gal. 32° Tw.
Charcoal.—£8 5s.—£10 per ton and upwards, according to grade and locality.
Iron Liquor.—1s. 6d. per gal. 32° Tw.; 1s. 2d. per gal. 24° Tw.
Red Liquor.—10d.—11d. 16° Tw. per gal.
Wood Creosote.—1s. 9d. per gal., unrefined.
Wood Naphtha.—Miscible, 3s. 10d.—4s. per gal., 60% O.P. Solvent, 4s. per gal., 40% O.P.
Wood Tar.—£4—£5 per ton and upwards, according to grade.
Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carbohc.—Crystals, 6½d. per lb. Crude 60's, 1s. 8½d.—1s. 9½d. per gal.
Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 1d. per gal. Pale, 95%, 1s. 10d.—2s. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
Benzole.—Crude 65's, 1s. 3d.—1s. 4d. per gal., ex works in tank wagons; Standard motor, 1s. 11d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 2d.—2s. 5d. per gal., ex works in tank wagons.
Toluene.—90%, 1s. 11½d. to 2s. 3d. per gal. Firm. Pure, 2s. 2½d.—2s. 6d. per gal.
Xylol.—2s. 3d.—2s. 6d. per gal. Pure, 4s. per gal.
Creosote.—Cresylic 20/24%—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal.
Naphtha.—Crude, 9½d.—1s. 0½d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, 1s. 9d.—1s. 10d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s. per ton.
Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
Pitch, medium soft.—107s. 6d.—120s. per ton, f.o.b. according to district.
Pyridine.—90/140.—9s. 6d.—13s. per gal. Nominal. 90/180 —7s. 6d. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered price include packages except where otherwise stated.

Acid Gamma.—8s. per lb.
Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
Acid H.—3s. 3d. per lb. 100% basis d/d.
Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzedine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d.—4½d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 a-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 a-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 11d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4d.—2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 3½d. per lb. Less 5%. Market still weak.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 5d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 0½d. per lb. Less 5%. Very firm market.
 Amidol.—9s. 6d. per lb. d/d.
 Acetanilide.—1s. 7d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Aspirin.—2s. 4d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.
 Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 4d.—2s. 5d. per lb. Potassium.—1s. 11d.—2s. per lb. Sodium.—2s. 2d.—2s. 3d. per lb. All spot.
 Calcium Lactate.—1s. 4d.—1s. 5d. per lb.
 Chloral Hydrate.—3s. 3d.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 1½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—6s. 6d.—7s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 8d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £33 per ton net.
 Magnesium Oxide.—Light Commercial £87 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.
 Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig. 6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 3d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—15s. 6d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. 9d.—4s. per lb.
 Phenazone.—5s. 9d.—6s. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 86s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6½d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s.—4s. 3d. per lb. spot.
 Saccharin.—55s. per lb.
 Salol.—3s.—3s. 3d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—77s. 6d.—82s. 6d. per cwt. net, according to quantity.

Sod. Salicylate.—Powder, 1s. 9½d.—1s. 10½d. per lb.; Crystal 1s. 10d.—1s. 11d. per lb.
Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
Sulphonol.—10s. 6d. per lb.
Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
Thymol, Puriss.—11s. 9d.—13s. 9d. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
Aubepine (ex Anethole).—10s. 6d. per lb.
Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb.
 Amyl Salicylate.—3s. per lb.
Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
Cinnamic Aldehyde.—Natural, 17s. per lb.
Coumarin.—11s. per lb.
Citronellol.—15s. per lb.
Citral.—9s. 6d. per lb.
Ethyl Cinnamate.—10s. per lb.
Ethyl Phthalate.—3s. per lb.
Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb.
 Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Shui Oil) 12s. per lb.—(ex Bois de Rose) 16s. per lb.
 Linalyl Acetate.—(ex Shui Oil) 14s. 6d. per lb.—(ex Bois de Rose) 18s. per lb.
Methyl Anthranilate.—9s. per lb.
Methyl Benzoate.—4s. 6d. per lb.
Musk Ketone.—36s. per lb.
Musk Xylol.—8s. 6d. per lb.
Nerolin.—3s. 9d. per lb.
Phenyl Ethyl Acetate.—12s. per lb.
Phenyl Ethyl Alcohol.—11s. per lb.
Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—19s. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—11s. 3d. per lb.
Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb.
 Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.
Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 20s. 9d. per lb. Lemon.—9s. 6d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. per lb.
 Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 22s. per lb. Japanese, 8s. 9d. per lb. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Apr. 9th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Feb. 24th. Complete Specifications marked* are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Blair. Centrifugal separators. 2932. Feb. 1.
 Cooper, Henshaw, and Holmes & Co. Drying gases. 3354. Feb. 5.
 Dunlop and Sibbald. Machines for expressing liquids from solids. 3180. Feb. 4.
 Garland and Pickard. Edge filtration. 2766. Jan. 31.

Hadamovsky. Heating, evaporating, or cooling vessel etc. 3116. Feb. 3. (Ger. 3.2.26.)
 Lowe, Podmore, and Manchester Furnaces, Ltd. Furnaces. 3017. Feb. 2.
 Marx. 3099. See XXIII.
 Mille. Furnaces. 3077. Feb. 3. (Fr., 22.9.26.)
 Norsk Hydro-Elektrisk Kvaestofak. Purification of gases. 3009. Feb. 2. (Norway, 25.2.26.)
 Roucka. Furnaces. 2947. Feb. 2. (Ger., 4.8.26.)
 Rowlands. Centrifugal separating and filtering apparatus. 2948. Feb. 2.
 Tittel. Fire-extinguishing composition. 2753. Jan. 31.
 Vallez. Filters. 2921. Feb. 1.
 Woodall-Duckham (1920), Ltd., and Wilkins. Furnaces. 2868. Feb. 1.

I. Complete Specifications

21,292 (1925). Vermeyen. Furnaces. (230,206.)
 26,938 9 (1925). Martin and Taylor. Furnaces. (264,919 20.)
 26,944--5 and 27,194 (1925). Stothert & Pitt, Ltd., and Minty. Drying machines. (264,921—2 and 264,931.)
 27,320 (1925). King, Tandevin, and Gregson, Ltd., and Nelson. Furnaces. (264,938.)
 28,324 (1925). Jones. Emulsification. (264,955.)
 32,586 (1925). Johnson (L-G. Farbenind.). Packings for apparatus working at high pressures. (264,988.)
 19,089 (1926). Davis. Drying and grinding wet materials. (265,070.)
 19,448 (1926). Simmonds. Mixing-apparatus. (265,073.)
 *18,033 (1926). Berton & Co. Machine for distilling water-containing products, particularly sugar solution. (265,127.)
 *2270 (1927). Mercier. Apparatus for condensing vapours and extracting non-condensable gases. (265,199.)

II. Applications

Dehn (Schuster). Treating oils etc. 2800. Jan. 31.
 L-G. Farbenind. 2745. See XX.
 International Combustion Engineering Corp. Apparatus for low-temperature distillation of coal. 3036. (U.S. 1.3.26.)
 Johnson. Production of carbon. 3236. Feb. 4.
 Lessing. Heat treatment of briquettes. 2801. Jan. 31.
 Norsk Hydro-Elektrisk Kvaestofakt. 3009. See I.
 Petroff. Treating mineral and naphtha oils. 2892 and 2896. Feb. 1.
 Wellman Smith Owen Engineering Corp., Ltd., and Kemp. Gas producers. 3309. Feb. 5.

II.—Complete Specifications

10,444 (1926). De Bataafse Petroleum Maatsch. Distillation of petroleum etc. (253,489.)
 11,945 (1926). McCormick. Apparatus for distilling carbonaceous materials. (265,046.)
 20,280 (1926). France. Plant for washing coal etc. (265,077.)
 *2294 (1927). Hoyois. Washing coal, ores, etc. (265,202.)
 *2312 (1927). Espes. Apparatus for detecting carbon monoxide. (265,207.)
 *2574 (1927). Tonmin. Carbonising coal. (265,228.)
 *2745 (1927). L-G. Farbenind. See XX.

III.—Application

Rogers (Kirschbraun). 2751. See IX.

IV. Applications

British Dyestuffs Corp., Cliffe, Linch, and Rodd. 3341. See XX.
 British Dyestuffs Corp., Davidson, and Shepherdson. Manufacture of anthraquinone derivatives. 3339. Feb. 5.
 British Dyestuffs Corp., and Simmonds. Manufacture of triarylmethane dyes. 3340. Feb. 5.

Carpmael (I.-G. Farbenind.). Manufacture of triaryl-methane dyestuffs. 2924. Feb. 1. Manufacture of vat dyestuffs. 3135. Feb. 3. Manufacture of 2·7-dinitroanthraquinone. 3243. Feb. 4.

Gardner. Treatment of dyestuffs etc. 3350. Feb. 5.

Scottish Dyes, Ltd., Anderson, Thomas, and Thomson. Production of benzanthrone derivatives. 3050. Feb. 2.

IV.—Complete Specifications

27,339 (1925). Zinke. Manufacturing dyestuffs. (242,306.) 8519 (1926). Johnson (I.-G. Farbenind.). See XIII.

*2186 (1927). I.-G. Farbenind. Manufacture of phthaloyl-2:3-thionaphthene and derivatives. (265,193.)

*2299 (1927). Geigy A.-G. Manufacture of mordant dyestuffs. (265,203.)

*2553 (1927). I.-G. Farbenind. Manufacture of isatins and N-arylsulpho-compounds thereof. (265,224.)

*2667 (1927). I.-G. Farbenind. Manufacture of vat dyestuffs. (265,232.)

V.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of artificial silk. 3041. Feb. 2.

Marks (Du Pont Visceloid Co.). Fire-proof products etc. 2890. Feb. 1.

V.—Complete Specifications

23,322 (1925). Ellis (Soc. Fabr. Soie Rhodiaseta). Apparatus for the manufacture of artificial silk. (264,708.)

27,153 (1925). Rushton. Manufacture of artificial silk. (264,929.)

27,309 (1925). Dreyfus. Manufacture of cellulose derivatives. (264,937.)

13,866 (1926). Jackson (Robinson Fiber Corp.). Treatment of paper-pulp stock. (265,055.)

VI.—Application

Gardner. Dyeing. 3351. Feb. 5.

VI.—Complete Specifications

15,395 (1925). Dreyfus. Manufacture of acetic acid. (264,558.)

27,308 (1925). British Celanese, Ltd., and Ellis. Treatment of yarns and fabrics. (264,936.)

29,780 (1925). Dehn (Stein Fur Dyeing Co.). Bleached and dyed furs. (264,969.)

31,049 (1926). Sallmann. Production of a smooth dull surface in dyed textile fabrics. (262,783.)

VII.—Applications

Robson. Preparation of sulphate of ammonia. 3110 and 3153. Feb. 3.

Vidal (Riedel A.-G.). Production of hydrogen peroxide. 3204. Feb. 4.

VII.—Complete Specifications

24,309 (1925). Commonwealth White Lead & Paints Proprietary, Ltd. See XIII.

28,185 (1925). Tennant (N. V. Philips' Gloeilampenfabrieken). Deposition of boron in coherent form. (264,953.)

9204 (1926). Marks (American Smelting & Refining Co.). See X.

*14,274 (1926). Roessler & Hasslacher Chemical Co. Manufacture of sodium peroxide. (265,124.)

*15,138 (1926). Cerini. Apparatus for purifying solutions of caustic soda etc. (265,126.)

*26,917 (1926). Oesterreichische Chem. Werke. Production of persulphuric acid and its salts. (265,141.)

*1885 (1927). Tardan. Manufacture of lead monoxide. (265,190.)

VIII.—Application

Withers (Vitrefrax Co.). Refractory compositions. 2881. Feb. 1.

VIII.—Complete Specification

2268 (1925). Hope. Manufacture of vitreous masses. (261,550.)

IX.—Applications

Curtin. Preserving wood. 2789. Jan. 31.

Kelly. Waterproof cement etc. 2726. Jan. 31.

Rogers (Kirschbraun). Process of making bitumen etc. emulsions. 2751. Jan. 31.

IX.—Complete Specification

*2309 (1927). Montan, Inc. Impregnating wood. (265,206.)

X.—Applications

Arrowsmith. Manufacture of steel. 2716. Jan. 31.

Ashcroft. Treating slags etc. 3119. Feb. 3.

Coley. Manufacture of zinc. 3016. Feb. 2.

Cruse. Reduction of metal etc. 3052. Feb. 3.

Dicker (N.V. Philips' Gloeilampenfabr.). Soldering metals etc. 2770. Jan. 31.

Fairweather (Nybergs Grufaktiebolag). Reducing ores. 2795. Jan. 31.

2 Fallon and Smallwood. Furnaces for heat treatment of metals. 2722. Jan. 31.

Johnson (I.-G. Farbenind.). Manufacture of finely-divided metals. 3235. Feb. 4.

Laebrecht. Electrodeposition of chromium. 2884. Feb. 1.

Woodward. Heat treatment of steel. 2841. Feb. 1.

X.—Complete Specifications

18,582 (1925). Smith. Extraction of lead. (261,569.) 9204 (1926). Marks (American Smelting and Refining Co.). Recovery of zinc and zinc compounds. (265,036.)

12,286 (1926). Hoorn. Removing hydrogen from the surface of metal objects to be coated by electrolysis. (265,047.)

*153 (1927). Krupp Grusonwerk. Working-up complex ores and metallurgical products. (265,162.)

*546 (1927). Aluminium Industrie A.-G. Manufacture of aluminium. (265,170.)

*2294 (1927). Hoyos. See II.

*2431 (1927). Kaiser-Wilhelm-Institut für Eisenforschung. Purification of metals. (265,213.)

XI.—Applications

2 Forgrove Machinery Co., Ltd., and Grover. Selenium cells. 2735. Jan. 31.

Laebrecht. 2884. See X.

Meyer and Spanner. Incandescent cathode for electric discharge tubes. 3270. Feb. 4. (Ger., 9.6.26.)

Pechkranz. Electrodes. 3227. Feb. 4. (Switz., 5.2.26.)

Postlethwaite, and Siemens Bros. & Co. Dry batteries. 2742. Jan. 31.

XI.—Complete Specifications

27,005 (1925). Siemens-Schuckertwerke. Electric furnaces. (244,426.)

29,826 (1925). Edison Swan Electric Co., and Webster. Electric accumulators. (264,970.)

1425 (1926). Fuller's United Electric Works Ltd., and Whaite. Electric accumulators. (265,000.)

12,286 (1926). Hoorn. See X.

29,284 (1926). General Electric Co., Ltd. Manufacture of filaments for electric incandescent lamps. (265,113.)

XII.—Applications

Dehn (Schuster). 2800. See II.

Petroff. Production of emulsifiable etc. preparations. 2890 and 2894. Feb. 1. Splitting of fats, oils, etc. 2895. Feb. 1.

XII.—Complete Specifications

*30,408 and 30,469 (1926). Henkel & Cie. Manufacture of a glycerin poor in polyglycerins and containing diglycerin. (265,146—7.)

*2429 (1927). I.-G. Farbenind. Extracting vegetable oils. (265,212.)

XIII.—Applications

Coles. Production of white lead. 3177. Feb. 4.

Petroff. Production of phenolic condensation products. 2893. Feb. 1.

XIII.—Complete Specifications

24,309 (1925). Commonwealth White Lead and Paints Proprietary, Ltd. Manufacture of lead compounds. (249,809.)

8519 (1926). Johnson (I.-G. Farbenind.). Manufacture of colour lakes. (265,032.)

8659 (1926). Jarny. Manufacture of condensation products from phenols and formaldehyde. (265,033.)

9037 (1926). Jackson (New Jersey Zinc Co.). Zinc sulphide pigment. (250,581.)

13,044 (1926). British Thomson Houston Co., Ltd. Resinous condensation products. (252,394.)

14,481 (1926). Koelman. Producing acid-proof adherent and repairable coatings from artificial resins. (253,531.)

XIV.—Applications

Butler. Liquidised crude rubber. 3039. Feb. 2.

Naugatuck Chemical Co. Treating latex etc. 2764. Jan. 31. (U.S., 243,26.)

XIV.—Complete Specification

509 (1927). Roessler and Hasslacher Chemical Co. Accelerators for vulcanisation of rubber. (265,169.)

XV.—Applications

British Glues and Chemicals, Ltd., and Drew. Process for degreasing bones etc. 3151. Feb. 3.

Tassel, and Van Tassel Co. Waterproofing leather etc. 2790. Jan. 31.

XVI.—Complete Specification

*2218 (1927). Rhenania-Kunheim Verein Chem. Fabr. Ges. Manufacture of chemical manures. (265,197.)

XVII.—Application

Berten & Co. (Ges. Apparatus for boiling and evaporating sugar solution 2767. Jan. 31. (Ger., 12,11,26.)

XVII.—Complete Specification

*18,033 (1926). Bertin & Co. See I.

XVIII.—Application

Hansana A.-G., and Nathan. Vessels for fermentation purposes. 3356. Feb. 5. Pasteurising beer. 3357. Feb. 5.

*XVIII.—Complete Specification

23,580 (1925). Fuller. Artificial malt product for brewing and bread-making. (264,890.)

XIX.—Complete Specification

23,580 (1925). Fuller. See XVIII.

XX.—Applications

Bhisey. Manufacture of eau-de-Cologne. 3159. Feb. 1.

British Dyestuffs Corp., Cliffe, Linch, and Rodd. Obtaining derivatives of diaryl ketones. 3341. Feb. 5.

Carpmael (Chem. Fabr. vorm. Schering). Manufacture of metallo-mercapt compounds. 3042. Feb. 2. Manufacture of anhydrides of acetic acid etc. 3244. Feb. 4.

Claasen. Production of ester mixtures. 3020. Feb. 2.

I.-G. Farbenind. Manufacture of esters. 2744. Jan. 31. (Ger., 29,1,26.) Production of organic compounds from hydrocarbons. 2745. Jan. 31. (Ger., 29,1,26.) Manufacture of condensation products from naphthalene etc. 3134. Feb. 3. (Ger., 4,2,26.)

Imray (I.-G. Farbenind.). Manufacture of 1-phenyl-3-methyl-5-pyrazolone. 3327. Feb. 5.

Marks (Parke, Davis and Co.). Immunising product etc. 2788. Jan. 31.

Petroff. Separating and purifying sulpho-acids. 2891. Feb. 1.

Soc. Anon. Prod. Chim. Coverlin, and Bots. Manufacturing vanillin. 3022. Feb. 2. (U.S., 25,5,26.) Manufacturing iso-eugenol. 3023. Feb. 2. (U.S., 25,5,26.)

XX.—Complete Specifications

15,395 (1925). Dreyfus. See VI.

15,621 (1925). Chem. Works (Sandoz). Making allium preparations for medical use. (235,883.)

*440 (1927). Chem. Fabr. (vorm. Schering). Manufacture of hormone from the sexual organs. (265,166.)

*441 (1927). Chem. Fabr. (vorm. Schering). Manufacture of derivatives of 2-aminopyridine. (265,167.)

*2744 (1927). I.-G. Farbenind. Manufacture of esters. (265,233.)

*2745 (1927). I.-G. Farbenind. Production of valuable organic compounds from gaseous or vaporous hydrocarbons. (265,234.)

XXI.—Applications

Bawtree. Photographic image, and means for producing same. 3279. Feb. 1.

Frost. Reproduction of photographic images. 3010. Feb. 2.

Green. Manufacture of photographic etc. films. 2805. Jan. 31.

Loeb and Wreschner. Manufacture of preparation emitting β -rays. 3133. Feb. 3. (Ger., 8,2,26.)

Schwickert. Producing diazo-type paper. 3249. Feb. 4. (Ger., 4,10,26.)

XXI.—Complete Specification

17,165 (1926). Imray (I.-G. Farbenind. A.-G.). Silver halide emulsion. (255,846.)

XXII.—Complete Specification

8086 (1926). Bombini Parodi-Delfino, and Benelli. Manufacture of explosives. (265,029.)

XXIII.—Applications

Magrath. Treatment of water for softening etc. purposes. 3335. Feb. 5.

Marx. Clarification of fluids etc. 3009. Feb. 3.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*British India*: Copper ingots (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Canada*: Druggists' specialities (129); Pulp machinery (B.X. 3211). *Chile*: Galvanised iron sheets, sheet and bar brass, copper, lead and zinc (C.X. 2183). *Dutch East and West Indies*: Galvanised corrugated and flat steel sheets (150). *Egypt*: Nitrate of soda, nitrate of lime, sulphate of ammonia, superphosphate of lime (C.X. 2196). *France*: Artificial silk yarns (136); rubber goods (138). *Holland*: Linoleum (145). *Rumania*: Tinplate, black sheets, terneplates, galvanised sheets, tin, etc. (146).

PUBLICATIONS RECEIVED

REPORT ON THE FERMENTATION INDUSTRIES FOR 1926. Prepared for the Society of Chemical Industry and the Institute of Brewing. By H. Lloyd Hind, B.Sc. Pp. 37.

Messrs. Crosby Lockwood & Son announce that Dr. Geoffrey Martin's comprehensive treatise on "The modern soap and detergent industry" has been translated and published in Russian.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, FEBRUARY 25, 1927

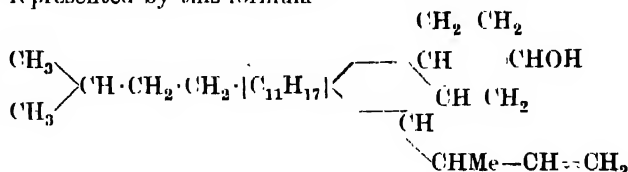
No. 8

EDITORIAL

You Never Can Tell

IT is very difficult to know which new facts are likely to be of value to mankind; much is published, and some of it is of value. Even the experts cannot be sure that the grain has been separated from the chaff. About the year 1845 a certain Waterston sent to the Royal Society a long paper in which he claimed that some of the properties of gases could be explained by assuming that these contained molecules rushing about in all directions and rebounding from each other and from the walls of the vessel containing the gases. The learned referee turned it down as preposterous. Afterwards Clerk Maxwell and other people put forward the same hypothesis, and by more or less of an accident Waterston's paper was rescued from oblivion by Lord Rayleigh and published nearly fifty years after it was prepared. We think that many people would have considered that the spectroscopic examination of such substances as cholesterol and ergosterol could hardly be of any practical value; they would have been wrong. We had the pleasure, in our issue of December 10 last, of publishing notices of two papers. In the one, Messrs. Rosenheim and Webster showed that the vitamin D obtained by exposing cholesterol to ultra-violet light was not derived from cholesterol, but from a substance usually associated with it: in the other, Messrs. Heilbron, Kamm and Morton showed that a substance associated with cholesterol had three well-defined bands in its spectrum which disappeared on exposure to ultra-violet light. More recently Messrs. Windaus, Heilbron and his colleagues, and Rosenheim and Webster, all making use of each other's ideas and knowledge, have been investigating ergosterol, and it has been shown that the parent substance of vitamin D is either ergosterol or a highly unsaturated sterol of similar constitution. This extremely important fact is announced in a paper by Messrs. Rosenheim and Webster which appeared in the *Lancet* on February 5. We learn from a more recent number of the *Lancet* that the British Drug Houses, Ltd., can now supply an activated ergosterol solution which is far more potent than any cod-liver oil: about half a cubic centimetre of a 0.1% solution is all that is required for a daily dose. Whether they

make the substance from ergot or yeast we do not know. Ergosterol can be prepared from either. The production of vitamin D, the anti-rachitic vitamin, from the so-called cholesterol, was independently discovered by Rosenheim and Webster here, and by Steenbock and others in America. According to the *Daily Mirror* Prof. Steenbock proposes to reveal gratuitously his method of isolating vitamin D, and has refused a sum which would have made him rich beyond the dreams of avarice. Cholesterol has a constitution probably represented by this formula—



The many interesting substances contained in ergot have been investigated by Messrs. Barger, Carr, Dale and several other chemists.

Medical Research

The Report of the Medical Research Council for the year 1925—6 has been issued this week: a hasty perusal of it shows that it is a document well worthy of the attention of those who are interested in the progress of chemistry. In the middle ages chemistry and medicine were closely allied; it appears to us that some of the most important developments of chemistry during the next 20 years will be in the regions of biochemistry and pharmacy, and that medicine and chemistry will again become, so far as they are sciences and not arts, bound together by numerous ties. The Report covers an extensive field, and we can merely allude to a small number of topics from it. There is a brief account of histamine, otherwise B-iminazolyethylamine isolated from ergot by Dale, Barger and Laidlaw before the war; this substance has an extraordinary power of causing contraction of muscle, and as it occurs in notable quantity in several parts of the animal body its importance in the regulation of various functions is becoming apparent. Further research work on cholesterol and the other sterols is described, also the recent work on

insulin. Insulin is not merely useful in the treatment of diabetes, it is of great use in physiological research, and especially in the examination of the chemistry of muscular contraction. What an extraordinary phrase this is: the chemistry of muscular contraction. It is perhaps the most singular evidence of the progress of chemistry that we have come across, and yet it is already a perfectly familiar one. A note on the relation of diet to the formation of teeth and the prevention of their decay deals with one of the vitamin questions. There is a notice of the work of Dudley, Rosenheim and Starling on spermine; the synthesis of this substance has been accomplished, and its constitution is therefore known. As it occurs in almost all living cells and has an effect on the nerves, it seems as if it plays an important part in the animal apparatus. Prof. Drummond, working in conjunction with Prof. Heilbron and Mr. Channon, has studied fish liver oils and, in particular, squalene; Heilbron has pointed out that squalene is a precursor of cholesterol, and it seems that hydrocarbons, somewhat similar to squalene, are more common in animal organs than was hitherto supposed. The Medical Research Council desires to extend work in chemotherapy, a word now used to mean the discovery or production of chemical substances which will kill infective organisms without killing the body itself: this study involves close touch between chemical and biological workers: details are given of the work carried on by Prof. C. H. Browning, of Glasgow, and Prof. J. B. Cohen, of Leeds, on the action of various amino-styryl quinoline compounds and on new organic compounds of bismuth. The biochemistry of nitrogen-fixing bacteria is being studied by Miss M. D. Whetham at Cambridge and Prof. McLeod at Leeds. The examination of anaesthetics is engaging the attention of Prof. F. G. Dounan and Mr. A. N. C. Bennett at University College, London. A special committee has investigated the legibility of type, and there is an immense variety of other research alluded to in the Report. We are glad to find that papers published in this JOURNAL are referred to: we hope that in the future we may be able to devote a little, a very little, more space to the great developments of biochemistry than has hitherto been possible. We have not been able in the past to deal often with drugs either from the point of view of the manufacturer or the user. If the modern tendency of chemistry towards life and disease is not a mere temporary phase, we ought to pay rather more attention to the manufacture of drugs as part of the chemical industry than we have done. The time is rapidly approaching when some knowledge of drugs is necessary to every all-round chemist, and when some knowledge of chemistry is essential to every well-educated person. We shudder to think how many subjects the well-informed chemist will have to learn, but are comforted by the reflection that when a study becomes too vast, provided you have the principles firmly in your mind, it is nearly as useful to know where to find the facts as to load your brain with them. Every chemist ought to know his way about Mellor, even if he has never read many of the volumes.

The Pageant of Chemistry

The British Industries Fair has opened its doors, and the pageant of British chemistry is displayed for all

the world to see. Buyers from thirty-four countries will visit the Fair; hundreds of keen, critical men from the provinces will be seen in earnest conversation at the stands, and in the evenings the public will be admitted to admire the resource and variety of British manufactures. We have visited the Fair before, and visited it often, but, let it be said at once, the Association of British Chemical Manufacturers have arranged the Chemical Section so conveniently at the Shepherd's Bush entrance, and the members of the Association have provided such tempting exhibits, so excellently arranged, that we have not been able to pass further into the Fair—the Chemical Section has provided enough and to spare. As it was last year, so it is this, but, somehow, this year's Chemical Section seems to be brighter, even more alluring. Is it the charm of the tavern, "At the sign of the Benzene Ring," which again houses the products of the South Metropolitan Gas Company, or is it that the revolving circular exhibit of the Gas Light & Coke Company, with its sectors brilliant with Prussian blue or pale with anthracene, suggests gaily the presence of a croupier ready with bags, not of money, but of sulphate of ammonia. What it is we do not know, but no one can deny that the dominating feature of the Section is the edifice—one can hardly call it a stand—erected by Imperial Chemical Industries, Ltd., which thus makes its first public appearance. The edifice, with its original and attractive design, symbolises admirably the world-wide scope of the new merger. The vast range of the company is effectively illustrated by a wonderful flow sheet, which shows, by means of an ingenious arrangement of coloured wires and arrows, how the various manufactures of the constituent firms are linked up, starting with primary raw materials such as air, sulphur, coal, brine and limestone, and passing through many intermediate products to manufactures such as dyes, fertilisers, bleaching powder, alkalis, ammonia, explosives. So can everyone see how closely the work of the chemist enters into the daily needs and doings of each and every one of us. Another aspect of the work of the chemist is portrayed by the British Drug Houses, Ltd. It only seems a few weeks since Dr. Harington described his synthesis of thyroxine before the Biochemical Society, but at the Fair, so quickly does the fine chemical manufacturer work, the British Drug Houses are showing examples of their synthetic thyroxine side by side with the glandular product, both available in quantity. Other B.D.H. novelties are irradiated ergosterol, containing vitamin D, and "Radiomalt," a food preparation which contains vitamins A and D, and saves childhood from the terrors of cod-liver oil. Space is running short, but we must mention the solvents and plasticisers for cellulose lacquers of Boake Roberts, the medicinal organic chemicals of May & Baker, the rare earth chemicals of Hopkins & Williams, Howard's new solvent, Sextol, Whiffen's vermilion, Bush's essential oils and solvents, Allen's oxalates, Tyrer's nickel formate and new reagent bottles, the interesting exhibit of Albright & Wilson, whose "silicon ester," so valuable for the preservation of stone, is now used as a medium for painting—decorative and artistic—with striking possibilities. We must resign ourselves to be incomplete, for the riches of the Chemical Section are far too great for our limited space.

THE SCIENCE OF THE SOIL

By H. J. PAGE, M.B.E., B.Sc., A.I.C.

As the medium on which man is ultimately dependent for the whole of his food supply (excepting only sea food), the soil is a material the study of which is of the greatest interest and importance. The complex and varied nature of its composition, and of the processes that occur in it, makes that study an intricate affair.

The soil consists of a mineral framework of rock material with which is associated colloidal matter of inorganic origin, derived from the weathering of this rock material, and of organic origin, derived from the breakdown of the residues of plants and animals.

Permeating this system are an aqueous phase existing partly as a free water film and partly in association with the colloidal matter in the gel condition, and a gaseous phase, the soil atmosphere. The whole is the habitat of a soil population, embracing organisms of the greatest variety—bacteria, actinomycetes, fungi, algae, protozoa, earth-worms, not to mention insects and other animals which are in the soil rather than of it. There is, in addition, a large number of relatively simple substances, both inorganic and organic, some in solid form, and some in solution—the products of chemical changes undergone by the more complex constituents, as a result either of the metabolic processes of the soil organisms, or of reactions of a non-vital origin.

Until recent years only the chemistry of the soil had received much attention, and that without providing any close insight into the nature of the chemical processes that occur in it or of the constitution of its chief components. The position of the subject has only recently passed beyond the stage that may be described as "matriculation chemistry applied to the soil." It is not difficult to see why this should be so. The parent substances of the most important soil constituents are themselves compounds of very great complexity, the constitution of which is not known. The complex silicates of rocks present some of the most difficult problems of inorganic chemistry, whilst the chief ingredients of plant residues—cellulose, lignin, hemicelluloses, pentosans, and the like—still provide a rich field of investigation for the organic chemist. When the constitutions of the parent substances are so complex and uncertain, it is not surprising that the chemistry of the products to which they give rise in the soil, the clay and humic substances, is still so little understood, more especially since these substances are colloids. The subject of colloid chemistry, despite the big advances that have been made in recent years, is still in its infancy, and although it affords much valuable information regarding the methods of handling soil colloids, it is not of much assistance in the study of their chemical nature. Many of the chemical changes which occur in the soil are of biological origin. The biochemistry of any one of the many kinds of micro-organisms in the soil is, however, to a large extent unknown, even in pure culture, and still less is known of the reactions occurring in the presence of such a heterogeneous mixture of all sorts and conditions of micro-organisms as exists in the soil.

The literature of such a many-sided subject is naturally a very comprehensive one, consisting for the most

part of original papers published in scientific and technical journals. The subject is of such recent growth, and knowledge is advancing so rapidly, that one can scarcely expect to find an authoritative and up-to-date review of it in all its aspects from the pen of a single author. One must look rather to the writings of specialists in the different branches of the subject, either in the form of monographs by single authors, or in the form of collections of papers or symposia on special questions. A convenient opportunity of contrasting these different methods of dealing with the subject, and at the same time of reviewing some of the most important of its aspects, is afforded by the recently-published works noted below.*

The first two volumes are examples of monographs by specialists. The book by Professor Stoklasa deals with methods for the biochemical investigation of the soil, a subject to which he has long devoted a large part of his energies. A defect from which any monograph of this type is liable to suffer is that of showing an undue bias to the views and methods favoured by the author. Stoklasa's monograph is certainly not free from this defect, and many sections of the book must be read as a presentation of the author's own point of view rather than as a critical review of rival hypotheses. The result is a very marked unevenness of treatment of the subject. A quite disproportionate amount of space is devoted to the so-called "rhizosphere bacteria," and to the author's work on such subjects as root respiration, radioactivity of soils, and the determination of the "availability" of phosphates and potash in the soil.

The introductory part of Stoklasa's monograph is devoted to an exposition of his own views regarding the existence and functions of specific "rhizosphere bacteria," which are supposed to be symbiotically associated with the roots of growing plants. One fact on which stress is laid is that of the considerable differences that exist in the "feeding power" of plants for insoluble substances such as mineral phosphates. In this connexion the author does not support Prianishnikov's views on the action of "physiologically acid" fertilisers such as ammonium sulphate, but ascribes greater importance to the nutritive action of fertilisers and of carbonaceous material on the bacteria, which are thereby enabled to produce greater amounts of carbon dioxide and organic acids, to the production of which the availability of insoluble phosphates and the like is due. There can be little doubt that this view has much to support it, but in the writer's opinion it has no bearing on the reality of the existence of a specific "rhizosphere" microflora; most of the free-living

* (1) "Methoden zur biochemischen Untersuchung des Bodens." By Julius Stoklasa. Pp. 262. (Handbuch der biologischen Arbeitsmethoden, edited by Prof. E. Abderhalden. Lieferung 145. Abteilung XI, Teil 3, Heft 1, spezielle Methoden: b) Boden. Berlin and Vienna: Urban and Schwarzenberg, 1924. Price: 9.60 m.

(2) "Die physikalische Untersuchung des Bodens." By E. A. Mitscherlich. "Die Methoden zur Untersuchung der Boden Kolloide und ihrer Eigenschaften." By G. Hager. "Gesamtanalyse von Pflanzenmaterial." By V. Grafe. Pp. 263—465. (Handbuch der biologischen Arbeitsmethoden, edited by Prof. E. Abderhalden. Lieferung 146. Abteilung XI, Teil 3, Heft 2, spezielle Methoden: b) Boden. Berlin and Vienna: Urban and Schwarzenberg, 1924. Price: 7.50 m.

(3) "Base Exchange in Soils." A general discussion held by the Faraday Society on December 9, 1924. Pp. 150—317. London: The Faraday Society, 1925. Price: 5s.

(4) "The Science of Soils and Manures." By J. Alan Murray, B.Sc. Third edition, revised and enlarged. Pp. xiv + 298. London: Constable & Co. Ltd., 1925. Price: 12s. 6d. net.

micro-organisms of the soil could take part in such processes. The author rightly lays stress on the selectiveness of the plant in its absorption of plant nutrients from the soil. The importance of recognising this has recently been aptly pointed out by Hoagland thus: "Water may be absorbed either more or less rapidly than the ions present in the solution, depending on the conditions of growth and transpiration, the concentration of the solution, and the nature of the ion. It is equally incorrect to consider the plant either as an organism carefully selecting only the essential ions from the culture medium, or as a sort of wick, taking up the solution, evaporating the water, and leaving the solutes behind."

In common with most other workers on the subject, Stoklasa assumes that the nutrient substances absorbed by the plant root are absorbed in solution. The alternative hypothesis advanced by Comber, largely lacking though it is in experimental support, might, however, have been referred to.

The first main section of the monograph deals with the methods of biochemical and biophysical investigation of the soil. Most of the matter discussed in this section is, however, of purely chemical and physical nature, the inclusion of which in a biochemical treatise is somewhat unnecessary, and the value of which is in any case much reduced by the incompleteness and often the out-of-date nature of the subject matter. Thus we find the old selective absorption theory of soil acidity still retained, with no mention of more modern views; the rather surprising statement is made that the "state of saturation" of clay acids has little effect on the reaction, although the work of the last few years has abundantly shown the opposite to be true. Stoklasa takes to himself the main credit for the use of weak citric acid in the estimation of the probably available phosphates and potash of the soil, the well-known and widely-used method of Dyer being only incidentally mentioned. Of the many methods proposed for isolating the "soil solution" only the pressure method of Ramann is described, although the most widely used method in recent years is the displacement method of Ischerekov-Parker.

The next main section of the book, written with the co-operation of V. Kás, deals with the study of the soil organisms and their actions. Here, again, a marked personal bias is evident in many places, and much non-Continental work is not mentioned. Thus under the heading of nitrification no reference is made to the classical work of Warington. Wann's claim that the soil algae are able to fix atmospheric nitrogen is accepted, although that claim has been shown by Bristol and Page to be without foundation. In dealing with the sulphur cycle the extensive recent work of the New Jersey school on sulphur-oxidising bacteria is not mentioned. However, a considerable amount of useful information has been collected in this section.

The third section of the book is concerned with the organic matter of the soil. The subject as a whole is treated in a rather incomplete fashion, the larger part of the section being given up to the work of the author and his co-workers on the carbon-dioxide production of the soil as a measure of biological activity.

An uninformed reader of Stoklasa's book would derive from it the impression that the most of our knowledge of the biology and biochemistry of the soil was due to the labours of Continental workers, and that the United States was the only English-speaking country that has contributed even modestly to the subject. He would conclude that English workers had achieved practically nothing, and that Stoklasa and his school had brought about the most considerable additions to our knowledge. Without in any way wishing to detract from the acknowledged great importance of Stoklasa's work and from the high position he holds in the subject, it must be pointed out that the book under notice gives an incomplete treatment of the subject, which is often sadly lacking in a sense of proportion. It can be commended to the expert who requires information on specific Continental investigations and, in particular, on the views and work of the Prague school, but as a general and comprehensive account of the subject it cannot be recommended.

The first part of the second volume under notice is a brief and self-contained article by Prof. Mitscherlich, in which he describes those methods of physical examination which are specially designed to provide information regarding the pore space and internal surface of the soil. This is a subject to which Mitscherlich has given much attention, and on which he is qualified to write authoritatively. Some space is also devoted to the water relationships of the soil, though here the treatment is less complete, probably intentionally; permeability and evaporation are only briefly discussed, and no experimental detail is given.

Following this, and occupying more than half of the whole volume, is a monograph by Prof. Hager on the soil colloids. In the introduction the author lays emphasis on the essential similarity between sols and gels with regard to the innate nature of many of their properties; as pointed out by Wiegner, it is important to remember this, since most of the colloidal matter of the soil exists normally in the gel condition, whilst a large part of our knowledge of the properties of colloids is derived from the investigation of sols.

On the whole the subject is dealt with by Hager in a markedly rational manner, although the treatment suffers, especially in that part specifically devoted to methods, from an entire absence of reference to work described in non-German journals. The author admits this shortcoming, which is excused by the inaccessibility of foreign journals in Germany since the war. It must be acknowledged that this excuse has some justification, although it is to be hoped that the position is now improving; but, however legitimate it may be as an excuse, it does not get away from the fact that much important modern work which is decidedly germane to the subject matter discussed is ignored; to this extent the monograph fails to give a complete account of modern views and methods. Thus the views of Stremme and of Wiegner on the origin of "zeolitic" soil colloids by mutual precipitation of sols of alumina and silica have been somewhat discounted by later work. Similarly, doubt has now been thrown on the older view quoted by the author according to which only a very small amount of the clay in the soil consists of "colloidal clay." However, despite its omissions, the monograph provides

a lucid and tolerably up-to-date account of present-day views. In the section on adsorption stress is laid on the essentially empirical nature of Freundlich's isotherm, and some of the pitfalls attending its use are demonstrated. It is rightly pointed out that chemical forces may play a large part in "adsorption" phenomena. The influence of the "state of saturation" with exchangeable bases, and of the kind of base, on colloidalilty is recognised.

The concluding part of this volume is an account by Prof. Grafe of methods for the detection and estimation of the organic and inorganic constituents of plants. It is not obvious why this article is included in this section of the "Arbeitsmethoden," which professes to be confined to the study of the soil.

The perusal of these two volumes of Abderhalden's monumental work reveals one of the faults which it is difficult to avoid in such co-operative productions. There is an appreciable amount of unnecessary overlapping and repetition. Thus, Mitscherlich's method for the determination of moisture and hygroscopicity of soils is described, with identical illustrations, three times in the two volumes, by Stoklasa, by Mitscherlich, and by Hager, whilst two of the three describe Wiegner's apparatus for mechanical analysis. An annoying feature is the absence of indexes to the separate volumes; this omission one associates more with Gallic than with Teutonic publications.

The Faraday Society's General Discussion on Base Exchange in Soils, which forms the subject of the next volume under notice, is an example of a much more specialised work, in which the views and results of a number of investigators in this field are set forth and discussed. Although the chief facts of base exchange in soils, as a phenomenon accompanying the adsorptive action of soils on salts, were discovered over seventy years ago by J. T. Way, it is only in the last decade that the subject has come to be recognised as one of considerable importance in the study of the soil. Indeed, the subject has now become such a popular one with soil investigators that there appears to be some danger of its becoming a "craze" in the same way that p_H has been almost run to death in recent years.

One of the most active and successful investigators of the subject is Dr. Hissink, the well-known Dutch soil scientist, and the Faraday Society was most fortunate in securing his attendance at the discussion, to which he contributed the opening paper. In this paper he gives a succinct and lucid explanation of his work, which serves admirably to show the main outlines of the subject. The succeeding papers by Prof. Comber, Messrs. Page & Williams, Robinson & Rice Williams, Saint, and Fisher, and the discussion which followed, not only show what British soil workers are doing in this field, but they also develop in more detail most of the important applications of base exchange to related soil phenomena such as the effects of manuring, the problem of soil acidity, and the colloidalilty of the soil. Although, hitherto, since the work of Way, the most important contributions to the study of base exchange in soils have come from abroad: from Hissink in Holland, Gedroiz in Russia, and Kelley in California, the action of the Faraday Society in holding this discussion and in publishing this volume must be reckoned as an important

contribution from this country which has undoubtedly done much to stimulate further work on the subject both here and abroad.

The last volume under notice is an example of an entirely different type of work. In contrast to the monographs in Abderhalden's *Arbeitsmethoden* and the Faraday Society's symposium on a highly specialised subject, Mr. Murray's book sets out to treat of the whole science of soils and manures in one volume of 300 pages. As pointed out in the earlier part of this article, one can hardly expect to find an authoritative account of such a rapidly advancing and complex subject from the pen of a single author. Murray's book, which is a new edition of a volume published in 1910 under the title of "Soils and Manures," cannot be said to disprove that statement. It is true that considerable alterations have been made in comparison with the earlier book, and that a valiant attempt has been made to cover the whole subject adequately, but the space is so restricted and the task so large that some aspects of the subject were bound to be neglected. The book is primarily intended as a manual for students for University Degrees and College Diplomas, as well as for planters and cultivators both in this country and overseas. For this type of reader a certain simplification of points of view is desirable, and many of the more advanced and intricate modern developments are best omitted or only lightly sketched in. For this reason some of the inaccuracies and omissions of the book need not be the subject of serious cavil. The advanced soil investigator would question the accuracy of statements such as that kaolin is the chief constituent of clay in soils, that hygroscopicity is a purely mechanical property, that when a soil comes in contact with a salt solution the resulting solution is generally more dilute, or that superphosphate is an acid manure. Similarly, he would deplore the fact that much of the more recent work on soil colloids, and the relation of their exchange reactions with cations to such important soil properties as tilth and acidity is scarcely mentioned. Some other respects in which the book is not as up-to-date as its preface would lead one to expect are the very scanty treatment of the carbon cycle in soil; the treatment of soil fertility in the chapter bearing that title, in the old-fashioned way as an almost wholly chemical phenomenon; the absence of any reference to the use of cresylic acid for partial sterilisation of soils in glass-houses; the omission of lucerne as a crop which has given important practical results from inoculation with nodule bacteria; and the omission of any reference to the Haber process for the fixation of atmospheric nitrogen, and to the successful working of an adaptation of that process for the large scale production of sulphate of ammonia at Billingham. Of perhaps greater importance for the general reader and the less advanced student is the presence of some definite inaccuracies; thus it is stated that ionisation is the *essential* difference between true solutions and colloid solutions; that soils are ignited prior to mechanical analysis; that nitrification is the term applied to include *all* the changes which nitrogenous constituents undergo in the decay of organic matter in the soil.

The picking of holes is the reviewer's prerogative, and he is often liable to take the line of least resistance and

to avail himself of it, and so to give perhaps an unduly unfavourable impression of the volume under notice. Let me therefore hasten to remark that much of Mr. Murray's book is excellent, and that his method of exposition is usually lucid in the extreme. There is in the book far more matter with which no serious fault can be found than there is of subject for stricture. Mr. Murray's book is primarily for the use of the student, whose reading is usually supplemented by personal instruction from his teacher. The specialist soil investigator, on the other hand, will not find it of much assistance. He is more dependent on books of the type of the other volumes here noticed, and even these must be read with discrimination. Only the specialist in any one branch of a subject can write an adequate account of that side of the subject, and unfortunately he is often so specialised that he loses his perspective of the rest of the subject.

Progress in so pre-eminently a "borderline" subject as the study of the soil must necessarily lag behind that in the pure sciences on which it depends, and only by the co-operation of specialists in those pure sciences can any real advances be made. However, such co-operation has obtained in increasing degree in recent years, and such formerly neglected aspects of the subject as the physics and biology of the soil have now received so much attention that we can truly speak of soil science as a distinct and increasingly important branch of applied science.

BRITISH INDUSTRIES FAIR

The Exhibition at Birmingham

The British Industries Fair, Birmingham, 1927, which is an integral part of the Board of Trade British Industries Fair, was opened at Castle Bromwich, Birmingham, on February 18, and will remain open until March 4. As last year, the undertaking is receiving whole-hearted recognition and active co-operation from the Birmingham Corporation, and the Lord Mayor of that city (Alderman A. H. James) attended at the formal opening, at which there was a most representative attendance of business and commercial men from the Midlands and many parts of the country.

The Birmingham Fair, which represents the heavy industries of this country, is by far the largest industrial exhibition ever held in the provinces, and the largest to be held under one roof in the country. The area exceeds 6 acres—the enclosed space is 250,000 sq. ft., and 130,000 sq. ft. represents the space taken by stands, of which there are 600, compared with 400 twelve months ago. The three exhibition halls have been enlarged considerably, 73 ft. being added to the width of each, so that the Fair is exactly 33% bigger than that of 1926. The schedule is the same as last year. The heavy industries have been divided into 10 groups. The biggest section in point of numbers is that devoted to hardware and brassfoundry, the number of stands being 167. Next in importance is the engineering group with 134 stands, together with 35 firms who are responsible for a co-operative exhibit, namely, a modern boiler house of great size. This is a new and spectacular contribution to the Fair, and

the object of it is, of course, to enable industrialists to visualise a thoroughly modern boiler house on practical lines, with each component part in its correct position. Powdered fuel firing and oil firing methods may be seen, and the generation of electricity on economical lines and the application of it find a place in the scheme. The engineering group is of special interest; it is more representative than last year, and important Sheffield firms are prominent among the exhibitors. Out of 114 stands in the power, lighting and heating group, 85 belong to the electrical industry. The non-ferrous metal trades are admirably represented; stainless steel for a variety of purposes is much in evidence; the drop forgers have a huge exhibit showing the increasingly important parts which drop forgings play in general and special engineering work; and electro-plating plants are also of special interest. The research laboratory of the Birmingham Gas Department has a large stand showing scientific equipment and gas-heated furnaces, and metallurgical problems and tests are dealt with on the spot.

Although the chemical industry is represented at the London Fair, there is at Birmingham a very fine display of paints, varnishes and lacquers, and on Stand 85, Building "A," visitors will see the applications of cellulose finishes used for metal and wood surfaces on such diverse objects as filing cabinets and railway coaches. On this stand may be seen a range of patterns beautifully finished in Belco, a cellulose finish manufactured by Nobel Chemical Finishes, Ltd., an associated company of Nobel Industries, Ltd. It is interesting to note that these finishes are actually being used by one of the biggest metal filing cabinet manufacturers in the country, and that Belco has also been applied to several coaches on two of the great English railways. The coaches are in use as a test of durability of this type of finish, and from recent reports to hand it is giving every satisfaction. Other exhibits of interest are pedestal and counter weighing machines, bronze taps and meat covers, and many other similar articles showing the application of Necol glossy enamels, another product of Nobel Chemical Finishes, Ltd. Furniture trade visitors' attention is called to Belco wood finish for furniture, which has many advantages over the ordinary french polish, and will withstand heat and the damaging effect of weak acids and alcohol.

Throughout the Fair the British tradition for a high quality standard is well maintained, and full credit is due to the British manufacturer for his determination to cater adequately, and at competitive prices, for the home and foreign markets. There is evidence of a desire to get at close grips with foreign competition.

STORY OF BAKELITE

A cinematograph film, entitled "The story of bakelite," will be exhibited at the Tyseley picture house, Greet, Birmingham, on March 3, at 3 p.m. The exhibition has been arranged by the Damard Lacquer Co., Ltd., in association with Mouldensite, Ltd., Redmanol, Ltd., and the Bakelite Corporation of Great Britain, Ltd.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

ANNUAL GENERAL MEETING, 1927 ACCOMMODATION IN EDINBURGH

Members who intend to be present at the Annual Meeting in Edinburgh will please note that the private bathroom accommodation, and all the single bedroom accommodation, in the North British Station Hotel have now been booked up for the week of the Meeting.

Some double bedrooms, with one or two beds, are, however, still available.

For list of Hotels and University Hostels, with respective tariffs, see CHEMISTRY AND INDUSTRY for February 4, p. 105.

LIST OF MEMBERS ELECTED

February 11, 1927

- Briggs, James A., 5, Cowgate, Dundee. Tar Distiller.
- Burghart, Lloyd M., Research Laboratory, U.S. Industrial Alcohol Co., Box 1103, Baltimore, Md., U.S.A. Director of Research.
- Burns, James A., Brewer's Room, Anchor Brewery, Mile End, London, E.1. Chemist.
- de Goenez, Dr. Denis, Arnold Printworks, North Adams, Mass., U.S.A. Chief Chemist.
- Duvosin, Alexander H., 4, Kensington Gate, Glasgow, W.2.
- Exell, Harold C., 41, Cantley Avenue, Clapham Common, London, S.W.4. Research Chemist.
- Garrels, John C., c/o Mathieson Alkali Works, Inc., Saltville, Va., U.S.A. Assistant Manager.
- Gellman, Israel, "Resthaven," 205, Brondesbury Park, Willesden Green, London, N.W.2. Research Chemist.
- Grattan, George E., Seed Branch, Department of Agriculture, Ottawa, Canada. Chemist.
- Hatfield, Dr. H. Stafford, Thackeray House, Maple Street, London, W. Consulting Engineer.
- Herstein, Dr. Bernard, U.S. Industrial Alcohol Co., 110, East 42nd Street, New York, N.Y., U.S.A. Chemist.
- Hunt, Arthur J., The Technical College, Cardiff. Bakery Lecturer.
- Hutchison, William Bell, 15, Radnor Street, Clydebank, N.B. Analytical Chemist.
- Jack, John A., 185, Neilston Road, Paisley, N.B. Chemist.
- Jackson, Joseph T., Wesleyan College, Bankura, B.N.R., India. Professor of Chemistry.
- Johnson, Alfred E., "Mayfield," 56, Stamford Brook Road, London, W.6. Chemical Sales Manager.
- Karwan, John, 18, Suburban Road, Anfield, Liverpool. Chemist.
- Le Moignan, Clarence S., Messrs. C. Le Masurier, Ltd., 86, Bath Street, Jersey, C.I. Technical Director and Secretary.
- McConnell, John A., 12, Haywood Avenue, Ormeau Road, Belfast, N. Ireland. Assistant Chemist to Corporation Gas Works.
- McCrone, Robert O. Orr, 50, Westbourne Gardens, Glasgow, W.2. Research Chemist.
- Mann, Charles E. T., The Globe, Long Ashton, Bristol. Research Chemist.
- Megson, Norman J. L., "Brunswick House," Olton, near Birmingham. Chemist.
- Merrick, John J., 14, Park Road, Sparkhill, Birmingham. Research Chemist.
- Mills, Miss Ethel, 35A, High Street, Rugby. Assistant Chemist.
- Nash, Alan W., The Leathersellers' Company's Technical College, 176, Tower Bridge Road, Bermondsey, London, S.E.1. Registrar.
- Pearson, Bertram Malcolm, 83, Ruskin Drive, Denton's Green, St. Helens, Lancs. Chemist.
- Phillips, Dr. Henry, Battersea Polytechnic, London, S.W.11. Research Chemist.
- Powell, D. H. Gordon, c/o P. & O. Banking Co., Cockspur Street, London, S.W. 1. Oil Engineer.
- Price, W. Geoffrey, Hawthorn Grove, Wilmslow, Manchester. Traveller.
- Richmond, John H., Cherry Bank, Morris Lane, Kirkstall, Leeds. Chemical Engineer.
- Saxon, Robert, Westfield Terrace, Baildon, Yorks. Schoolmaster.
- Simpson, Miss Winifred M., "Rostrevor," Southwold, Suffolk. Teacher of Science.
- Swan, Richard L., Messrs. A. & F. Pears, Ltd., The Soap Works, Isleworth, Middx. Works Chemist.
- Tritton, Frederic J., 45, Ranelagh Road, Ealing, London, W.5. Chemist and Technical Manager.
- Weber, Harry M., 88, Broad Street, Boston, Mass., U.S.A. Research Chemist.
- Wiegand, William B., Messrs. Binney & Smith Co., 41, East 42nd Street, New York, N.Y., U.S.A. Chemist.
- Wilkinson, J., Nottingham Corporation Gas Department, 6, George Street, Nottingham. Engineer and General Manager.
- Wylam, Dr. Birkett, 54, South Marshall Street, Grangemouth, Stirlingshire. Chemist.

BIRMINGHAM AND MIDLAND SECTION

At a meeting at the University of Birmingham, on February 8, Mr. J. C. Munn presiding, Mr. F. Twyman, F.R.S., lectured on "Metallurgical spectroscopic analysis."

The author, dealing first with the historical aspects of the spectrum analysis by emission spectra, pointed out that Newton's discovery of the dispersion of light, published in 1672, was the first step to the development of spectrum analysis. The publication by Kirchhoff and Bunsen, in 1861, of their discovery that the vapour of a metal produces absorption lines identical in position with the emission lines of its flame spectrum, and their accompanying description of their spectrometer, and of the first use in that spectrometer of a collimator, brought spectrum analysis up to a point beyond which it was not to develop to any considerable extent for many years. The method won many brilliant successes, among them the discovery of numerous new elements. Yet it was to be nearly 50 years before it even began to fulfil the original expectation that it would find use as a general method of qualitative analysis.

Now those chemists (they are very few) who use the spectroscope, use it very often and find it indispensable. As a means of detecting minute quantities of the metals it is unrivalled. A metal can be readily distinguished in the presence of any other element, compound or mixture without the necessity of separation. The qualitative analysis of the metallic constituents of a substance, which the spectroscope gives so easily, is a sure basis for planning a chemical analysis. As the determination of each element proceeds the purity of precipitates may be checked as often as desired.

Of recent years, therefore, attempts have been made in the laboratory of Adam Hilger, Ltd., and elsewhere, to found a method of quantitative analysis on observation of the varying intensities of the spectrum lines with the proportion of the corresponding ingredients. It is true attempts of the kind were made many years ago, and were not very successful. Recent attempts, however, have been more so.

The lecturer then described spectrographic methods for the quantitative determination of impurities present in a metal which have been found to give reliable results. Work carried out in the Hilger laboratories had shown that, in general, one could distinguish between 0.001%, 0.01%, 0.1% and 1.0% of any metallic impurity, and in many cases intermediate stages, by visual examination of the comparative intensities of the lines. Examples were given relating to the estimation of bismuth in copper, calcium in magnesium, aluminium in brass, nickel and chromium in steels.

GLASGOW SECTION

A symposium on "Rubber" was held by the local section and the Institution of the Rubber Industry in the Institute of Engineers and Shipbuilders, Glasgow, on February 15, Mr. S. H. B. Langlands presiding.

The first paper, on "The effect of heat on raw rubber in the presence and absence of air," by G. D. Fry, M.Sc., and B. D. Porritt, M.Sc., F.I.C., was read by Mr. Porritt.

A brief history of the progress made in the utilisation of raw rubber was given, and attention was drawn to the importance of the "milling" process and to the changes which took place as a result of that treatment. The results of an investigation of the effect of heat upon raw rubber were given, along with a detailed description of the experimental work. The heating of raw rubber in the presence of air brings about a definite lowering of the value of the solution viscosity, to an extent depending on the temperature to which the rubber is raised and on the duration of heating. In order to test whether this change is due to heat alone, raw rubber was heated in presence and in absence of oxygen. When heated in a vacuum, or in an atmosphere of steam, hydrogen, or nitrogen to a temperature of 150° C., no great change in solution viscosity can be detected.

On the other hand, when heated in presence of oxygen the solution viscosity of raw rubber shows a marked decrease, and under the particular experimental conditions a relation was established between the quantity of oxygen present per gramme of rubber and the fluidity of the resulting solution.

It would thus appear that the marked changes in solution viscosity which are produced by heating in air are due to some chemical action between the rubber and the oxygen present, and that the effect produced by "milling"—so far as is indicated by solution viscosity—can be imitated by heating rubber in the presence of air. The results which had been obtained had special reference to the changes which occur during washing, drying (both in air and in vacuo), in the milling of raw rubber, and in connexion with the storage of unvulcanised compounded stock.

The second paper, on "The hardness testing of

vulcanised rubber," was read by Mr. T. R. Dawson, M.Sc., F.I.C.

Four types of indentation tests on rubber were described: the helical-spring durometer type, the dead load plastometer, the impact test scleroscope, and the Herbert pendulum. The first two tests were described as "static," while the last two were called "dynamic resilience" tests. The kind of result obtained in these tests was outlined in connexion with the effects of temperature of testing, the time of "cure" of a range of rubbers, and the proportions of the compounding ingredients. Correlations between the different instruments were examined, and, as in the corresponding cases of metal hardness testing, some notable linear relations were found in particular groups of samples, whilst in other groups the relations were exceptional. It was concluded that the factors which govern the static hardness properties must also operate largely in the dynamic resilience properties.

The third contribution to the symposium was "A demonstration of a new piezo-micrometer," by Mr. James Strachan, A.I.C.

The inventor described this new instrument and showed how adaptations had been made upon those instruments to which reference had been made in the second paper. Attention was directed to the simplicity of the instrument without loss of sensitivity, and to the numerous uses to which it might be put in various industries.

LIVERPOOL SECTION

A meeting was held on February 18, in the Muspratt Lecture Theatre, the University. Professor E. C. C. Baly was in the chair in the absence, through illness, of the chairman of the section.

Colonel Sir Frederic L. Nathan, K.B.E., delivered a lecture on "Fuels for internal-combustion engines."

Sir Frederic Nathan first pointed out that so long as petrol is available at present prices its use will continue. Opinions differ as to how long supplies will equal requirements, but search for new sources is extending, improved methods of winning are constantly being introduced, recovery of natural gas is augmenting supply, and the quantities of light spirit obtained by "cracking" are increasing; moreover, the enormous shale deposits are practically untouched. On the other hand, it may be that saturation point as regards motor vehicles is being reached more rapidly than the world's supplies of petrol are being exhausted.

Owing, however, to the dependence of the British Empire on imported petrol, the production of alternatives is a matter of importance. Benzol, of which limited quantities are obtained from gas works and coke ovens, is the most suitable. Naphthalene from gas works can be hydrogenated to produce liquid tetralin which can be used with benzol and alcohol as a motor fuel.

Much consideration has been given to alcohol production. Its large scale manufacture, by fermenting the sugar and starch of vegetable materials, is impossible in this country for many obvious reasons. In the Empire overseas, however, its manufacture in this way is possible and is taking place, using molasses, cassava, sweet

potatoes, etc., as raw materials. A fermentation process is also being worked out for producing alcohol from tropical grasses, straws and waste vegetable materials. This process might provide limited quantities of fuel in various parts of the Empire.

Other possible sources of alcohol in limited quantities are:—(a) Sawdust and wood treated by the Prodor process; (b) Ethylene recovered from coal and coke oven gases; (c) Acetaldehyde prepared from carbide; (d) The lyes from the sulphite paper-making process.

Alcohol alone cannot be used in existing engines to develop maximum efficiency. A mixture of alcohol, benzol and petrol is quite suitable, however, and limited quantities are prepared, under the name of Discol, by the Distillers Company.

Coal is the obvious raw material for the production of liquid fuels in this country. By distilling it at temperatures of about 600° C., some three gallons of motor fuel and other products are obtained per ton of coal. At present the process is being worked commercially only in certain cases where all conditions are favourable. The liquefaction of coal by the Bergius process has passed the experimental stage in Germany, and if it can be worked commercially the quantities of liquid fuel would be practically unlimited.

The Badische Company in Germany, and Patart in France, have made methyl alcohol commercially by passing hydrogen and carbon monoxide over catalysts. Fischer and Tropsch, the Badische Company and Patart have also succeeded in making from the same gases mixtures of liquids suitable for motor fuels. So far, however, none of the processes has reached the commercial scale, although there is little doubt that success will be achieved at no very distant date.

The combustion of anthracite, gas coke and charcoal in suction gas producers gives rise to gaseous fuels that can be used in existing motors, and coal gas can be similarly employed. Suction gas producers using charcoal prepared in portable charcoal burners in the forests are being fitted to motor lorries in France. There are one or two experimental types in this country designed to use anthracite, but low-temperature coke is also very suitable.

It is not possible to predict which, if any, of these sources will develop to provide alternative liquid fuels. It may well be that before the supplies of motor spirit from petroleum and shale are exhausted, some other form of propulsive power may have been discovered.

SOUTH WALES SECTION

A meeting was held jointly with the South Wales sections of the Institute of Chemistry and the Institute of Metals, at the University College, Swansea, on January 26, when a paper on "Quantitative spectrographic analysis in metallurgy" was read by Mr. J. R. Green, M.C., B.Sc., B.I.C. The chair was taken by Mr. A. M. O'Brien, F.I.C.

The lecturer commenced by demonstrating the copper and zinc lines in the visible spectrum of an arc between copper and brass poles, also the taking of comparison spectra on a large quartz spectrograph. He then, by means of lantern slides, explained how, when the proportion of a given metal present in another or in an

alloy is gradually increased from zero, the lines due to the metal in question appear in a definite order in the spectrum. When the proportion is large, most of the lines of the "foreign" metal will appear, and a considerable variation in the percentage of it will cause little alteration in spectra. Hence complete quantitative analysis of an alloy is not practicable by spectral means as a rule.

When, however, the content of the "foreign" metal (or metals) is small, say 1% or less, few of its lines appear, and by carefully comparing the spectra of similar alloys of known composition with that of an "unknown" taken on the same plate and under the same conditions in every respect, the percentage of "foreign" metal can be very closely determined.

An interesting discussion followed, in which Messrs. C. M. W. Grieb and L. Tavernier took part. After Mr. Green had replied, a cordial vote of thanks was accorded him for his paper.

CALENDAR OF FORTHCOMING EVENTS

- Feb. 26. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, Mining Institute, Neville Hall, Newcastle-upon-Tyne, at 3 p.m. "Winning thin seams of Great Britain," by W. Leebetter.
- Feb. 28. SOCIETY OF CHEMICAL INDUSTRY. *Joint meeting of the Yorkshire Section and the Fuel Section.* Queen's Hotel, Leeds, at 2.30 p.m. (See further particulars on p. 125 of the issue for Feb. 11, and p. 153 of the issue for Feb. 18.)
- Feb. 28. ROYAL SCOTTISH SOCIETY OF ARTS, 117, George Street, Edinburgh, at 8 p.m. "The application of coal and oil to marine propulsion," by A. S. Younger. (Also on March 14.)
- Mar. 1. HULL CHEMICAL AND ENGINEERING SOCIETY, Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m. "Stainless steel," by Dr. W. H. Hatfield.
- Mar. 1. INSTITUTE OF METALS, *North-East Coast Local Section.* Armstrong College, Newcastle-on-Tyne, at 7.30 p.m. Annual General Meeting.
- Mar. 1. INSTITUTE OF CHEMISTRY, 30, Russell Square, London, W.C.1, 49th Annual General Meeting, at 4.30 p.m. The Meldola Medal will be presented to Dr. R. G. W. Norrish.
- Mar. 2. UNIVERSITY OF LONDON, University College, Gower Street, W.C.1, at 5.30 p.m. "Volta," by W. H. Patterson.
- Mar. 2. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Ordinary Meeting). "The corrosion of metals at joints and crevices," by Ulick R. Evans.
- Mar. 2. SOCIETY OF PUBLIC ANALYSTS. Annual General Meeting. Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. (1) "Cacao butter substitutes and their detection," by A. W. Knapp, J. E. Moss and A. Melley. (2) "The detection of Illipé butter in chocolate," by H. W. Bywaters, F. T. Maggs and C. J. Pool. (3) "A study of the determination of saccharin, colorimetrically and by the ammonia process," by A. F. Lerrigo and A. L. Williams. Informal Dinner will be held at 6.30 p.m. at St. James's Restaurant, 178, Piccadilly, W.1.

- Mar. 3. SOCIETY OF CHEMICAL INDUSTRY, *Bristol Section*. The University, Woodland Road, Bristol, at 7.30 p.m. Annual Meeting. "Science and industry," by G. Gray.
- Mar. 3. INSTITUTION OF THE RUBBER INDUSTRY, *Birmingham and District Section*. The Grand Hotel, Birmingham, at 7 p.m. "The effect of carbon dioxide and antioxidants upon rubber," by Dr. S. S. Pickles.
- Mar. 3. INSTITUTE OF METALS, *Birmingham Local Section*. Meeting arranged by the Co-ordinating Committee, Engineers' Club, Waterloo Street, Birmingham, at 7 p.m. "Metal melting furnaces," by Dr. E. W. Smith.
- Mar. 3. INSTITUTION OF ELECTRICAL ENGINEERS. Ordinary Meeting. Savoy Place, Victoria Embankment, W.C.2, at 6 p.m. (1) "Illuminating engineering," by J. W. T. Walsh, and (2) "The problems of public lighting by electricity," by Lieut.-Commander H. T. Harrison. At 5.30 p.m. a demonstration of an electro-pneumatic lamp will be given by L. B. Atkinson.
- Mar. 3. CHEMICAL SOCIETY, Burlington House, Piccadilly, W.1, at 8 p.m. *Ordinary Scientific Meeting*. (1) "The decomposition of carbon monoxide in the corona due to alternating electric fields. Part II," by R. W. Lunt and R. Venkateswaran. (2) "The properties of the chlorides of sulphur. Part I. Freezing-points," by T. M. Lowry, L. P. McHatton and O. G. Jones.
- Mar. 4. SOCIETY OF CHEMICAL INDUSTRY. *Joint Meeting of the Manchester and Liverpool Sections*, to be held in Manchester. Visit to the Shirley Institute of the British Cotton Industry Research Association, Didsbury, Manchester. A paper will be read later on "Chemical control in the cotton bleaching industry," by D. Clibbens.
- Mar. 7. SOCIETY OF CHEMICAL INDUSTRY, *London Section*. Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. "Recent progress in the glass industry," by Prof. W. E. S. Turner.
- Mar. 7. GLASGOW UNIVERSITY ALCHEMISTS' CLUB. Annual General Business Meeting, at 7.30 p.m.
- Mar. 7. INSTITUTION OF THE RUBBER INDUSTRY, *London and District Section*. Engineers' Club, Coventry Street, W.1, at 8 p.m. "Some electrical properties of rubber," by P. Dunsheath.
- Mar. 7. INSTITUTE OF CHEMISTRY, *Manchester and District Section*. "Plant chemistry," by Prof. E. C. C. Baly.
- Mar. 8. INSTITUTION OF PETROLEUM TECHNOLOGISTS. Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m. "Two shallow oilfields in Texas," by Dr. A. Wade.
- Mar. 8. INSTITUTE OF BREWING, *London Section*. Engineers' Club, Coventry Street, Piccadilly, W.1. A paper will be given by H. Lloyd Hind.
- Mar. 9, 10 and 11. INSTITUTION OF CHEMICAL ENGINEERS. Conference and Fifth Annual Corporate Meeting and Annual Dinner. (For further particulars, see the issue for Feb. 18, p. 151).
- Mar. 9. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Ordinary Meeting.) "The utilisation of gas coke," by Dr. E. W. Smith.
- Mar. 9 and 10. INSTITUTE OF METALS. Annual General Meeting. (For full particulars see CHEM. & IND., 1927, p. 106.

CHEMICAL SOCIETY

On February 10, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., occupying the chair, Prof. Ernst Cohen, of the University of Utrecht (Honorary Fellow of the Society), delivered the Kamerlingh Onnes Memorial Lecture at the Institution of Mechanical Engineers.

Prof. Cohen commenced by giving a sketch of Kamerlingh Onnes' early life—he was born at Groningen on September 21, 1853—and his school days. Onnes was a pupil at the Hoogere Burgerschool, Groningen; the Director being Van Bemmelen (afterwards Professor of Chemistry at Leyden), for whose influence he has expressed his gratitude in appreciative terms. Before he had attained his eighteenth year, Onnes had been awarded a gold medal by the University of Utrecht for an essay on vapour density; in 1871 he studied under Bunsen at Heidelberg, and later more exclusively in Kirchhoff's laboratory. While at Groningen he was actively interested in the Studentencorps, and, as Rector, actively opposed the suggested abolition of the University. In his doctorate thesis, presented at Groningen in 1879, Onnes remarked that the theorist must first be an experienced practitioner, and that experiments must always be guided by wide theoretical knowledge—an attitude which he maintained throughout his life. In October, 1882, the young assistant in Bosscha's laboratory was called to Leyden to succeed Ryke as Professor of Experimental Physics, and it was from this time that his work became a triumphal progress through the realm of low temperatures.

The first part of Onnes' programme consisted of an experimental test of Van der Waals' equation of state, investigations which led directly to the establishment of the famous cryogenic laboratory at Leyden. Onnes always expressed keen appreciation of the work of Dewar and others, and continually insisted on the fact that he owed much to their researches. No less did he acknowledge his indebtedness to the devoted care of his wife, Elisabeth Byleveld.

Having referred to the award of the Nobel prize in 1913, Prof. Cohen next proceeded to describe the successful liquefaction of helium in 1908. The circumstances attending this achievement included a premature report of success, due to solution phenomena of solid hydrogen in gaseous helium being mistaken for the solidification of the rare gas; Onnes' integrity both as a man and as an investigator is exemplified by the public announcement made immediately after he had discovered the mistake. He was surely entitled to be called the "gentleman du zéro absolu." He did not live to complete the last stage of his work on helium. After at least five unsuccessful attempts to obtain solid helium, he passed away on February 21, 1926, and it was left to Keesom to complete this work a few months later.

A constant demand for better instruments led Onnes, in 1901, to found the Society for the Promotion of the Training of Instrument Makers. The training school attached to the Leyden laboratory proved its value not only in the progress of investigations in that University, but also in many other institutions in Europe and America. The establishment in 1909 of the Association Internationale du Froid also owed much to his activities.

Kamerlingh Onnes' life, although long and rich in discoveries, had been all too short. It was, perhaps, his greatest triumph that, in spite of the honours and marks of esteem showered upon him by the whole world, he had remained a simple, genial, and kind-hearted man.

Prof. F. G. Donnan, C.B.E., F.R.S., proposing a vote of thanks, after adding his tribute to the memory of Prof. Onnes, said that Prof. Cohen was one of the most famous representatives of the famous thermodynamic school of Gibbs. Both the lecturer and the President, by their researches, had made life very difficult for the physicist. They were also alike in the importance which they ascribed to experiment, and in their desire to keep their theoretical views in the background. The motion was seconded by Prof. Sir James Walker, F.R.S., and, having been put by the President, was carried with acclamation.

A representative of the Netherlands Embassy was present, and expressed his appreciation of the recognition of Dutch science in general and the work of Kamerlingh Onnes in particular in this country.

At a meeting held on February 17, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., reminded Fellows that the Anniversary Dinner would be held on March 24 at the Hotel Victoria, at 7 for 7.30 p.m. A ballot resulted in the election of 76 new Fellows.

Dr. H. O. Askew described :

The Production of Fog in the Neutralisation of Alkali with Hydrogen Halides.

Air carrying carbonyl chloride vapour after passage through charcoal and an alkaline absorbing medium sometimes gave rise to a fog over the solution, due to hydrolysis of the carbonyl chloride by adsorbed moisture, the hydrogen chloride thus produced being incompletely absorbed by the alkali. Phosphorus oxychloride behaved in a similar manner.

The absorption of hydrogen chloride in alkaline solutions was then studied. In aqueous solutions, whether simple or containing colloids, dyes, or suspended solids, in general the wider the jet the shallower the liquid, and the faster the gas was bubbled through the solutions the greater was the amount of fog formed.

The concentration of acid in the fog particles and the partial pressure of the water vapour in the gas remained practically constant and independent of the amount of fog formed. With alcoholic solutions the acid concentration in the droplets decreased with increase in concentration of alcohol. Pyridine solutions gave intense fogs. Hydrogen bromide was more active in fog formation than hydrogen chloride. In no case was any fog obtained after neutralisation of the alkali. The fog particles were larger when small amounts of fog were obtained than when large amounts were formed. No electrical charges have been found on the particles.

It is suggested that the alkaline film slows down very greatly the rate of absorption of the acid vapour, this being intensified by the added dyes etc. This film, however, very readily permits diffusion of water vapour into the bubbles of gas.

The President referred to other reactions in which fogs are observed, and to the possibility of condensation of moisture following ionisation being a cause of the phenomenon.

Prof. J. C. Philip said that the work arose out of an observation made during the war that, as soon as the carbonyl chloride in an air-carbonyl chloride mixture ceased to be completely absorbed by a charcoal, a fog appeared over an alkaline solution placed next in the gas stream. With present knowledge he was disinclined to theorise regarding the origin of the fog. The amount of hydrogen chloride in the fog droplets was strikingly constant, and the amounts escaping absorption were surprisingly large.

Prof. H. Bassett presumed that if hydrogen chloride were bubbled through sodium hydroxide solution of a concentration such that the vapour pressure was less than that of constant b.p. hydrochloric acid, no fog would result, and asked whether experiments had been performed in this direction. Apparently the surface film became saturated, excess of hydrogen chloride escaping. Prof. Philip interposed the remark that with sodium chloride solution all the hydrogen chloride was absorbed, but Prof. Bassett suggested that the "absorption compound" was not necessarily sodium chloride.

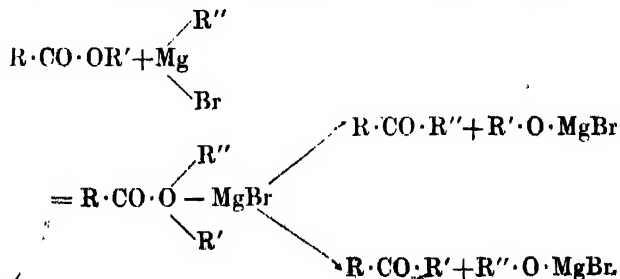
Dr. Askew replied that, although fogs were often formed when electrical charges were present, the experimental data were still somewhat conflicting. Hydrogen chloride solutions do not appear to follow exactly Ostwald's statement that no acid solution of concentration less than that of the constant b.p. mixture would fume in moist air. He agreed that the decreased absorption was probably due to a film round the bubble. Answering Mr. S. J. Gregg, the author said that surface tension did not appear to be a determining factor in the formation of the fog. In reply to a question concerning the possibility of the presence of ammonium salts, he said that the sodium hydroxide was always prepared from the metal.

Prof. D. R. Boyd discussed :—

The Mechanism of the Reaction between a Carboxylic Ester and a Grignard Reagent. [With H. H. Hatt.]

IN the preparation of tertiary alcohols from ethereal salts, if the ester is caused to react with the Grignard reagent in the presence of metallic magnesium, the products include a pinacone. It is now concluded that a ketone is formed as an intermediate step in the production of a tertiary alcohol from an ethereal salt. The process by which the ketone arises is also discussed.

The authors criticise the hypothesis of Stadnikoff :—



Lausitz district; indeed, the Germans claimed this to be the greatest concentration of glass works in the world. There were centres in Silesia, Dresden, Saxony, Thuringia, and Bavaria; whilst in the Saar district there was a considerable glass industry. Similarly, in the district between Cologne and Essen there was a strongly-developed industry, and a still further group of factories in the neighbourhood of Aix-la-Chapelle. Out of about 350 factories which existed in Germany in 1924, not more than between 50 and 60 were concerned with glass bottle production. The largest group of factories was that known as the hollow-ware group, which was identified with the production of all kinds of domestic articles. The manufacture of window glass and plate glass was also more widely separated than in Britain. Chemical and scientific glassware was also produced in considerable volume, the Thuringian factories being particularly important from this particular aspect. As regards raw materials, the German manufacturer might be said to be well supplied, although as regards fuel, supplies of hard coal were not so well distributed as in England. The Lausitz district, for instance, had depended almost entirely for its fuel supplies on the enormous beds of brown coal situated thereabouts. In respect of other raw materials, Germany was particularly fortunate. German glass making had not undergone anything like such drastic changes since the war as had been the case in England. In Germany sheet-glass was still being produced by methods which did not involve continuous operation. The general expectation, however, seemed to be that within a year or two the hand production of sheet glass would be a negligible quantity. In the making of electric-light bulbs, automatic equipment was only just being installed. In the bottle section, conservatism was far deeper than in any other branch of the industry. The machines which had been developed were largely of the semi-automatic type. It was noticeable that something had been done directly and definitely during the last four or five years to encourage research work in glass technology. In this connexion such institutions might be mentioned as that at Zwiesel: a trade school in Bavaria in which technique played a part; the technical school at Karlsruhe in which, in 1923, there was set up a department of glass technology; the high school at Hanover, where there was a section devoted to glass and ceramics; and the department of silicates which was opened in May, 1926, at the Kaiser Wilhelm Institute in Berlin.

"Developments in the glass industry in Russia," by Prof. J. F. Ponomareff (Tomsk, Siberia).—One of the many difficulties encountered was the great distances which separated the various factories. Many works were run without having any technical or trained men in authority. The supplies of raw materials were good, there being plentiful deposits of sand and limestone. Sodium sulphate was obtained cheaply by evaporation from natural lakes. Since the revolution the number of glass factories had been reduced from 200 to 100; some 40,000 labourers were now employed.

Owing to lack of time, the reading of the following paper was postponed, namely, "The thermal expansions of some boric oxide containing glasses," by Prof. W. E. S. Turner and F. Winks, M.Sc.Tech.

THE INSTITUTION OF CHEMICAL ENGINEERS

The Institution of Chemical Engineers announces that examinations for the Associate-membership of the Institution will be held in June and July next.

Particulars of the examinations and the memorandum on "The training of a chemical engineer" may be obtained on application to the Hon. Registrar, C. S. Garland, Esq., The Institution of Chemical Engineers, Abbey House, Westminster, London, S.W. 1. Applications for entry must be received not later than May 1, 1927.

PHYSICAL SOCIETY

At the meeting held on January 28, Prof. A. O. Rankine and J. W. Avery submitted a paper on "Electrical polarisation in selenium cells and the effects of desiccation," in which it was shown that certain electrical polarisation effects exhibited by the Thirring type of selenium light-sensitive cell were attributable to the deposition of an invisible water film upon the surface of the cell. That this film was the principal seat of the polarisation was proved by the almost complete disappearance of the polarisation effects on prolonged drying of the cell. The light-sensitivity of the cell was very considerably increased by such drying.

Series in the spectra of doubly-ionised gallium and indium, and in the spectrum of ionised tin (Sn III) were discussed in two papers presented by K. R. Rao.

Dr. Ezer Griffiths discussed some of the physical problems connected with the transport by sea of cargoes of apples from Australia to this country. Such cargoes are stored in boxes in holds which are artificially cooled. Apples during storage generate very considerable volumes of carbon dioxide, and are extremely liable to become diseased unless the carbon dioxide content and temperature of the atmosphere in which they are stored are suitably controlled. Methods of exercising such control and of determining the measure of efficiency of the system of control installed were illustrated.

ADVISORY COMMITTEE ON FERTILISERS AND FEEDING STUFFS

The Advisory Committee provided for in section 23 of the Fertilisers and Feeding Stuffs Act, 1926, has now been appointed jointly by the Minister of Agriculture and Fisheries and the Board of Agriculture for Scotland. Its constitution is as follows:—

Lord Clinton (chairman), Mr. E. Richards Bolton, F.I.C., Mr. E. G. Haygarth Brown, I.S.O., Dr. C. Crowther, Mr. J. Garton, Mr. C. W. Higgs, Mr. A. Holgate, Mr. T. Kyle, Mr. Alexander Main, M.A., B.Sc., Mr. J. C. Menzies, Mr. Brian S. Miller, Lieut.-Col. R. L. Norrington, C.M.G., Mr. J. W. Pearson, Mr. R. R. Robbins, C.B.E., Dr. G. Scott Robertson, D.Sc., Sir E. J. Russell, D.Sc., F.R.S., Mr. J. Speir, Mr. G. Stubbs, C.B.E., F.I.C., Dr. J. F. Tocher, F.I.C., Dr. J. A. Voelcker, and Prof. T. B. Wood, C.B.E., F.R.S. Mr. H. J. Johns, Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W. 1, is the secretary.

The immediate duties of the committee will be to prepare recommendations as to the regulations which will require to be made before the Act can come into operation, and to consider a number of suggestions with regard to the contents of the schedules to the Act.

CORRESPONDENCE

ECONOMIC QUESTIONS

SIR,—Among the many pearls of wisdom cast before your readers week by week there is one which should merit particular appreciation and attention. I refer to the suggestion, made in your editorial of February 11, for a section of the Society of Chemical Industry devoted to the study of economic questions.

Recent discussions about the commercial abilities of chemists and the chemical abilities of industrialists are symptomatic in showing that there is still considerable uncertainty and difference as to the relative proportions of commerce and chemistry that are required to produce men suitable for occupying responsible positions in chemical industry.

The position in this case is closely analogous to that which existed some years ago with reference to the chemical engineer. As a result of the formation of the Chemical Engineering Group, followed by that of the Institution of Chemical Engineers, a definite conception has arisen of the functions and the requirements of the chemical engineer. The old controversy, of which so much was heard at one time, of the engineering inadequacies of the chemist and the chemical inadequacies of the engineer has died since it has been realised that a mixture of chemistry and engineering according to various recipes would not solve the difficulty, and that the only solution lay in a definite synthesis of the two sciences to form a compound with properties differing from those of the component molecules.

An economic or commercial section (the exact term is not of great importance) could perform a similar function in facilitating the exchange of ideas and crystallising opinion, in addition to its obvious educational value through lectures and discussions.

There is no doubt—or, at least, there should not be any—that some such result would be of distinct value in the development of the chemical industry, and it would be of extreme interest to hear the opinion of your readers, especially those who are more qualified to speak than myself, as to the practical steps best calculated to produce this desirable result.

Yours faithfully,

A. J. V. UNDERWOOD

PHOTOGRAPHIC SENSITIVITY

SIR.—I venture to suggest that the report, given on pp. 149–150 of the February 18 issue of the JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY, of my lecture on "Photographic sensitivity" would have been correct if it had stopped at the end of the first paragraph. The second paragraph does not give a true idea of the subject of the lecture, and conveys false impressions. There are some 500 to 5000 millions (5×10^8 – 5×10^9) of grains per sq. in. of surface, and not 500 to 5,000,000. The statement that I gave an account of some of the more recent theories of the action of light in relation to crystal structure does not give a true idea of my remarks.

Yours faithfully,

T. SLATER-PRICE

MEMORIAL TO FARADAY

SIR,—Will you kindly permit me to invite the interest of your readers in the following?

The progress of electrical science and industry in the past century is founded largely upon the results of the labours of the illustrious natural philosopher, Michael Faraday, whose experimental researches and discoveries opened wider the power-houses of nature and pointed the way to the utilisation of the forces stored therein, as evidenced by the present universal application of them, particularly electricity, in the service of mankind, and who, in the words of Sir Oliver Lodge, initiated a whole new profession electrical engineering, while Sir Richard Gregory in a recent presidential address declared that "every dynamo in the world owes its origin to Faraday." In his lifetime he was described as "our great electrician."

Michael Faraday, to whom the world thus owes so large a debt of gratitude, was born in Southwark, the son of a blacksmith whose forge stood near the well-known local landmark, the "Elephant and Castle."

To commemorate this great pioneer worker, who, in the world of science holds a place almost equivalent to that of Shakespeare in the world of literature, the Southwark Borough Council desire to form a special collection of standard and current literature on electrical and allied sciences in the Central Reference Library of the borough, which is situated close to the spot where the forge stood.

It is suggested that the memorial shall include also a bust of Faraday.

The use of the library is not limited to local residents, but like the benefits of Faraday's discoveries is open to all. Moreover, it is centrally and conveniently situated near the junction of all the main thoroughfares of populous South London converging upon the principal London bridges; and it is well used—there was an issue of over 100,000 volumes last year.

It is purposed to create a Faraday Memorial Library Fund, the income from which would be expended in the acquisition of the best new books year by year and so keep the Memorial Collection always abreast of developments in, and practical applications of, the sciences for which Faraday did so much.

The Council would welcome the co-operation of electricians and scientists generally, many of whom it is believed would be glad to know of this opportunity to assist, if only in a small measure, in establishing in Faraday's native borough a memorial that will be worthy, permanent, and increasingly useful in character.

The year 1927 has been described as the "dawn of Britain's electrical age," and the time would thus seem appropriate to pay tribute to the memory of the man who made the "electrical age" possible.

The project has the interest and generous support of, among others, the Royal Society, the Royal Institution, Messrs. Benn Bros., the British Electrical and Allied Manufacturers' Association, the Eastern Telegraph Co., the British Thomson-Houston Co., the General Electric Co., the Western Union Telegraph Co., Provincial Tramways Co., Ltd., Messrs. J. Dewrance & Co., Ltd., the County of London Electric Supply Co., the City of London Electric Light Co., the Edison Swan Electric Co., Messrs.

W. H. Willcox & Co., Ltd., Sir R. A. Hadfield, Bart., F.R.S., and a number of private individuals.

I shall be happy to acknowledge any contributions which may be sent to the Town Hall, Walworth Road, S.E. 17.

Believe me,
Yours faithfully,
T. E. HEWITT,
Mayor

Southwark Town Hall

PERSONAL AND OTHER ITEMS

The President and Council of the Royal Society decided at a recent meeting to recommend for election into the Society the following fifteen candidates:—Prof. Edward Victor Appleton, Prof. T. G. Brown, Mr. R. Higgins Burne, Dr. J. Chadwick, Dr. G. M. B. Dobson, Dr. S. Z. de Ferranti, Prof. J. Kendall, Prof. P. P. Laidlaw, Prof. A. A. Lawson, Dr. J. W. Mellor, Dr. O. Rosenheim, Prof. M. Saha, Prof. J. S. B. Stopford, Dr. H. H. Thomas, and Mr. C. M. Kenyon.

The Research Medal of the Worshipful Company of Dyers has been awarded to Dr. H. H. Hodgson for his papers on "The behaviour of the sulphides of sodium in aqueous and alcoholic medium," and on "The action of sulphur on the monochloroanilines." Dr. Hodgson's investigations were carried out in the Department of Colour Chemistry of the Technical College, Huddersfield. The medal is awarded each year for the best scientific research or technical investigation submitted to the Society of Dyers and Colourists for publication in its Journal.

Mr. A. Sciver, B.Sc., A.I.C., has been appointed junior partner in the consulting practice of Drs. S. and E. K. Rideal. Mr. Sciver is also lecturer on bacteriology applied to chemistry at the Battersea Polytechnic.

Dr. J. A. Murray has been elected president of the Royal Microscopical Society, and Mr. A. Chaston Chapman, F.R.S., has been elected a vice-president.

The Bureau of Chemical Abstracts has appointed Mr. F. G. Crosse, F.I.C., to be Assistant Editor in charge of British Chemical Abstracts "B" (Applied Chemistry).

Mr. A. Spyer has been appointed general manager of Messrs. Babcock & Wilcox, and Mr. C. S. Davy assistant general manager.

Mr. F. S. Hooker, chairman of the Rubber & Industrial Trust, has joined the board of the Cheshire United Salt Company.

Dr. W. D. Coolidge has been awarded the Edison medal of the American Institute of Electrical Engineers for the production of ductile tungsten and the fundamental improvement of the X-ray tube.

Mr. Russell R. Brown has been elected president of the United States Industrial Alcohol Company. Mr. Brown, who is 34 years of age, was some years with the U.S. Bureau of Internal Revenue, and joined the company as assistant treasurer in 1917.

Mr. J. C. Minor, consulting chemical engineer, has been elected president of the U.S. Compressed Gas Manufacturers' Association.

The late Mr. H. H. Sissons, J.P., chairman of Sissons Bros. & Co., Ltd., paint and varnish manufacturers, left £35,121, with net personalty £28,676.

The late Mr. H. S. Gotts, chairman of Barrett, Tagent & Gotts, Ltd., oil refiners, left £40,474.

The late Mr. H. Probyn, a director of Guest, Keen & Nettlefolds, Ltd., of the Skinningrove Iron Company, and of other companies, left £40,133.

The late Mr. J. W. S. Ashworth, of Radcliffe, Lancs manufacturing chemist, left £84,355, with net personalty £75,243.

Dr. A. Liebmam, who died recently at Weybridge, had been prominently concerned in consulting work connected with chemical patents, especially in relation to dyestuffs. As an expert witness he was frequently associated with the late Sir James Dewar, with whom he carried out many investigations in the laboratories of the Royal Institution.

Inquiry into Coal Transport

The Minister of Transport and the Secretary for Mines have appointed a standing committee, the Standing Committee on Mineral Transport, to review the equipment for the transport of coal and, with special reference to the recommendations of the Royal Commission on the Coal Industry, to devise means that will lead to the greatest efficiency and economy in transport and be of mutual advantage to the coalmining industry and the transport agencies; to report upon the steps taken and upon any further measures necessary from time to time, and generally to watch over the matter. The chairman of the Committee is Sir Arthur Duckham, K.C.B., M.I.C.E., M.I.Chem.E., who is chairman of the Woodall-Duckham companies, and has a distinguished record of public service on the Air Council, the Coal Industry Commission, and the Ministry of Munitions. The members of the Committee include representatives of the Ministries concerned, the railways, and other transport agencies, coal producers and merchants, and labour.

Proposed Representative Body for Scientific Workers

An appeal has been sent from the National Union of Scientific Workers to all professionally qualified men of science and technicians in the country, with the object of obtaining their views "on the possibility and desirability of building up a body fully representative of their broader interests." The appeal bears the signatures, with many others, of Dr. E. F. Armstrong, F.R.S., Sir William Beveridge, Sir William Bragg, Prof. F. G. Donnan, Prof. W. H. Eccles, Sir Richard Gregory, Dame Helen Gwynne-Vaughan, Sir Robert Hadfield, Lord Haldane, Sir Hugo Hirst, Sir Thomas Holland, Sir F. Gowland Hopkins, Sir Max Muspratt, Mr. Ormsby-Gore, M.P., Under-Secretary of State for the Colonies, Sir Charles Parsons, Sir Horace Plunkett, Sir Humphry Rolleston, Sir Charles Sherrington, Sir Arthur Shipley, Mr. H. G. Wells, and Prof. Julian S. Huxley.

Long Service under Brunner, Mond & Co.

On February 18, Messrs. Brunner, Mond & Co. presented 36 gold medals, 123 gold watches, and 133 silver watches to employees with 40, 35, and 25 years' service respectively. Up to date 240 men have completed 40 years' and 768 have completed 35 years' service.

REVIEW

TUNGSTEN: A TREATISE ON ITS METALLURGY, PROPERTIES AND APPLICATIONS. By COLIN J. SMITHELLS, M.C., D.Sc. Pp. vii + 167. London: Chapman & Hall, Ltd., 1926. Price 21s.

Most of the tungsten produced is in the form of an amorphous powder somewhat resembling lamp black and finds its way into steel, but in this aspect of his subject Dr. Smithells has no more than a passing interest, his main concern being with the tungsten wire, rod and sheet of the electric lamp manufacturer. In this sense tungsten is the product of the last twenty years, and a summary of the present state of our knowledge is opportune, especially as the author has endeavoured to collate all the important work up to the end of 1925, and has manifestly succeeded. A careful account is given of the quasi-laboratory methods employed for getting the very pure tungstic oxide (99.9 to 99.95%) which is an essential preliminary for success in the subsequent mechanical working of the metal. This holds good even when certain impurities such as thorium are afterwards added to the purified oxide to modify the properties of tungsten used for lamp filaments. It is somewhat surprising to read on page 19 that the amber colour of some ammonium tungstate solutions is due to dissolved iron, the author being apparently unaware that vanadium and not iron is the cause of the colour. Two important chapters are devoted to the reduction of tungstic oxide and to the manufacture of ductile tungsten. In the former the work of Chaudron and van Liempt receives attention, though that of Wöhler and his colleagues on the equilibria of tungsten and its oxides is not mentioned. All the illustrations of plant show the methods used by the company with which the author is associated, and should be regarded as convenient examples of the kind of apparatus employed rather than as strict types. Considerable space is devoted to the author's own work on the metallography of tungsten, and many excellent photomicrographs are included. Most of the other important contributions to the subject have also been summarised. A mass of data on the properties of tungsten has been collected together, special stress being laid on those properties affecting the operation of tungsten at high temperatures. The method of citing the American Chemical Abstracts is useful, but sometimes trips up the author, as when he quotes the U.S. Patent for the Jacoby process and omits all reference to several cognate British specifications.

There are very few misprints, though on page 10 we have FeWO_3 & MnWO_3 for FeWO_4 & MnWO_4 ; on page 13 "oxidisation" for oxidation, and on page 29 "phosphorous" for phosphorus.

Anyone desiring to become acquainted with the remarkable progress made in connexion with ductile tungsten during recent years can be confidently recommended to read this book.

P. D. OAKLEY

A faculty of mechanical engineering and mining chemistry and technique is to be founded in the University of Münster (Westphalia) at a cost of £75,000.

PARLIAMENTARY NEWS

Lead Poisoning

In reply to Major Hills, Sir W. Joynson-Hicks said that during the years 1916—1926 there were 67 cases of lead poisoning in the Potteries in factories using low-solubility glazes since the Regulations of 1913, which gave special exemption to such factories. This was out of a total of 351, and in 60 out of the 67 cases there had been previous employment, often for many years, in factories using raw lead glazes. An investigation by one of the medical inspectors is to be carried out shortly regarding lead poisoning in potteries of this class.—February 14.

Poison Gases

The Prime Minister informed Mr. Hudson that until such time as a definite assurance could be obtained that all Powers would adopt measures of prohibition in regard to poisons and bacteria, H.M. Government must take steps to be in a position to defend itself against such attacks. Research work for this purpose would therefore be continued.—February 15.

Beet-Sugar Industry

Answering Mr. Gillett, Mr. Guinness said that fourteen beet-sugar factories in Great Britain received subsidy in the 1926-27 campaign, and about 6,500 persons were employed in these factories. The area under sugar-beet in 1926 was 129,463 acres.

Moving that a supplementary sum, not exceeding £450,000, be granted in respect of the sugar beet subsidy, Mr. Guinness said the reason for this supplementary vote was that, during the current season, a very high rate of production had been reached—about an extra ton per acre on 130,000 acres under beet cultivation as compared with last year. In addition, the demand of the factories on the vote had been increased by the better sugar content of the crop, which this year was estimated at about 17% as against 16.3 last year. The bill was a debt of honour under the Act of 1925, and was really a cheap charge for the creation of a new industry at private risk. The vote was put and agreed to.—February 15 and 16.

Safeguarding of Industries (Leatherette)

Replying to Sir H. Cowan, Sir P. Cunliffe-Lister said that paper of a packing or wrapping description which has been coated or treated was subject to duty, and that the duty also applied to articles made either from such paper, or from such paper with the addition only of some adhesive substance or other material, the value of which did not exceed one-sixth of the total value of the whole article. It was a mistake to suppose that leatherette was not made in this country.—February 17.

Effluents from Sugar-Beet Factories

Mr. Guinness informed Mr. Hurd that reports had been obtained from all the principal beet-growing countries, but so far no remedy had been found for overcoming the difficulties which confront sugar manufacturers in the disposal of effluents. The information contained in the reports, however, might facilitate scientific investigations which were being conducted by the

manufacturers and the Government in co-operation. A summary of the information acquired from abroad was furnished to each factory some months ago, and the same action will be taken with regard to the more recent information received.—February 21.

Sale of Food and Drugs Bill

This Bill was read a second time and committed to a Standing Committee.—February 21.

COMPANY NEWS

COURTAULDS, LTD.

The profits for 1926, after charging all taxation, depreciations and expenses, amounted to £3,840,791, compared with £4,411,413 for 1925, when £400,000 was placed to insurance reserve. It has been decided to carry £750,000 to general reserve account, which will also benefit by a sum of £1,250,000 transferred from taxation reserves as no longer required. A final dividend has been recommended on the ordinary shares of 3s. 3d. per share, free of income tax, making 4s. 6d. or 22½% for the year, compared with 25% for 1925.

UNITED TURKEY RED CO., LTD.

A dividend has been recommended of 5% on the ordinary shares for 1926, compared with 10% for 1925, carrying forward approximately £36,900.

BRITISH VISADA ARTIFICIAL SILK CO., LTD.

The first report and statement of accounts has been issued, covering a period from October 15, 1925—the date of incorporation—to December 31, 1926. As the whole of this period was employed in bringing the factory to a state of production, no profit and loss account is shown. Assets are shown in the balance sheet at £377,073, of which £107,486 is in the form of cash. Plant and machinery account for £160,504, buildings etc. for £70,343, and preliminary and formation expenses for £33,143. Sundry creditors at £17,073 is the only current liability.

MELSO, LTD.

Owing to the strikes, the net trading profit for 1926 amounted to £32,198, against £53,220 for 1925. A dividend has been recommended of 7½% (compared with 10%) on the preference and ordinary shares, carrying forward £8,540. The directors report that with the return to normal conditions the business has shown a marked improvement.

SNIA VISCOSA CO., LTD.

A dividend of 10% has been declared for the year ended December 31, 1926. In pursuance of the working agreement recently arrived at between this company, Courtaulds, and Glanzstoff, the following appointments to the board have been made:—Dr. F. Bluthgen, representing Vereinigte Glanzstoff Fabriken, Elberfeld; Mr. E. Lunge, representing Courtaulds (London).

MATHER AND PLATT, LTD.

A dividend has been recommended on the ordinary shares of 10% per annum, together with a bonus of 5%, both free of tax, less the interim dividend of 5% already paid (same for 1925), leaving £164,458 to be carried forward, against £178,281 brought in.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime—£7 10s. per ton, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammiac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.r. London, casks free. Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton. Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
Arsenic, Sulphide, Yellow.—2s. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 2d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbanilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Good demand. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£7—£10 per ton, according to grade and locality. Quiet.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—1s. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P. Both in good demand.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade. Better demand.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 6d. per lb. Crude 60's, 1s. 8½d.—1s. 9½d. per gal.
 Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 1d. per gal. Pale, 95%, 1s. 10d.—2s. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 3d.—1s. 4d. per gal., ex works in tank wagons; Standard motor, 1s. 11d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 2d.—2s. 5d. per gal., ex works in tank wagons.
 Tolnole.—90%, 1s. 11½d. to 2s. 3d. per gal. Firm. Pure, 2s. 2½d.—2s. 6d. per gal.
 Xylol.—2s. 3d.—2s. 6d. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%, 10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal.
 Naphtha.—Crude, 9½d.—1s. 0½d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, 1s. 9d.—1s. 10d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s. per ton.
 Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—105s.—115s. per ton, f.o.b. according to district.
 Pyridine.—90/140.—9s. 6d.—13s. per gal. Nominal. 90/180.—7s. 6d. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d.—4½d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4½d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 3½d.—1s. 4½d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 5d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 1d. per lb. Less 5%. Firmer market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 3d.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Aspirin.—2s. 4d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d.—2s. 6d. per lb. Potassium.—1s. 11d.—2s. 1d. per lb. Sodium.—2s. 2d.—2s. 4d. per lb. All spot.

Calcium Lactate.—1s. 4d.—1s. 5d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ether meth.—1s. 1d.—1s. 11¼d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£30 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—6s. 6d.—7s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £33 per ton net.

Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 12s.—13s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.

Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig. 6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 7d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.

Methyl Salicylate.—1s. 6d.—1s. 9d. per lb.

Methyl Sulphonal.—15s.—15s. 3d. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s.—1s. 4d. per lb.

Phenacetin.—3s. 9d.—4s. per lb.

Phenazone.—5s. 9d.—6s. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 90s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb.

Salol.—3s.—3s. 3d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 2d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—77s. 6d.—82s. 6d. per cwt. net, according to quantity.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal 1s. 10d.—1s. 11d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—10s.—10s. 3d. per lb.

Tartar Emetic B.P. cryst. or powder.—1s. 10d.—2s. 1d. per lb.

Thymol, Puriss.—11s. 9d.—13s. 9d. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (ex Anethole).—10s. 3d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. 9d. per lb.

Citronellol.—15s. per lb.

Citral.—9s. 6d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—3s. 3d. per lb.

Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb. Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol (ex Shui Oil) 12s. per lb.—(ex Bois de Rose) 16s. per lb. Linalyl Acetate.—(ex Shui Oil) 14s. 6d. per lb.—(ex Bois de Rose) 18s. per lb.

Methyl Anthranilate.—9s. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—30s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—11s. per lb.

Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—10s. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—11s. 3d. per lb.

Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb. Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 20s. 9d. per lb. Lemon.—9s. 6d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 22s. per lb. Japanese, 8s. 6d. per lb. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than April 18th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Mar. 3rd. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Arnot. Metallic fabric etc. for chemical etc. industries. 3377. Feb. 7.

Cryer and Hill. Grinding and mixing mills. 3632. Feb. 9.

Goldman. Mixing machines etc. 3556. Feb. 8. (Belg., 9.3.26.)

Gordon & Co. (Hagan Corp.). Extraction of extraneous material from fluids or gases. 3724—5. Feb. 9.

Hünsl. Grinding mills. 3820. Feb. 10.
Henshaw, Holmes, and Holmes & Co. Apparatus for bringing liquids and gases into intimate contact. 3467. Feb. 7.

Kirk and Martinez. Crushing and mixing mills. 3607. Feb. 8.

I.—Complete Specifications

19,840 (1925). Marks (Tracy Engineering Co.). Fluid separators. (265,250.)

932 (1920). White (Gas Research Co.). Transferring heat. (265,358.)

3009 (1926). Internat. Combustion, Ltd., and Rosencranz. See II.

3937 (1926). Whitehead. Mixing apparatus. (265,382.)

9518 (1926). Robertson. Furnaces. (265,422.)

15,373 (1926). Minter. Drying apparatus. (265,449.)

19,552 (1926). Bentley. Rotary kilns and furnaces. (265,462.)

*352 (1927). Habermann. Centrifugal driers and separators. (265,561.)

*3116 (1927). Hadamovsky. Heating, melting, evaporating, or cooling vessel. (265,597.)

II.—Applications

Barry. Distillation of coal etc. 3726. Feb. 9.

Cooper. Treatment of gases arising from distillation of coal etc. 3913. Feb. 11.

Elektronmetall Ges. Apparatus for purifying oil etc. 3795. Feb. 10. (Ger., 8.10.26.)

Fenby. Solid fuel. 3541. Feb. 8.

I.-G. Farbenind. Catalytic oxidation of carbon monoxide. 3429. Feb. 7. Decomposition of hydrocarbons. 3903. Feb. 11. (Ger., 11.2.26.)

Jansen. Apparatus for cracking hydrocarbons. 3477. Feb. 7.

Lamberty. Distillation of coal etc. 3726. Feb. 9.

Nederlandsche Mijnbouw en Handel Maatsch. Manufacture of alkaline coke. 3926. Feb. 11. (Ger., 12.2.26.)

N. V. Silica en Ovenbouw Maatsch. Recovery of benzenes from coal gas. 3887. Feb. 11. (Ger., 12.2.26.)

Salerni. Apparatus for distilling carbonaceous materials. 3565. Feb. 8.

Smallwood. Making fuel briquettes etc. 3397. Feb. 7.

Soc. des Brevets Etrangers Lefranc et Cie. Liquid fuel for internal-combustion engines. 3916. Feb. 11. (Fr., 3.4.26.)

III.—Complete Specifications

32,065 (1925). South Metropolitan Gas Co., and Evans. Manufacture of coal gas. (265,349.)

3009 (1926). International Combustion, Ltd., and Rosencranz. Apparatus for drying coal etc. (265,374.)

3160 (1926). Braunkohlen-Produkte A G., Bube and Erlenbach. Obtaining low-boiling hydrocarbons etc. from bituminous materials. (265,375.)

7186 (1926). Lederer. Production of carbon. (251,244.)

12,313 (1926). Meiro. Fractional distillation of solid fuels at a low temperature. (265,435.)

*3429 (1927). I.-G. Farbenind. Catalytic oxidation of carbon monoxide. (265,624.)

III.—Application

N. V. Silica en Ovenbouw Maatsch. 3887. See II.

IV.—Applications

British Dyestuffs Corp. Baddiley, Dootson, Shepherdson, and Thornley. Manufacture of dyestuffs. 3609. Feb. 8.

British Dyestuffs Corp., Bunbury, Evans, and Shepherdson. Manufacture of vat dyestuffs. 3713. Feb. 9.

Geigy A.-G. Manufacture of acid dyestuffs. 3890. Feb. 11. (Ger., 13.2.26.)

I.-G. Farbenind. Production of primary aliphatic etc. amines. 3430. Feb. 7. (Ger., 9.2.26.) Manufacture of vat

dyestuffs. 3559. Feb. 8. (Ger., 9.2.26.) Manufacture of solid diazo salts. 3889. Feb. 11. (Ger., 12.2.26.)

IV.—Complete Specifications

18,597 (1925). Drescher, Smith, Thomas, and Scottish Dyes, Ltd. Production of anthraquinone derivatives. (264,916.)

25,406 (1926). Ransford (Cassella & Co.). See XX.

*32,187 (1926). Newport Co. Tetrakisazo dyes. (265,553.)

*3134 (1927). I.-G. Farbenind. Manufacture of condensation products from naphthalene or naphthalene derivatives and ethylene. (265,601.)

V.—Applications

British Celanese, Ltd., and Olpin. Treatment of materials containing cellulose derivatives. 3652. Feb. 9.

British Dyestuffs Corp., and Hollins. Manufacture of wool, fur, etc. 3714. Feb. 9.

Carpmael (I.-G. Farbenind.). Manufacture of cellulose esters etc. 3595. Feb. 8.

Chavassieu. Manufacture of artificial textile threads etc.

3832. Feb. 10. (Fr., 3.4.26.)

Comptoir des Textiles Artificiels. Manufacture of artificial textile threads etc. 3832. Feb. 10. (Fr., 3.4.26.)

Dreyfus. Treatment of materials containing cellulose derivatives. 3653. Feb. 9.

Gallert. Treatment of artificial silk yarns after spinning. 3738. Feb. 10.

Klotz. Manufacturing transparent papers. 3421. Feb. 7.

Silver Springs Bleaching & Dyeing Co., and Hall. Rendering cellulose acetate yarn etc. resistant to deterioration. 3499. Feb. 8.

Soc. des Brevets Etrangers Lefranc et Cie. Hydrolysis of cellulose substances. 3917. Feb. 11. (Fr., 20.5.26.)

Verein. Glanzstoff-Fabriken. Means for treating artificial silk. 3991. Feb. 12. (Ger., 13.2.26.)

Wade (Bouwonderrening Ketabang IV). Apparatus for manufacture of artificial silk threads. 3708. Feb. 9.

V.—Complete Specifications

25,161 (1925). Levy and Silberrad. Manufacture of cellulose acetate. (265,267.)

24,345 (1926). Carpmael (I.-G. Farbenind. A.-G.). Manufacture of benzyl celluloses. (265,491.)

*2413 (1927). Syntheta A.-G. Manufacture of artificial silk. (265,577.)

VI.—Applications

Butterworth and Butterworth. Production of solid shades on mixed fibres. 3757. Feb. 10.

Janvier. Rendering cotton fibre, yarn, etc. fireproof. 3756. Feb. 10.

Rohm & Haas Co. Bleaching etc. textile fabrics. 3585. Feb. 8. (U.S., 25.2.26.)

Wilkinson. Dyeing textile fabrics etc. 3976. Feb. 12.

VI.—Complete Specifications

29,781 (1925). Dehn (Stein Fur Dyeing Co., Inc.). Bleaching and dyeing furs. (265,324.)

9196 (1926). Benekiser, Reimann, Reimann, and Draibach. Stabilisation of bleaching baths. (265,417.)

15,964 (1926). Fruh. Wet treatment of textile fabrics. (254,706.)

VII.—Applications

Bentley, Catlow, and Blythe & Son. Purification of sulphur. 3946. Feb. 12.

Geffcken and Richter. Devices for activating oxygen etc. 3564. Feb. 8. (Ger., 8.2.26.)

I.-G. Farbenind. 3429. See II.

Leemans. Manufacture of sulphuric acid. 3907—8. Feb. 11.

New Jersey Zinc Co. Manufacture of zinc oxide. 4002. Feb. 12. (U.S., 27.3.26.)

VII.—Complete Specifications

22,252 (1925). Hammond and Shackleton. Concentration or purification of caustic soda etc. (265,252.)

27,769 (1925). Meister, Lucius & Brining. Separating solid salts of ammonium and of the alkalis or alkaline earths. (242,975.)

28,054 (1925). Coulier. Manufacture of alkali cyanides. (265,305.)

31,951 (1925). Cassella & Co. *See* XX.

1915 (1926). Ebers. Obtaining heavy spar and a paint or a material for the manufacture of cement. (246,498.)

4319 (1926). Deutsche Gold- und Silber-Scheideanstalt, and Freudenberg. Manufacture of alkali metal cyanides. (265,639.)

9196 (1926). Benckiser, Reimann, Reimann, and Draibach. *See* VI.

20,019 (1926). Deutsche Gasglühlicht-Auer-Ges. Producing titanate acid unaffected by light. (257,259.)

*16,394 (1926). Rhenania Verein Chem. Fabr. Manufacture of moulded sulphur. (265,540.)

*2452 (1927). Rosenheim. *See* XXI.

*3429 (1927). I.-G. Farbenind. *See* II.

*3504 (1927). Geffcken and Richter. Devices for activating oxygen etc. (265,636.)

VIII.—Complete Specifications

7043 (1926). Hartford-Empire Co. Glass-annealing lehrs. (250,200.)

15,653 (1926). Scheidhauer & Giessing A.-G. Manufacture of refractory bricks. (253,947.)

IX.—Applications

Bayer. Producing porous materials etc. 3588. Feb. 8. (Denmark, 9.2.26.)

Massie. Colouring magnesium oxychloride cements. 3734. Feb. 10.

Pease. Manufacture of bricks etc. 3697. Feb. 9.

Schmid. Painting and preserving stone, wood, etc. 3457. Feb. 7.

IX.—Complete Specifications

1915 (1926). Ebers. *See* VII.

24,738 (1926). Hertzka. Manufacture of alumina-containing cements. (265,494.)

X.—Applications

Akt. Norsk Staal, and Edwin. Production of synthetic pig iron. 3980. Feb. 12.

Arnot. 3377. *See* I.

Goldschmidt A.-G. Bearing-metal alloy. 3707. Feb. 9. (Ger., 25.2.26.)

Kamishima. Alloy having high electrical resistance. 3676. Feb. 9.

Rowlands. Treatment of ores etc. 3824. Feb. 10.

X.—Complete Specifications

19,239 (1925). Merle. Manufacture of metals. (265,243.)

27,765 (1925). Marks (Grasselli Chemical Co.). *See* XI.

6138 (1926). Internat. Nickel Co. Manufacture of alloys of copper, nickel, and aluminium. (250,194.)

31,237 (1926). Penniman and Shackelford. Decarbonising ferrochrome. (262,795.)

*30,706 (1926). Fourment. Treatment of ores, wastes, etc. (265,548.)

*32,876 (1926). Krupp Grusonwerk. Treatment of zinciferous flying dust. (265,558.)

*1055 (1927). Metallbank u. Metallurgische Ges. Purifying aluminium and its alloys. (265,563.)

XI.—Applications

Kamishima. 3676. *See* X.

Standley. Electric accumulators. 3962. Feb. 12.

XI.—Complete Specifications

27,765 (1925). Marks (Grasselli Chemical Co.). Electrolytic deposition of cadmium. (265,292.)

19,237 (1926). Norske Akt. for Elektrokemisk Ind. Electrodes for electric furnaces. (258,500.)

*3227. (1927). Pechkranz. Electrodes. (265,606.)

XII.—Application

British Drug Houses, Ltd., and Carr. Manufacture of oils containing vitamins. 3440. Feb. 7.

XII.—Complete Specification

12,748 (1926). Petroff. Production of sulpho-aromatic fatty acids. (252,212.)

XIII.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of non-thickening pastes and lacquers. 3473. Feb. 7.

Fraser and Smith. Manufacture of varnishes etc. 3557. Feb. 8.

XIII.—Complete Specifications

1915 (1926). Ebers. *See* VII.

*18,430 (1926). Acheson. Preparing pigment-oil compositions. (265,541.)

*31,278 (1926). New Jersey Zinc Co. Manufacture of lithopone. (265,550.)

XIV.—Applications

Brown. Substitute for rubber, balata, etc. 3378. Feb. 7.

Williams. Coagulating rubber latex etc. 3373. Feb. 7.

XV.—Applications

I.-G. Farbenind. Manufacture of tanning agents. 3802. Feb. 10. (Ger., 23.2.26.)

Massin. Depilating skins etc. 3045. Feb. 9. (Fr., 10.2.26.)

XVI.—Applications

Carpmael (I.-G. Farbenind.). Immunising seed grain etc. 3987. Feb. 12.

Chem. Fabr. vorm. Schering. Preventing loss of carbohydrates in plants when stored. 3702. Feb. 9. (Ger., 26.2.26.)

XVI.—Complete Specification

301 (1926). Siemens & Halske A.-G. Producing artificial manures. (245,768.)

XVIII.—Applications

British Arkady Co., Ltd., Hewitt, and Whympers. Manufacture of fermenting products. 4003. Feb. 12.

Merek. 3721. *See* XX.

XIX.—Applications

Campbell and Pocock. Preserving eggs etc. 3710. Feb. 9. Chem. Fabr. vorm. Schering. 3702. *See* XVI.

Coles. Treatment of milk. 3630. Feb. 9.

Cook and Cook. Preserving etc. food. 3530. Feb. 8.

Matsubara. Treating milk. 3684. Feb. 9. (Japan, 27.2.26.)

XIX.—Complete Specifications

29,689 (1925). White (Merrell-Soule Co.). Treatment of milk powder. (265,323.)

8670 (1926). Kirke. Preserving or improving foodstuffs. (265,416.)

XX.—Applications

British Drug Houses, Ltd., and Carr. 3440. *See* XII.

British Dyestuffs Corp., Saunders, and Wignall. Manufacture of ethylene glycol. 3610. Feb. 8.

Dreyfus. Manufacture of aliphatic compounds. 3551. Feb. 8.

Engelke and Komlos. Manufacture of compounds of carbon and sulphur etc. 3928. Feb. 11. (Ger., 15.2.26.)

I.-G. Farbenind. 3430. *See* IV. 3903. *See* II.

Merck. Dehydrating ethyl alcohol. 3721. Feb. 9. (Ger., 30.10.26.)

Riedel A.-G. Producing adipic acid. 3427. Feb. 7. (Ger., 12.2.26.)

Soc. des Brevets Etrangers Lefranc et Cie. Extraction of butyric acid etc. 3918. Feb. 11. (Fr., 27.8.26.)

XX.—Complete Specifications

24,618 (1925). Long, Willson, and Wheeler. Manufacture of halogenhydrins. (265,259.)

31,010 (1925). Faithfull. Making lactic acid and lactates. (265,336.)

31,951 (1925). Cassella & Co. Manufacture of new complex aurosodium thiosulphate solutions. (246,809.)

5918 (1926). Soc. Chem. Ind. in Basle. Manufacture of quinolinic anhydride. (249,497.)

10,402 (1926). Sartig. De-nicotining tobacco etc. (265,427.)

12,748 (1926). Petroff. See XII.

25,406 (1926). Ransford (Cassella & Co.). Manufacture of aromatic compounds. (265,498.)

28,197 (1926). Chem. Fabr. vorm. Schering. Manufacture of complex metal alcoholates. (261,377.)

*26,212 (1926). Newport Co. Preparing nitroamino-benzoyl-o-benzoic acid and its derivatives. (265,545.)

*1169 (1927). Soc. Chem. Ind. in Basle. Obtaining highly active substances from female internal secretory organs. (265,567.)

*3134 (1927). I.-G. Farberund. See IV.

XXI.—Applications

British Thomson-Houston Co., Ltd., and Hands. Photo-sensitive paper etc. 3612. Feb. 8.

Soc. de Photochimie Elka. Production of pictures on gelatin silver bromide. 3475. Feb. 7. (Fr., 8.2.26.)

XXI.—Complete Specifications

27,825 (1925). Trist. Mercurial printing-surfaces. (265,294.)

*3133 (1927). Wreschner and Loeb. Preparation which emits β -rays. (265,600.)

*3475 (1927). Soc. de Photochimie Elka. Production of pictures on gelatin silver bromide. (265,630.)

XXII.—Complete Specification

3258 (1926). Robinson. Match-striking compositions. (265,378.)

XXIII.—Applications

Bishop, Elsmore, and Holford. Centrifugal apparatus for treatment of sludge. 3825. Feb. 10.

French and Holmes. Bactericidal etc. agents. 3584. Feb. 8.

XXIII.—Complete Specification

*2452 (1927). Rosenheim. Increasing the base-interchange capacity of glauconite. (265,578.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Brazil*: Tinplate, galvanised corrugated iron sheets, ingot and bar lead, heavy chemicals, linseed oil (170). *Egypt*: Photographic material (B.X. 3240); nitrate of soda, nitrate of lime, sulphate of ammonia, superphosphate of lime (C.X. 2196). *Germany*: Technical oils and fats for the soap industry (161). *Rumania*: Yellow and red ochre and iron minium (B.X. 3239); refined white opaque paraffin wax (B.X. 3243); rubber belting (B.X. 3238). *South Africa*: Mild steel plates (A.X. 4254). *United States*: Steel tubing, mild steel channels (A.X. 4257).

PUBLICATIONS RECEIVED

THE PAPER MILL CHEMIST. By H. P. Stevens, M.A., F.I.C. Third edition, revised, Pp. viii + 317. London: Ernest Benn, Ltd., 1926. Price 10s. 6d. net.

COURS DE CHIMIE INORGANIQUE. By F. Swarts. Fourth edition, revised and enlarged. Pp. 786. Brussels: M. Lamertin; Paris: J. Hermann, 1926. Price 72 frs. Belges.

REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1925—1926. Committee of the Privy Council for Medical Research. Pp. 161. H.M. Stationery Office, 1926. Price 3s. 6d. net.

THE INFLUENCE OF MOLYBDENUM ON MEDIUM CARBON STEELS CONTAINING NICKEL AND CHROMIUM. R. D. Report No. 67. Research Department, Woolwich. 1926. Pp. 58. H.M. Stationery Office, 1927. Price 3s. 6d. net.

HISTORY OF THE SCIENCES IN GRECO-ROMAN ANTIQUITY. By A. Reymond. Translated by Ruth Gheury de Bray. Pp. x + 245. London: Methuen & Co., Ltd., 1927. Price 7s. 6d. net.

COLLECTED PAPERS OF SIR JAMES DEWAR. Edited by Lady Dewar, with the assistance of J. D. Hamilton Dickson, H. M. Ross, and E. C. Scott Dickson. With two supplementary papers not heretofore published, and an appendix and indexes. Vol. I. Pp. xxii + 674. Vol. II. Pp. ix + 675—1489. Cambridge: The University Press, 1927. Price, for the two volumes, £4 4s. (Not sold separately).

HAND-LIST OF SHORT TITLES OF CURRENT PERIODICALS IN THE SCIENCE LIBRARY. Edited by S. C. Bradford, D.Sc. Board of Education. Fourth edition. Pp. 176. H.M. Stationery Office, 1926. Price, 1s. net.

LES ÉTABLISSEMENTS KUHLMANN 1825 1925. Cent Ans D'Industrie Chimique. Compagnie Nationale de Matières Colorantes et Manufactures de Produits Chimiques du Nord Réunies. Pp. 137. Paris: Établissements Kuhlmann, 1926.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF STANDARDS, WASHINGTON: Government Printing Office, 1926:—Recent Developments in Lamp Life-Testing Equipment and Methods. By J. F. Skogland and R. P. Teele, Jr. Technologic paper No. 325. Pp. 681-702. Price 15 c. Supplement to Circular No. 25. Standard samples issued or in preparation. Pp. 7. United States Government Master Specifications:—No. 268A for Brick, Fire-clay. Circular No. 299. Price 5 c. Testing of Thermometers (4th edition, 1926). Circular No. 8. Pp. 18. Price 10 c. No. 429 for Ash, Soda. Circular No. 314. Price 5 c. No. 432 for Sodium Carbonate Granular (Monohydrate Crystals). Circular No. 317. Price 5 c. No. 414 for Matting, Rubber, for use around electrical Apparatus or Circuits not exceeding 3,000 volts to Ground. Circular No. 312. Price 5 c. No. 33A for Soap Cake, Grit. Circular No. 130. Price 5 c. No. 430 for Soda, Caustic (Lye) (For Cleaning Purposes). Circular No. 315. Price 5 c. No. 431, for Soda, Laundry (Washing Soda). Circular No. 316. Price 5 c. Technologic Paper No. 328. Tests of Large Columns with H-Shaped Sections. By L. B. Tuckerman and A. H. Stang. Pp. 88. Price 40 c. Asphalt. Simplified Practice Recommendation No. 4. Elimination of Waste. Pp. 11. Price 5 c. A Primer of Simplified Practice. By E. L. Priest. Elimination of Waste. Pp. iv + 58. Price 15 c. Sterling Silver Flatware. Simplified Practice Recommendation No. 54. Elimination of Waste. Pp. 12. Price 5 c. Tissue Paper. Simplified Practice Recommendation No. 46. Elimination of Waste. Pp. 7. Price 5 c.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW SERIES**

LONDON, MARCH 4, 1927

No. 9

EDITORIAL

Biochemistry

THERE is always a very pleasant atmosphere at the meetings of the Royal Society of Arts. The subjects which are chosen for the meetings are such that thinking people must go to John Street to learn more about them, and so not only are the audiences representative, but the meetings are stimulating to an unusual degree both to the audience and to the speakers. We have never heard a more interesting address than that which Mr. Francis H. Carr, C.B.E., the President of the Society of Chemical Industry, delivered last week. His subject was fascinating—it was "Insulin and its manufacture"—but the treatment was equally attractive. Mr. Carr unfolded the history of the utilisation of natural remedies produced within the body to supplement its activities, and showed how every discovery depends upon previous work, how every stage in the unfolding of knowledge prepares the way for some further advance. Our readers are familiar with the story of thyroxine, the active principle of the thyroid gland, how it was first isolated, how the process of preparation was improved and how, recently, Dr. Harrington accomplished its synthesis so that thyroxine has now become a product of the fine chemical manufacturer. As yet we have not advanced so far with insulin, but there is ample cause for satisfaction with the achievement of the British fine-chemical industry in so improving the manufacture of insulin that, within a year of its manufacture, the selling price could be so reduced that the cost of treatment, at first prohibitive to many, came within the reach of all. Mr. Carr adduced evidence which suggests that we are within almost measurable reach of a disclosure of the chemical identity of insulin. A great deal is known about the biochemistry of the body, but a great deal more is still unfortunately obscure. At present the line of progress seems to lie in the isolation, identification and subsequent synthesis of products produced by groups of cells of the body, but how much is known about the chemical activities of the vital unit, the living cell? How such a delicate problem is to be solved we confess we do not know, but we are certain that the extraction of other valuable constituents of the animal body will be quickly followed by their production on a large scale by the British fine-chemical manufacturer. We are privileged to print a short account of Mr. Carr's address in this issue, and shall

look forward to the pleasure of reading it in full when it appears in the Journal of the Royal Society of Arts.

The British Industries Fair

How varied and how interesting is the life of an editor! But for the work attached to the post it would be an ideal existence. One week you are invited to stay at Oxford and see "those regal dons, with hearts of gold and lungs of bronze, who shout and bang and roar and bawl the Absolute across the hall, or sail in amply billowing gown, enormous through the Sacred Town." A few days in this lofty and rarefied intellectual atmosphere brings you up to date in the philosophy of science, and thus fortified you may sit at the feet of the physiologists and biochemists who speak of vitamins, of irradiated ergosterols, of the functions of glycogen, of the benefits arising from stockings transparent to ultra-violet light, of oxidation of the blood and the proper use of the lungs. In our infancy we could scoff at their teaching with the carelessness of the ignorant: "when Duty whispered softly 'Breathe,' the youth would answer 'Blow,'" but long association with, and exposure to, the learned has got us into the habit of obedience. Then the editor meets manufacturers and those who bestow their wisdom in industry and he finds a rich field to enjoy and praise in such a monument as the British Industries Fair. The chemical exhibit justly occupies the premier and most important place. None can ignore it, none can pass by without admiring the artistic way in which chemical products are displayed and marvelling at their infinite variety. The casual visitor sees thorium and titanium compounds prepared from precious sand from southern climates brought, but even Dryden with all his prophetic sense did not see what could be prepared from monazite. There are heavy and fine chemicals of every colour, and crystalline form, perfumes which are at once a tribute to the skill of the chemist and to the extraordinary delicacy of the human nose as a piece of apparatus, drugs which will pleasantly convey the most essential vitamins to the most dainty palate, unguents and ointments which will restore the blush of youth to all those who are compelled to make up for lost time or to those others who wish to be in the fashion and say not with the Pharisee, that they thank God they are not as others are. There are fructoses and saccharins compared with whose

marvellous sweetness honey and manna are bitter to the taste. There are eloquent salesmen and courteous instructors and neat-handed Phyllises to offer you means of soothing the parched and torrid throat. You may wander for many hours finding always something to charm. It is, we mean the Fair, all very good.

The Indigo Industry of India

The indigo planting industry in India has lost its former very great importance since the discovery and introduction of synthetic indigotin, a substance prepared from coal-tar, and identical with the principal colouring matter obtained from the plant. This substitute has ousted the natural product to a very large extent in Europe and America, and, even in the East, the home of the indigo plant, the energetic representatives of the German colour manufacturers are found everywhere carrying on intensive propaganda for the synthetic dyestuff. During the past 30 years various attempts have been made by the Indian Government in collaboration with the planters to maintain the indigo industry by improved methods of cultivation and manufacture, but each improvement resulting in a reduced cost of production has been countered by a competitive reduction in the price of the synthetic product. For certain purposes natural indigo is preferred. The heavier and deeper shades of blue which it yields are due to the presence of certain subsidiary colouring matters and make it especially suitable for very deep navy-blues on wool, and for the peculiar tones esteemed in Persian carpets. Against this preference must be put the fact that synthetic indigotin is supplied in the form of a paste of absolutely constant composition, whereas the plant indigo in each individual chest may contain a different percentage of colouring matter, and this difference has to be taken into account in preparing the dye-vat. In recent years this difficulty has been overcome, and, as the result of work carried out by Prof. H. E. Armstrong and Mr. Reginald Brown, it has been made possible to supply natural indigo also in the form of a standard paste with good keeping qualities: given equal prices, there is no difficulty in finding a market for this paste. The chief problem, therefore, as far as sale in the British home market is concerned, is the production of natural indigo at a sufficiently low price. The manufacturers of synthetic indigotin have scored, however, a further advantage by placing it on the market in an alternative form which greatly simplifies the preparation of the dye-vat. This newer form of paste, known as "reduced indigo," "indigo solution" or "indigo vat," allows of the production of a perfectly clear dye-vat in a few minutes, whereas most vats made from the ordinary synthetic paste and all vats made from natural indigo contain more or less sediment which must be allowed some time to settle before the vat can be used for dyeing. The problem of making a readily and completely-soluble product of the kind mentioned from plant indigo, which shall retain all the other advantages of the natural indigo, is engaging the attention of workers in this field, but offers very considerable difficulties. It is hoped and expected that a market of some extent, even if limited in comparison with former days, may still be retained for natural indigo.

"Hg. 33"

Addressing the Royal Society of Tropical Medicine last autumn, Lord Balfour remarked that our predecessors maintained that man was the crown of creation, and although he did not deny it, he felt that man was having a very uphill fight against organisms which were not the crown of creation, and he was not sure that man was getting the best of it. That feeling is shared by all who know much about the struggle that is being perpetually waged against tropical diseases, but it is lightened by the thought that what chemotherapy has done before it can do again: malaria, yellow fever, and sleeping sickness are now well under control, then why not leprosy and similar scourges? Although much progress has been made in the treatment of leprosy by the use of the rhodium salts or ethyl esters of the characteristic acids of chaulmoogra and hydnocarpus oils, and particularly by improved methods of administering them, this malady is still rife. In the Indian census of 1921 no fewer than 102,513 cases of leprosy were recorded, and the number was probably much larger because, owing to ignorance of the early symptoms of the disease, together with fear of social ostracism and loss of employment, the native seeks to hide his affliction as long as possible. Thanks to the success which has attended modern methods of treating leprosy in its early stages, victims of it are beginning to realise that cure is at last possible, and they are offering themselves for treatment; and owing to this development medical men are making a more effective study of a far larger number of cases than they could before. One of the chief remaining difficulties, however, is to treat patients who are suffering simultaneously from leprosy and another disease, like hookworm, malaria, or syphilis, because a drug that alleviates or cures one disease may be very harmful to another. Thus, Dr. E. Muir, a recognised authority on tropical diseases in India, has stated that it is often dangerous to administer an arsenical drug like neo-salvarsan to a syphilitic leper, and a remedy is needed which will combine the oil-treatment of leprosy with a harmless anti-syphilitic treatment. Such a drug has been discovered by Dr. T. A. Henry, Director of the Wellcome Chemical Research Laboratories in London, and has been tested on a considerable scale by Dr. Muir in India since August, 1924. The drug is a mercury derivative of *m*-hydroxybenzaldehyde, which is dissolved in hydnocarpus or chaulmoogra oil, or in ethyl esters made from these oils. When injected with this potion, the patient undergoes treatment for the two diseases at the same time. A preliminary account of Dr. Muir's results is published in the last issue of the Indian Journal for Medical Research. The compound he used was "Hg. 33," or 2-myristoxymercuri-3-hydroxybenzaldehyde [$C_{20}H_{33}(CHO)(OH)(HgO.CO.C_{13}H_{27})$], and he found that practically all his patients improved under the treatment: the Wassermann reaction (the usual diagnostic test for syphilis) became negative in a majority of the cases, whilst the concurrent leprosy was alleviated in all. Moreover, the new drug gave rise to none of those undesirable effects which so frequently accompany chemotherapeutic treatment. We congratulate Dr. Henry on the success of his long research, which, we understand, he is still pursuing.

INSULIN AND ITS MANUFACTURE

Dr. H. H. Dale, C.B.E., F.R.S., presided over the meeting on February 23, when Mr. Francis H. Carr, C.B.E., F.I.C., the President of the Society of Chemical Industry, gave an address on "Insulin and its manufacture" before a large and representative audience.

Mr. Carr said that long before the discovery of insulin the pancreas was regarded as the source of a substance which controls the amount of sugar in the blood stream, but in 1922, Banting and Best were the first to isolate from the pancreas a substance—insulin—which had this property in a marked degree. Their method of investigation was to inject extracts of pancreas into living animals and to determine the effect upon the sugar content of the blood. For this they required to use living animals, for insulin does not produce its effects in blood which has been removed from an animal. They required, too, delicate methods of determining minute amounts of sugar in blood. These had been recently evolved by biochemists, and the work of Banting and Best was in no small measure dependent upon these delicate methods of analysis which others had elaborated before them.

Now the pancreas had another function, namely, that of secreting digestive enzymes, including a proteolytic ferment, trypsin. This ferment passes down a duct into the alimentary canal. Insulin, on the other hand, does not pass down this duct, but finds its way from the pancreas to the blood stream internally. It was unlucky that insulin and these digestive secretions should occur in close proximity in the pancreas, because the chemical nature of insulin is such that it is rapidly destroyed by these digestive substances. It was mainly due to this fact that previous investigators had failed to isolate insulin; this was the difficulty which Banting and Best overcame.

It had been shown that the foetal pancreas does not, up to the fourth month of development, secrete trypsin, and Banting and Best found that an extract of foetal pancreas, though free from trypsin, had a powerful effect in reducing the blood sugar. This gave them the clue, and they set out to devise methods of extracting the pancreas which would give an extract rich in insulin and poor in trypsinogen. As trypsinogen is insoluble in 95% alcohol, they employed this solvent, and finally arrived at a method of preparing a very active extract.

Mr. Carr then summarised the properties of insulin, and said that the most characteristic property which is used for separating it from accompanying impurities is precipitation by adjusting the acidity of the solution exactly to p_H 5, the iso-electric point. By precipitating with absolute alcohol and then re-precipitating from dilute solution with picric acid and, finally, taking advantage of this iso-electric precipitation, repeating the process, if necessary, a white powder may be obtained which has an activity such that a unit is represented by 0.5 mg. Abel had, however, carried the purification further by precipitating with pyridine from acetic acid solution, and he claimed to have produced a substance of which 0.01 mg. represents a unit. Others claimed to have produced insulin which gives negative reactions for tryptophane and tyrosine. Casimir Funk claimed to have

prepared a substance of constant composition to which he assigns the formula $C_{86}H_{102}O_{22}N_{18}S$. He considered that it is a polypeptide in which fifteen amino acids are coupled. Abel found that with increasing purification there was an increase in the sulphur content of insulin, and he believed that that portion of the sulphur which is easily split off is an index of the physiologically active hormone present in impure insulin. Abel thought that sulphur is an integral constituent of the molecule. One well-known amino acid of the body, cystine, a substance readily obtained from hair or wool, contained sulphur. Would the insulin molecule be found to possess similar grouping?

Under normal conditions the body produces insulin in the pancreas and stores it, and there is continually discharged into the blood stream that amount of insulin which maintains the blood sugar at the usual level. By some wonderful adjustment the supply of insulin is increased when the blood sugar rises above and cut off when it falls below normal. In a person suffering from diabetes the supply of insulin fails, either from lack of insulin or from a defect in this process of releasing it.

Within the past year it had been shown what happens to the sugar when it disappears from the blood under the influence of insulin. The sugar was not entirely used up, since the increase in the amount of carbon dioxide given off by the body or of oxygen taken up by it was not sufficient to account for all the sugar which disappears. Best, Dale, Hoet, and Marks had shown in a fine piece of work, that the loss of sugar was completely accounted for by conversion into glycogen and by combustion.

The main part played by insulin was, therefore, to promote the storage of sugar in the form of glycogen and also its oxidation of sugar. In normal metabolism some sugar is formed in the liver, from protein and possibly from fat. Dale and his colleagues had shown that insulin depresses this formation in the liver of glucose from protein and fat. In the diabetic, and probably also in the normal individual, sugar was produced from fat, but in the diabetic certain abnormal products of fat metabolism were formed, namely aceto-acetic acid and acetone, and these were excreted in the urine. There was frequently also present what is obviously the parent substance of these two compounds, namely, hydroxy-butyric acid. These substances resulted from the oxidation of fats. Not only, therefore, was a diabetic unable properly to dispose of carbohydrate, but the fat was not oxidised to the normal end-products CO_2 and H_2O . Insulin treatment caused the rapid disappearance of aceto-acetic acid as well as of sugar from the urine. It seemed likely that insulin acted primarily on the sugar metabolism, and that fat metabolism could not proceed normally without simultaneous occurrence of the former process, but we had to await the final elucidation of this and a host of other problems of a similar nature. The discovery of insulin had given a new and very valuable method of investigating body metabolism, opening out a vast field for research.

While insulin was necessary to prevent the accumulation of sugar in the blood beyond the point at which the sugar, so to speak, becomes harmful to

the body, and interferes with the cell processes, on the other hand, too much insulin reduces the sugar to a minimum figure and acts as a poison, causing severe symptoms and ultimate death. There was, moreover, stored in the pancreas of a normal person insulin much more than sufficient to cause death were it all released at the same moment.

An account was then given of the determination and standardisation of insulin, and in the course of a detailed description of the manufacture the method of preparation was outlined as follows: (1) The pancreas glands were procured, dissected and cooled as rapidly as possible after the death of the animal. (2) Grinding and mincing at a low temperature was employed to break up the cells very thoroughly. (3) The material was made acid to pH 2.5 or alkaline to pH 7.0 in order to set free the insulin from the tissue on which it is adsorbed. (4) It was then extracted with alcohol of such a strength that but little of the enzyme is dissolved, and as much as possible of the insulin. For this purpose alcohol of 65-70% had so far proved the best solvent. (5) This extract was clarified by cooking it to 5° and filtering or centrifuging it. (6) After concentrating at a low temperature to one-tenth of its volume, the fat was extracted, followed by filtration. (7) The proteins were precipitated with ammonium sulphate or with absolute alcohol at pH 5. (8) The protein mixture was precipitated by adjusting the aqueous solution to pH 5.2. Proteins which were precipitated above and below pH 5.2 did not merely dilute insulin, but were antagonistic to its action. This purification was consequently of great importance. (9) Finally came formation of the picrate and regeneration as a hydrochloride by Dudley's method. By this means alone 90% of the inactive protein could be removed from some samples of crude insulin, since, although insulin when pure may be almost completely precipitated at its iso-electric point, the presence of accompanying proteins tended to keep it in solution even at this point.

• The large-scale manufacture had been installed as a continuous process which was illustrated with a comprehensive flow sheet. The plant had been so arranged as to ensure rapid handling, continuous recovery and strengthening of alcohol, automatic control of temperature, and so forth. When first this manufacture was commenced the yields obtained were very low, though quite as high as those obtained in other laboratories, being but 50 units per kg. of pancreas. There was also, at first, a great loss of alcohol. As our knowledge had extended and the plant had been perfected, it had been possible to increase the yield twenty-fold, and to reduce the loss of alcohol to a very low figure. So great progress could not have been made without the assistance given by communications from many workers in the field, both in this country and in America and Denmark. In particular, mention must be made of the invaluable help given by the National Institute of Medical Research. As the result, the selling price of insulin was reduced by successive stages from 25s. to 2s. 8d. per bottle of ten doses within the first year of its manufacture, thus bringing the cost of treatment, at first prohibitive to many, within the reach of all. At the same time the purity of the insulin had been greatly improved.

The clinical use of insulin was then discussed, and it was shown how, with the skilful regulation of diet with insulin administration, a comparatively normal blood sugar could be maintained. Abundant evidence was at hand to show the wonderful results achieved by the treatment, and two remarkable and dramatic cases were shown on the screen. Very severe diabetics were likely to die in a state of coma. The onset of these symptoms had, until recently, been regarded as proof that death was at hand. With insulin treatment recovery from the comatose condition was not only likely but probable; numerous cases were on record of people who had thus been snatched from the jaws of death.

The discovery of insulin had been the starting point of many researches. Although insulin was discovered in Canada, much of the work referred to had been contributed from other countries: in particular from the United States, from Denmark, from Japan, and from this country: and quite recently the news had come from Germany that Frank, Nothmann and Wagner, colleagues of Minkowski, who contributed greatly to our early knowledge of the physiology of the pancreas, had discovered a chemical substance—a derivative of guanidine—which produced effects similar to, although much less intense than, those of insulin. A Japanese investigator, Watanabe, showed that guanidine reduces blood sugar, but was too toxic for use in the treatment of diabetes. Another guanidine derivative, which was said to exercise in diabetic patients the same effects as insulin, but produced them much more slowly, had the advantage that it would be administered by the mouth. Perhaps its greatest interest was that it may prove a step in a direction which by leading chemists and pharmacologists to study other derivatives of this nature will enable them to find a true substitute for insulin.

In whatever state of purity, insulin seemed always to give, in common with proteoses, the biuret action, which implies that it is a derivative of $NH_2 \cdot CO \cdot NH \cdot CO \cdot NH_2$. Guanidine is $HNC \equiv (NH_2)_2$, agmatine is $NH_2C \equiv NH \cdot NH(CH_2)_4NH_2$, while synthalin is stated to be a guanidine derivative with a longer chain of CH_2 groups. The elucidation of the chemical nature of insulin itself is the step to be most profoundly desired. It might be that this would involve the destruction of as much as £1000 worth of insulin, but the priceless contribution to human happiness which the discovery of insulin represented made even that expense appear to be but a grain of sand on the sea shore. Once we understand the chemical nature of insulin, it is not too much to expect that the history of adrenalin and thyroxine will be repeated, and insulin, like the two latter, will be manufactured artificially.

In opening the discussion Dr. H. H. Dale paid a warm tribute to the skill of the British fine chemical manufacturer in developing the large-scale production of so delicate a product to such a high pitch of efficiency within a very short period. An interesting discussion followed, many points being raised. Mr. C. A. Hill quoted testimony to the excellence of British insulin and other fine chemical products, which showed that they were being appreciated to a gratifying extent abroad, and various speakers dealt with the clinical use of insulin.

A MESSAGE FROM OLD LEIPZIG THROUGH LONDON (TO GERMANY)*

By Prof. HENRY E. ARMSTRONG, Ph.D. Leip. 1870

The *Chemiker Zeitung* has been a faithful record of chemical activity in the past fifty years—a period during which progress has been continuous. As I can also look back upon the ten years prior to the establishment of the journal, probably there are few who can better appreciate the influences that have been at work and the vast development of the usefulness of chemistry that has been effected. Perhaps its growth has been almost too rapid. Chemists, to-day, seem to be too little aware of the greatness of the burden that is now cast upon them; they are probably insufficiently alive to the opportunities and the difficulties that lie before them. If Liebig could say to Kekulé: "If you will be a chemist, you must ruin your health. No one who does not ruin his health by study comes to anything to-day in chemistry"—what must be the position to-day? Use has been made of our science mainly on the industrial side and in sanitary affairs: thus far, no success has attended our efforts to spread its influence among the masses, to give it intellectual and moral value. Chemists, hitherto, have been mostly artificers; artists have been rare among them and philosophers still rarer. There is danger that our science may be made too materialistic in its outlook: especially is this true of the United States.

I began the study of chemistry in 1865, under Hofmann shortly before he left England. I was sufficiently in contact with him to be influenced by his magnetic personality and fortunately, in after years, had the opportunity of meeting him often enough to appreciate the greatness of his character. If he did not lay the foundations of chemical study in London, he was undoubtedly the first to establish a school of devoted and enthusiastic workers. The qualities he developed were at the root of the wonderful influence he afterwards exercised in Germany. A courtier and diplomatist of the first rank, gifted with great literary skill, he not only did much to encourage technical advance but also exercised a commanding social influence. Chemistry to-day is more in need of men of his type, of high social ability, than of mere technical experts. Chemists are growing up a race apart, with little influence upon intellectual thought and public opinion. Scientific occupation is apt to narrow, if not to sterilise mental outlook. It is on this account that we need to ponder the characters of men of genius of the Davy, Faraday, von Humboldt, Liebig, Dumas, Hofmann, Helmholtz, Pasteur, Cannizzaro type—all men of universal mind. Such men are born, not made; still, we might do more to encourage their development. We are not sufficiently alive to the dangers which the growth of present-day specialism brings in its train. We are fast becoming less and less able to solve the great problems of life, because these involve a breadth of treatment which none attempts to cultivate. In fact, we have too long worshipped the specialist and greatly overrated his importance.

My first English teacher, the celebrated Frankland, was associated with Kolbe, in London, before going with him to Marburg, to study under Bunsen. They were fellow workers in the laboratory of Dr. Lyon Playfair and there began their joint work on the nitriles (1847-48). Frankland's great discovery of zinc ethyl was made in Bunsen's laboratory in 1849. I assisted Frankland in devising the method of determining organic matter in drinking water, involving combustion of the residue *in vacuo*, with the aid of the Sprengel mercury pump. With the aid of this method, Frankland made a complete survey of our English water supply, and brought home to the public the fact that contamination by sewage matter was the one great source of danger. Frankland should rank with Lister and Pasteur as a saviour of the world's health.

This work finished, at Frankland's recommendation, I went to Germany in the autumn of 1868, naturally to his friend Kolbe, who was then professor in Leipzig. I remained with him until the spring of 1870. Those were days when German chemistry was a "selbständige Wissenschaft," uncontrolled by industry. We were a very happy family, most of us trying to work out small ideas of our own, not themes suggested by the professor. The desire we had was to learn to work independently and make ourselves chemists—to do something creditable and, therefore, to finish our work. We gained a wide experience.

Kolbe was a very remarkable man—a Puritan and a hater of pretence. Full justice has never been done to his memory and character nor to the service he rendered to German chemistry. To-day, probably, few will understand his writings. He necessarily made himself unpopular by the sharpness of his criticisms but he was essentially right. His protests against slovenly writing in the *Berichte* were thoroughly justified and the cause of no little improvement. Himself, he wrote a German perfect in its clearness and directness. We gained much from his example.†

Changes were taking place, however, with which he could not sympathise, even if he understood them. At that time a new era in organic chemistry was setting in. The dawn of a fully developed structural chemistry was just breaking: logical application was being made of the principles of valency propounded by Frankland and by Kekulé. We were trying to develop the position—chemistry of benzene; in fact, the task Kolbe set me, on arrival, was to study (*ortho*)phenolsulphonic acid. I first worked in the old laboratory. Gräbe, who was then Privat Dozent, had a bench near to mine. I well remember his going to England to meet Perkin and others over the Alizarin patent. Hüfner was among the workers, also Ludwig Darmstaedter. I was present (1868) at the birth of urea from ammonium carbamate and witnessed its delivery by Basarow. *Iso-Succinic acid*, the first dicarboxylic acid with two carboxyl groups attached to one carbon atom, was also born at

† That the present generation cannot enter into the spirit of the happenings of those days, and can no longer form a just estimate of the character of those they have never known, is clear from the absurd account of the Kolbe-van't Hoff episode published in this JOURNAL at the time of the recent Leiden-van't Hoff celebrations. Kolbe was one of the most genial of men, a fine example of German *Gediegenheit*. I saw him now, as one asked his opinion of a projected experiment. Pulling at the lapels of his coat with his two hands and smiling, he would even answer:—*Versuchen Sie es! Try it! Herr A.*

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this time. In the new laboratory, my bench companion and great friend was, Liebig's nephew, Karl Knapp, a *Prachtkerl*. Sad to say, he soon fell a victim to tuberculosis. Although I never saw Liebig, to have been so nearly in touch with him, in this way, was more than interesting, especially as I had the privilege, on one occasion, of spending several days, during the vacation, in Knapp's parents' home in Braunschweig and thus was able to appreciate his mother's charm. Heinrich Fresenius was another special friend.

One dabbled in all sorts of subjects besides chemistry. Agricultural chemistry (Knop), botany (Schenk), mineralogy (Naumann), physics (Hanckel), physiology (Ludwig) and even anatomy. I attended Ludwig's complete course of lectures. The anatomy class we attended was a special one Knapp managed to arrange for on Sunday mornings, by Professor Braun, then in repute on account of the sections he was making through frozen cadavers. In London, as a student, I had frequently witnessed, on Saturdays, the surgical operations in the theatre at one of our great hospitals. We also attended the *Gewandhaus*, which provided priceless chamber-music, the theatre and the *Kneipe*, the last, in those days, one of the greatest of German institutions, where much of the real work of understanding was done. Those were indeed happy times. I mention these things to show what some of us managed to include in chemistry in those days. We did this too without any obligation and in no way as preparatory to an examination—apart from the prescribed qualifying courses of lectures we attended on the two subjects we were called upon to select outside our own special subject. Judged by results, I think that those of us who grew up under such a system compare not unfavourably with the modern ever- and over-examined product, studying only subjects that will pay.

I had met Peter Griess when I was a student in London, as my chief friend, Horace Brown, came from Burton-on-Trent and I often visited him. Griess had then but recently taken the place at Allsop's Brewery of Dr. Böttlinger, father of the H. von Böttlinger, who played so leading a part in the Baeyer firm at Elberfeld. After my return from Germany, I soon became intimate with Griess and through him with Heinrich Caro, who gained much inspiration of the greatest importance to the Azo-farben industry from his visits to Griess. I learnt to know Lunge and was on terms of intimacy with Otto Witt during the time that he was engaged in producing the Tropæolins at Williams, Thomas & Dower's factory near London.

In 1875 I became associated with W. H. Perkin. We were fellow secretaries of the Chemical Society. He was then still a manufacturer and engaged in studying the hydroxyanthraquinones. I took part in one of the earliest of the great chemical patent law suits, the salicylic acid case, von Heyden v. Neustadt, in 1879. I had made salicylic acid from carbon dioxide and phenol, by Kolbe's original process, when at Leipzig. Later on, I was in the celebrated Fast-red case, *Badische v. Levinstein*. I was also in the Aspirin case, appearing against the Baeyer firm. I mention these facts to show that I was long in close touch with the dyestuff industry in Germany. Attending, as I frequently did in early

years, the *Naturforscherversammlung*, I learnt to know all the leading workers. I first met Emil Fischer in 1883, the year in which I made a tour of nearly all the German laboratories.

What I have said thus far will have shown that I was largely "made in Germany." I therefore may venture upon an opinion of the present as compared with the past condition of affairs chemical. In the application of chemistry to industry, progress has been extraordinary; on the academic side. I incline to think that there has been a definite retrogression in outlook. The range of the subject has been so widened that it has lost the compactness and philosophic precision it had in early days: in some respects it is lacking in "moral" and certainly far too speculative. As in religion, we are broken up into too many churches.

Two transforming influences have been at work: one commercial, the other academic in its origin. Neither Perkin's prime discovery of Mauve in 1856, nor the later work (1869) of Graebe and Liebermann on Alizarin, had any notable effect upon academic workers: dyestuffs were not yet in the public eye. A great change in the academic outlook was produced by Kolbe's discovery (1874) of an easy method of producing salicylic acid from phenol, using caustic soda instead of sodium and operating under pressure. Chemists became suddenly aware of their value and of the opportunities open to them. They recognised that industrial methods could be developed in the laboratory. The further discovery of the great medicinal value of salicylates gave additional importance to the discovery. Soon every chemist of promise was retained by this or that firm and his services were subsidised. Suddenly, the members of the junior staff in University laboratories became selfish workers—each had his little band of embryo *Doctoren* working under him, all of whom were pledged to secrecy. Laboratories ceased to be units and were broken up into close coteries. From that moment the *Lern* and *Lehrfreiheit* of the past were no more. Academic chemistry was commercialised. As a consequence, the German laboratory lost much of the value it had as a training school in my time when everything that was going on was freely discussed. It has often been said that no man can serve two masters.

The centre of gravity thus became shifted from the University to the Works Laboratory, the more as time went on and industry prospered. The works laboratories have now long been the real centres of progress, where work has been carried out not only with scientific precision but with true logical purpose, zeal and method. German chemical industry has set a great example, both to scientific workers and to the commercial world generally.

Apart from the work done by a few, especially by a giant like Emil Fischer, whose example no one has properly followed, most academic study has been spasmodic and sporadic in character and weak in purpose. In fields unexploited in industry, our knowledge is still scrappy and indeterminate. The fields cultivated by industry have been filled in and rounded off with marvellous completeness.

The value of University study has been further lowered by the intrusion of an influence definitely adverse

from the work of the chemist—that of mathematics, the more as a type of mind has been thereby introduced into the profession to which chemistry proper makes no appeal. This is not to say that mathematics is not of value in our subject when properly applied, nor that the chemist should be without mathematical training.

Chemistry is not merely a science but an art and mainly a constructive art. The chemist is of little value unless he can make something and have full sympathy with the characters of the materials he handles; he must have both fingers and feeling (*Gefühl*). During the past forty years, a new school, the physical school, has been brought into existence which has neither fingers nor feeling. As I once heard friend Duisberg say: *Die Schule hat keine Methode!* Six months spent in determining electrical conductivity is no training in chemistry and this is true of most physical exercises. No Doctor's degree in chemistry should ever have been given upon such work. In so far as it is necessary—and that it has its value in its proper place is beyond question—the work should be incidental or post graduate. Again, in no field has premature specialisation done more harm than that of so-called Biochemistry. The main cause of the slow increase in our understanding of vital phenomena is the incomplete chemical equipment of a majority of the workers and the almost complete ignorance of chemistry of medical men. In chemistry, more perhaps than in any other branch of scientific work, we need to get back, as far as possible, to a single subject: to make the training as thorough and complete as possible before allowing specialisation. The chemist is now as necessary to the community as is the medical man and as much care should be taken in training him.

In another way, harm has been done of an even more serious character than that caused by premature specialisation—of the character foreseen by Kolbe in his criticism of van't Hoff. A distinct metaphysical element has been introduced into our teaching. The rigid logic of experiment has been put aside and dogmatic methods of treatment adopted in its place. Thus, the Arrhenius speculation has been elevated into a pure religion by Ostwald and his school and they have avoided and resented all discussion of its validity. The effect has been that several generations of students have grown up without training in logical argument and consequently without judgment or critical power, with no proper respect for proved fact. Progress in science necessarily involves questioning every conclusion arrived at, not once but repeatedly, as new evidence is produced; the habit seems to be nowhere cultivated. I several times talked the matter over with Emil Fischer, who was fully alive to the danger. He was too good natured, however, and had not the courage to incur the odium involved in protesting against the decay that was setting in, destroying the old art of experimenting.

We need to get rid of the practice which now has so long prevailed of worshipping authority, especially when so-called "theory" is in question. Too often those who have been ranked as authorities have been men who patently are not to be regarded as chemists in any real sense of the term—such as van't Hoff, Arrhenius, Ostwald and Nernst.

We need to turn more to facts and to analyse them.

The disregard of almost everything fundamental underlying the problems of chemical change in the text-books of to-day is astounding and most pitiable. There is no authenticated science of chemistry to be found in them. We are little further in these matters than we were forty or fifty years ago. Scarcely a chemist has a clear conception of the actual process in this or that change which he can defend by any force of argument based upon fact. The first principles are scarcely established. In other words, we are disgracefully behind in our treatment of theory. Probably also not a little of our accepted theory may be wrong.

To take the special case of carbon. Frankland proposed his general theory of valency in 1853. Kekulé, a little later, dealt specially with that of carbon and outlined the tetrahedron conception, already foreshadowed by Pasteur, which was more fully developed and made popular by van't Hoff in 1875. Van't Hoff's lead has been followed to the present day. The proposal he made was to represent the carbon atom by a regular tetrahedron and to assume that the four valencies were directed from the centre of mass, one to each of the four apices. He joined tetrahedra at their apices to represent carbon atoms united by single affinities. The use he made of the hypothesis in explaining optical activity, already implicit in Pasteur's discovery, was so satisfactory and gave rise to so many opportunities for work that it was accepted without discussion or question and extended. Chemists had acquired the habit of talking about the benzene ring and so soon began to think of rings built of fewer atoms than benzene—the polymethylenes. Baeyer developed his strain hypothesis, explaining the variations in unsaturation in such supposed rings on the assumption that the more the angle at which the carbon atoms meet in the ring departs from the angle between the valencies in the tetrahedral atom (109.3°) the greater is the strain. The ring is figured as a loose structure and no hesitation is felt in filling atoms into or bridging the ring—as in camphor, for example.

To-day, at last, we are beginning to think in terms of solid structure, not merely of isolated molecules, and to discern the arrangement of atoms in the molecules in crystals. Van't Hoff, strange to say, seems never to have thought in terms of solid geometry, although he made use of a solid geometrical model but only to deduce a certain superficial geometrical consequence.

To arrive at conceptions of solid structure it is only necessary to use the model geometrically—to think of the four affinities in the carbon atom as emerging each at the centre of a face of the tetrahedron. The paraffinoid form of union is then represented by joining tetrahedra *face to face*.

In attempting to correlate structure with crystalline form, Barlow and Pope have represented valency in terms of volume. Regarding hydrogen as having unit volume, they assume that oxygen, nitrogen and carbon occupy respectively twice, thrice and four times this unit volume. Acting on this view, Mr. Barlow and I have constructed models, using a single sphere to represent hydrogen and two, three and four spheres to represent oxygen, nitrogen and carbon. The model of the carbon atom thus becomes a regular pyramid of

four-unit spheres, corresponding to the van't Hoff tetrahedron. Such pyramids closely packed together endlessly, alternately base downwards and base upwards, form a model which is in accordance with Sir Wm. Bragg's analysis of the diamond. Six such tetrahedral pyramids can be so arranged, to form a *closed system*; if six unit hydrogen spheres be arranged symmetrically around the periphery of the system, three in a lower and three in an upper plane, a model is obtained which may be regarded as that of benzene. No less a number of tetrahedral units than six can be so arranged to form a closed system. If the model of carbon used be in any way an approximation to fact, it follows that many of the supposed ring systems are non-existent.* It is at least necessary, therefore, to re-examine the evidence upon which a large number of structural formulae—particularly of compounds of the terpene class—have been constructed.

It may be heresy to so question conclusions that are now confidently accepted, but to make full logical use of the tetrahedral hypothesis—to use solid models and pack them closely, on the assumption that the atoms themselves practically fill space—is at least as legitimate a use as that made of it by van't Hoff.

To conclude, looking back, as I do, over sixty years of herculean practical achievement, it is impossible not to be greatly struck by the marvellous constructive and analytic genius displayed by workers in the laboratory: equally, not to be surprised at our comparative failure, in the study, to utilise the wealth of material so accumulated. It is clear that we need to develop the mental powers of the rising generation more fully and more soundly than in the past, to enable it to cope with theory in a satisfactory manner.

Germany to-day can congratulate herself on the steadfast purpose and success with which, during the past fifty years, science—especially chemistry and engineering—has been applied to industry. If she wish to retain her position, she will needs strengthen her academic system, so that the training in chemistry may once more be made serious and thorough, honest and logical, not speculative and superficial.

Chemistry is the business of handling and knowing the materials the earth provides: yet the extent to which such materials are considered to-day in academic study is "verschwindend klein"; they count for little in examinations.

Such is the message I would fain bring in pious memory of my revered master Kolbe.

Having arrived at so awkward a conclusion I have necessarily been led to study the problem, and have found that a second mode of union distinct from that ordinarily postulated between carbon atoms, which admits of close packing, is possible. I referred to this in my recent Horace Brown Memorial Lecture.

SODIUM PEROXIDE IN NORWAY

Sodium peroxide has been manufactured in Norway by two firms, the Fredrikstad Elektrokemiske Fabriker A.S., of Fredrikstad, and the Vadheim Elektrokemiske Fabriker, A.S., of Bergen. According to the U.S. Trade Commissioner, both companies have discontinued the manufacture of sodium peroxide, which is not being produced in Norway at present.

VALENCY TERMINOLOGY

By J. D. MAIN SMITH, Ph.D., B.Sc.

The charge is often levied against chemistry that it makes use of a mysterious and incomprehensible language, and the layman, unconvinced of the necessity for this strange lingo, has not hesitated to stigmatise it as sheer jargon. In general, the charge is unjustified, for chemistry deals with facts and ideas for which the words of living and dead languages offer an insufficient description. In order to give definiteness and intelligibility to these technical facts and ideas, it has been necessary to devise new words which are outside the common ken. It is the usual scientific practice to coin new words from the dead languages, Latin and Greek, by impressing on the old words a scientific meaning having some connection with or relevance to the original meaning. It is further customary to inflect the root word with prefixes and suffixes from the same language.

The mathematical sciences prefer words adopted or adapted from Greek, the language of a race of theorists, whereas the experimental sciences prefer Latin, the language of the more practical Romans. As chemistry is rooted in alchemy, for which Latin was the invariable medium, chemical terminology is almost exclusively Latin in origin.

Occasional hybrid words, having roots in one and inflections in another language, have crept into chemical nomenclature. Such hybrids, however, are generally admitted to be etymological monstrosities, and their use is sanctioned only by a consensus of chemical opinion, based on appreciation of very definite advantages offered by such hybrids over alternatives of purer origin.

The plea of guilty to the charge of jargon must be entered where hybrids are used indiscriminately or without obvious advantages, where inapt and repellant words are used when simpler and more euphonious words are available, or where a technical word is coined redundantly or in application to several different conceptions. That odd and unnecessary hybrids, and words repellant, clumsy, unpronounceable, defective, and indeterminate in meaning, are among the current coin of chemical nomenclature cannot be denied, and the time appears ripe for purification and simplification.

Perhaps no word is the subject of more confusion in chemical terminology than *valency*. There is no general agreement even as to the definition of the term. Probably the definition most free from ambiguity and most generally accepted is that valency is a number expressing into how many equal parts, each chemically *equivalent* to a hydrogen atom, an atomic weight is divisible. Whatever definition of valency be proposed, it must embody the idea of multiplicity of units each *equivalent* in combining capacity to a hydrogen atom. The word valency in fact is merely Wicelhaus's shorthand form for *equivalency*, suggested by Hofmann in 1865. The idea underlying equivalency had, however, been grasped nearly a century prior to the formal conception of valency, as is evident from the work of Cavendish and Richter on the equivalency of metals and bases in their power of neutralising acids.

Though equivalency and equivalent do not appear to have had any precisely equivalent forms in Latin, they

are definitely of pure Latin origin, being derived from *aeque* = *equally* and *valens* (*valentis*) = *strong, efficacious or available*. It is well known that in Latin, as well as Greek, the letter *e* was pronounced *ei*, and was usually indistinguishable from the sound of *i*. So near in sound were *e* and *i*, that these letters were indifferently written by authoritative Latin writers, as in *here* and *heri*, *legans* and *eligans*, *sibe* and *sibi*, *quase* and *quasi*. The Romans, in fact, in the three like cases of the plural of the third declension, wrote many, if not all, words indifferently in *es*, *is*, and *eis*, as in *partes*, *partus*, and *partes*; and in the accusative and ablative singular of the same declension, these terminations were indifferently used in innumerable cases. Hence, it came about, in the formation of English words compounded from Latin, that the Latin *e* was transcribed as *i*, as in *equivalent* from *aeque*. From this interchangeability arises the Latin variants for three, *tres*, *tria*, *trium*, *tris*, *trini*, and *terni*, and the prefixes *ter*, *tre* and *tri*.

Whatever prefixes are used for valency and valent, strict etymology requires that they shall be of Latin origin. There can be no excuse for the use of Greek prefixes, the consistent application of which would involve discarding the original word equivalent. At the present day, however, we find that Latin and Greek prefixes to valent and valency are used without the slightest pretence to consistency or uniformity. Not only does confusion exist as between consistent Latin or Greek prefixes, but Latin is used for some prefixes and Greek for others.

Even among writers who confine themselves to Latin prefixes, there is no semblance of uniformity of usage, as for example in *tervalent* and *trivalent*. Moreover, as *tri* and *octa* are prefixes common to both Latin and Greek, the words *trivalent* and *octavalent* are either Greek-Latin hybrids or pure Latin according to whether the writer habitually uses Greek or Latin prefixes.

The confusion is not lessened by the fact that the Greek terms *monad*, *dyad* and its incorrect variant *diad*, *triad*, *tetrad*, etc., suggested by Odling in 1861, are still in occasional use. Hofmann's *equivalency* and *quantivalency*, which are synonymous with *valency*, are also still in occasional use by the older generation of writers in chemistry.

In my book "Chemistry and Atomic Structure," and elsewhere, I called attention in 1924 to the confusion centering round the word *valency*, and suggested the consistent use of the Latin prefixes, *uni*, *bi*, *tri*, *quadri*, *quinque*, *sexa*, *septa*, *octa*, *equi*, and *multi*. The use of these prefixes can be fully justified by reference to analogous Latin and English words. These prefixes, however etymologically good, do not form a consistent series, the terminal letter of the prefix varying from *i* to *e* and *a*, six out of the ten prefixes ending with *i*. The other four prefixes have the variant good Latin forms *quinqui*, *sexi*, *septi*, and *octi*. Moreover, the sole Latin words for "five times," "six times," "seven times," "eight times," and "many times," are *quinques*, *sexies*, *septies*, *octies*, and *multi*, all of which have the same general form, the letter *i* following the roots of the words. This may be taken as good authority for the use of the *i* termination for the prefixes *quinqui*, *sexi*, *septi*, *octi*, and *multi*. If these forms are accepted the

whole of the ten prefixes for valency and valent fall into a series with the invariable *i* termination, in which uniformity and good Latin are maintained. The series offers in addition the immense advantage that it is easily memorised.

An examination of the Latin and English languages reveals the fact that the prefixes *uni*, *bi*, *tri*, *quadri*, and *aqui* (or *equi*), predominate greatly over all other variants.

In order of frequency of occurrence in Latin, the prefixes for *one* are *uni* (20), *un* (11), and *unu* (2), the bracketed numbers being the respective occurrences. *Uni* is the sole Latin prefix which can precede *v*, as in *universus*. In English, the order is *uni* (73), and *un* (6); and *uni* is the sole prefix that can precede *v*, as in *univulvar*, a word in which the first three letters (*val*) of the root are the same as in *valency*.

The Latin prefixes for *two* are *bi* (65), *du* (21), *duo* (17), *bis* (2), and *dua* (1), and *bi* is the sole prefix that can precede *v*, as in *bivertex*. In English, the order is *bi* (97), *du* (10), *duo* (8), *dua* and *bis* (6 each), and *bi* is the sole prefix that can precede *v*, as in *bivulve*.

The Latin prefixes for *three* are *tri* (118), *tertia* (7), *tre* and *ter* (6 each), *tertiu* (3), *terni* (2), and *terna*, *ternu*, *tres*, and *tris* (1 each). Of these only *tri*, *ter*, and *tres* are known to precede *v*, *tri* in five common words such as *trivium*, *ter* in one rare word *tervenificus*, and *tres* in the word *tresviri*, an obsolete form of *triumviri*. In English, the order is *tri* (141, excluding over 100 Greek words), *tre* (12), *ter*, *tertia*, and *terna* (4 each), *tern* and *terni* (1 each); of these, *tri* is the sole prefix that can precede *v*, as in *trivulve* and ten other words.

The Latin prefixes for *four* are *quadri* (37), *quadra* (17), *quadru* (12), *quarta* (7), *quater* (6), *quatuor* (5), *quartu* (3), *quadro* (2), *quatri* (2), *quarti* and *quarto* (1 each), and of these *quadri* is the sole prefix known to precede *v*, as in *quadrivium*. In English, the order is *quadri* (26), *quadra* (12), *quadru* (8), *quadr* and *quarter* (6 each), *quater* (5), *quarte*, *quad*, *quator*, and *quadro* (2 each), and *quart*, *quarta*, *quarti*, *quarto*, *quatra*, and *quatre* (1 each). Of these *quadri* is the sole prefix known to precede *v*, as in *quadrivulve* and four other words.

The Latin prefixes for *equal* (excluding *par*, which has the meanings of equal and opposite) are *aqui* (10), *aqua* (7), *aquo* (1), *aquabili* and *aquali* (3 each), *aquu* (2), and *aeque* (1). No case is known of any of these prefixes preceding *v*. In Latin, however, the mute consonants *v* and *p* are interchangeable, as in *ovis* (*opilio*), and *vervex* (*verpus*), and *aqui* is the sole prefix known to precede *p*, as in *aquipondium* and other words. In English, no precedent is needed, for *equivalent* is already established in common use.

The vast preponderance of the prefixes *uni*, *bi*, *tri*, and *quadri*, over all other variants in both Latin and English, renders it difficult to appreciate on what grounds the prefix *ter*, for example, has been approved, particularly in official publications. In Latin the word *ter* signifies thrice or three times, just as *semel* and *bis* signify once and twice respectively. Nevertheless, it does not appear that *semivalent* and *bisvalent* have ever been used in chemical literature, though by analogy with *ter* they appear to have equal force and application.

The words *semel*, *bis*, and *ter* are numerical adverbs

with ambiguous meaning. Not only do they signify multiplicity of fact, but also repetition of event. The latter meaning is quite alien to that of valency. A trivalent element may mean an element which exhibits valency periodically on three occasions, as, for example, thrice a week, on Mondays, Wednesdays, and Fridays, but not on other days. Multiple valency indicates simultaneous multiplicity, not periodical repetition. A simultaneous multiplicity of three is indicated accurately and unambiguously in Latin by *trinus* -- three together, or by *triplex* or *tripulus*, both of which signify triple, treble, threefold, or threeply. The prefix common to these words is *tri*.

Similarly, the prefix *uni* is derived from *unicus* -- single, and *bi* from *binus* (*binus*) -- double, pair, or couple, or from *bis* -- twice or double.

Too much stress cannot be laid on the fact, already cited, that *uni*, *bi*, *quadri*, *æqui*, and *multi* in Latin and *uni*, *bi*, *tri*, *quadri*, *equi*, and *multi* in English, are the only prefixes known to precede the letter *v*. The prefixes *quinqvi*, *sexi*, *septi*, and *octi* are established by derivation from *quinqvies*, *sexies*, *septies*, and *octies*, signifying five, six, seven, and eight times respectively, and by analogy with *uni*, *bi*, *tri*, *quadri*, *æqui* and *multi*.

Numerous precedents for the invariable *v* termination of numerical prefixes exist in other sciences. The English words *valve* and *valvular*, already referred to as being similar in form to valency, are in use in botany, zoology, and engineering science. The numerical prefixes in use in these sciences are *uni*, *bi*, *tri*, *quadri*, *equi*, and *multi*, as in *univalvular*, *bivalve*, *trivalve*, *quadri-valve*, *equivalvular*, and *multivalvular*. In botany we have *bifid*, *trifid*, *quadrid*, *multifid*, and *unifarious*, *bifarious*, *trifarious*, *quadrifarious*, and *multifarious*. In botany, conchology, and heraldry we have *bipartite*, *tripartite*, and *quadripartite*. In most sciences we have *uniform*, *biform*, *triform*, *quadriform*, and *multiform*. In no science or art does there appear to be any series of numerical terms in which the prefix *ter* occurs.

There are thus abundant etymological and analogical grounds and precedents for the prefixes **uni**, **bi**, **tri**, **quadri**, **quinqvi**, **sexi**, **septi**, **octi**, **equi**, and **multi**, when used with valency, valent, or valently. The uniformity of termination of these prefixes constitutes a valuable mnemonic aid, the compound words formed with these prefixes are euphonious to a high degree, and their general adoption in chemical science would remove the existing confusion and some of the reproach of jargon.

NEW FERTILISER FACTORY IN BRAZIL

A new factory is to be erected in Brazil by the Cia. Hidro-electrica de Adubos Chimicos e Alkalis, with the aid of subventions from the Federal and State Governments, for the manufacture of fertilisers by a process for the synthesis of ammonia from atmospheric nitrogen. The company anticipates an output of 75,000 tons both of nitrogenous and phosphatic fertilisers, and will make provision for increasing its capacity. At present Brazilian agriculture consumes roughly 100,000 tons of nitrogenous fertilisers and 200,000 tons of phosphatic fertilisers annually, and the demand is growing.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

ANNUAL GENERAL MEETING, JULY 4 to 8, 1927

RAILWAY FACILITIES

The Railway Companies of Great Britain (except the Metropolitan, the Metropolitan District, and London Electric Railway Companies) have agreed to issue tickets at the ordinary single fare and one-third for the double journey to persons travelling to Edinburgh to attend the meeting. Tickets will be available from Saturday, July 2, to Saturday, July 9.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

ANNUAL REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY - VOL. XI

This volume of the Annual Reports (covering the year 1926) is now ready, and copies are being despatched to those who have subscribed for them.

The price of the volume is 7s. 6d. to members of the Society and 12s. 6d. to non-members. Fellows of the Chemical Society, who are not members of the Society of Chemical Industry, can purchase the book at the price of 10s.

Orders for copies, accompanied by the appropriate remittance, should be sent to the General Secretary of the Society.

EDINBURGH AND EAST OF SCOTLAND SECTION

The fifth ordinary meeting was held jointly with the Local Section of the Institute of Chemistry in the Hall of the Pharmaceutical Society, Edinburgh, on February 14, 1927, Mr. J. Adam Watson in the chair.

A paper by Mr. B. D. W. Luff on "The use of the microscope in qualitative analysis" was read.

In many branches of chemistry the utility of the microscope has long been recognised, but much more extended use might be made of microscopic method than is generally done. In the microscopic method of qualitative analysis the reagents used are such as give precipitates of a definite crystalline structure, and the characteristic appearance of these crystals is used as a means of establishing the identity of the substances under examination. The reactions themselves are generally carried out on a microscope slide usually made of glass, but in certain cases celluloid or bakelite may be employed.

A few preliminary tests on a material under examination may be made on the slide. For example, its solubility in water or acids may be examined by noting its behaviour when placed in a drop of the liquid. This may be followed by decantation on the slide and allowing the drop of liquid to evaporate and the presence or absence of residue noted. If it is desired to know whether gas is evolved during solution, the solid under test is covered with a drop of gelatin near which, after setting, the drop of reagent is placed. Bubbles of gas, if formed, will be imprisoned in the gelatin, where they will be readily seen under the microscope.

Decantation is performed by holding the slide in a slightly inclined position and drawing a thin channel of the liquid along the surface of the slide with the aid of a platinum wire or a finely-drawn-out glass rod. Filtration is effected by pressing a narrow glass tube having a flat ground end on to a filter paper resting on the slide, and bringing the filter paper near to the drop of the liquid. The liquid is drawn into the tube by gentle suction, and in this way passes through the filter paper, where the precipitate is retained.

Whilst the presence of a number of metals interferes with the formation of characteristic crystals in many instances, there are for every metal three or four different tests which may be applied, and with a little practice it is a comparatively simple matter to decide upon the presence or absence of the commonly-occurring metals by following up one test with one or more other tests.

This method of qualitative analysis is particularly valuable in determining the nature of materials of which only small quantities are available. In this way small specks of foreign matter or surface dust on manufactured articles or material in process can be identified.

A further point in favour of the micro-chemical method is that reagents are used in such small quantities that economy is effected both in material and in space occupied: a complete set of reagents in small drop bottles occupying no more space than is taken up by two or three ordinary reagent bottles.

Mr. J. Adam Watson followed the reading of the paper with a few remarks on the use of the microscope—particularly the petrological instrument—and described the classification of crystals by this means.

YORKSHIRE SECTION

The second meeting of the session held by the Yorkshire Section of the Society of Chemical Industry took place on November 15, at the Great Northern Hotel, Leeds, when a paper on "The chlorination of wool" was read by Mr. J. B. Speakman, M.Sc., and Mr. A. C. Goodings, M.Sc. Mr. B. A. Burrell, Leeds City Analyst, presided.

The paper was divided into two sections, the first of which was concerned with the cause of unshrinkability, and the second with the amounts of chlorine required to produce that condition with wools known to possess widely different milling properties.

Dealing with the cause of unshrinkability, the actions of chlorine and hypochlorous acid on wool were studied microscopically. Apart from the elasticum reaction, which occurs only with chlorine, no drastic alteration of the fibre could be detected. But as soon as the chlorinated fibres are treated with soap or soda solution profound changes take place. The outer layers of the fibre gelatinise and swell enormously. With the amounts of chlorine used in practice, a layer of jelly is formed between the scales and the unattacked core of the fibre. This jelly layer causes unshrinkability because it renders the scales incapable of causing the fibre-travel necessary for shrinkage. It is also responsible for the bad wearing properties of chlorinated wools; the jelly layer and its surrounding scales are easily removable by friction. Good wearing properties could be restored by any process which would cause the jelly layer to shrink and harden to the unattacked core of the fibre, but in order

to ensure unshrinkability sufficient chlorine must be used to cause the scales as well as part of the cortex to gelatinise. It was shown that mordanting chlorinated wools with chromium did restore good wearing properties. The search for a similar agent for undyed goods is being continued.

Cloths of the same structure, made from three different wools, were treated with varying amounts of chlorine and their milling shrinkages determined. In only one case was absolute unshrinkability attained, namely, with Oxford Down wool. Curves showing the relation between shrinkage and the percentage chlorine employed were given for both acid and soap milling. Analysis of the curves showed that the amount of chlorine required to produce absolute unshrinkability is a complex function of many variables:—the kind of wool and its fineness, the yarn structure and the cloth structure. It was further demonstrated that, while absolute unshrinkability is definitely attainable, the limiting factor is that of diffusion, i.e., the difficulty of ensuring even chlorination of all fibres.

An interesting discussion followed, in which Messrs. Rusby, Pickering, Atkin, King, and Dr. Lloyd took part.

The Yorkshire Section collaborated with the Society of Glass Technology to discuss "Silicate analysis" in a meeting held in the Applied Science Department of Sheffield University, on February 16. Members of the Sheffield Metallurgical Association, the Sheffield Section of the Institute of Metals, and the Sheffield Society of Engineers and Metallurgists also took part. Mr. Butterworth presided.

Mr. W. H. Withey, B.A., read a paper entitled "A critical survey of methods for the analysis of the simpler glasses." He pointed out that the glasses comprised in the scheme normally contained silica, iron oxide, alumina, manganese oxide, magnesia, soda and potash, with sulphate, chlorides, and sometimes the oxides of arsenic and antimony in small proportions. The soda-lime series of glasses was included, and lead glasses differed only in that they contained lead. Borosilicate glasses containing zinc and other glasses of more complex composition were excluded. Referring to the question of the limits of accuracy possible in glass analysis, the author pointed out that the adoption of any standard became naturally a matter for personal opinion and experience. It was not unreasonable to suppose, however, that the limits of accuracy for the major constituents were in the order of 0 ± 0.08 , calculated on the weight of the original material, and that the total for the best analyses should fall within the limits 99.75 to 100.20. Only two methods of decomposition of glass for analysis were now in common use, viz.: fusion with sodium carbonate, or a mixture of sodium carbonate with potassium carbonate, and decomposition with hydrofluoric acid and sulphuric acid, or, more rarely, ammonium fluoride and sulphuric acid. There was good evidence for condemning the use of potassium carbonate, and it was therefore not recommended for use in the most accurate analyses. In the determination of silica, the old practice of prolonged heating at 120°, or even higher, was now entirely discredited, and must be abandoned. The following precautions were necessary in the accurate estimation of

silica:—Fusion with not too large an excess of sodium carbonate; five to six times the weight of glass was ample. Solution in sufficient water so that on acidification granular silica was formed; evaporation to dryness and heating on the water bath or in the oven not exceeding 110° for a comparatively short period (half to one hour); solution in dilute hydrochloric acid, followed by filtration and washing with cold water; sufficient "blasting" of the silica; treatment of residue with hydrofluoric acid and sulphuric acid to determine impurities, followed by "blasting" and re-weighing of crucible; addition of silica from alumina precipitate, and deduction of any silica from re-agents and correction for loss of weight of crucible. Two evaporations were sufficient for any but the most accurate work. In the determination of iron and alumina, only two methods were in common use, viz.: separation as basic acetate of iron and alumina, and precipitation by means of ammonium hydroxide, but neither of these two methods was entirely satisfactory. Difficulty arose from the presence of manganese from which alumina and iron were separated by ammonia with some difficulty. The estimation of silica and alumina presented the greatest pitfalls for the analyst.

In the course of a brief discussion which followed, Captain Wood enquired if it was assumed that all the residue after treatment with hydrofluoric acid consisted of alumina only, and Mr. Withey, in reply, said that quite frequently a small quantity of calcium was left.

Miss Violet Dumbleby, M.Sc., asked if Mr. Withey had any figures which showed the relative value of evaporations conducted in platinum and in porcelain vessels, and if there was any marked difference. Mr. Withey replied that his experience was that it was extremely difficult to obtain a perfectly clean platinum basin for use, and difficult to see when all precipitate was removed from platinum.

Miss Violet Dumbleby read a paper, "Notes on methods used in the analysis of glasses," in the course of which she said that it was her experience that manganese was best precipitated by bromine, whilst for the determination of alkalis she thought the Lawrence Smith method was the best. She expressed the hope that manufacturers would not take to putting titania and zirconia into glasses in very great quantities. They caused the analyst a very, very great deal of trouble; indeed, more trouble than any other oxides. If manufacturers put them into glasses she hoped at least they would not send the glass for analysis.

In a brief discussion which followed one speaker suggested that in the future analysts would find considerable difficulty with beryllium oxide in glass. It would be much worse to deal with than titania. Miss Dumbleby expressed the hope that the day was very far distant when they would encounter beryllium in glass. She appreciated that the difficulties would be very real if the eventuality mentioned occurred.

"The analysis of refractories" was discussed by Mr. W. J. Rees, B.Sc. Tech.—With most refractories the finest grinding of the sample before fusion was necessary, whilst for a glass an exceedingly fine division was not absolutely necessary. For fireclays containing 3% or more of iron oxide and titania, it was undesirable to heat the evaporated fusion at a temperature higher

than 105° C. He found that above 105° there was an increase in the contamination of the silica. He contented himself with evaporating on a water bath. He cordially seconded Mr. Withey's recommendation of the use of methyl red as an indicator: it was very useful when the materials contained large proportions of lime and magnesia. Reference was then made to the analysis of magnesite bricks, basic dolomites, sillimanite, chrome refractories, and silica bricks. Sillimanite gave trouble in analysis unless care was taken in the fusion. For the determination of alkalis in fireclays the author relied on the Lawrence Smith method. He expressed his great interest in a suggestion made by Dr. W. Rosenhain to use superheated water for the first breakdown of the original material. He (Mr. Rees) had tried the method in a small way, without getting very good results. The method, however, was worthy of further investigation.

A paper entitled "Notes on the analysis of silicate slags" was read by Mr. T. P. Colclough, M.Sc., B.Met.—A close knowledge of the compositions of the slags formed in metallurgical processes was of fundamental importance, and methods for their rapid and reasonably accurate analysis were necessary. A table was given showing typical analyses of various kinds of slags, from which it was seen that the slags were generally much less siliceous than glasses. Methods were then indicated for the determinations of silica, iron oxide, alumina, phosphate, manganese oxide, lime, magnesia, sulphur, and vanadic oxide. In addition to the more precise methods indicated, it was necessary, for the control of commercial processes, to be able to make analyses of slags for certain constituents with sufficient rapidity and accuracy to be a guide to the person operating the plant. In each of the separate operations in iron and steel making at least one constituent of the slag was of vital importance in either the control of the operation or the manner of disposal of the material produced, and a method for the determination of that constituent must be available.

CALENDAR OF FORTHCOMING EVENTS

- Mar. 4. SOCIETY OF CHEMICAL INDUSTRY. *Joint Meeting of the Manchester and Liverpool Sections*, to be held in the Textile Institute, 16, St. Mary's Parsonage, Manchester, at 7.30 p.m. Visit to the Shirley Institute of the British Cotton Industry Research Association, Didsbury, Manchester, will precede the meeting. A paper will be read later on "Chemical control in the cotton bleaching industry," by D. Clibbens.
- Mar. 7. CERAMIC SOCIETY, North Staffordshire Technical College, Stoke-on-Trent, at 7.30 p.m. "Refractories for the pottery industry. Part 2, saggers, setters, cranks, etc.," by W. Emery.
- Mar. 7. SOCIETY OF CHEMICAL INDUSTRY, *London Section*. Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. "Recent progress in the glass industry," by Prof. W. E. S. Turner.
- Mar. 7. GLASGOW UNIVERSITY ALCHEMISTS' CLUB. Annual General Business Meeting, at 7.30 p.m.
- Mar. 7. INSTITUTION OF THE RUBBER INDUSTRY, *London and District Section*. Engineers' Club, Coventry Street, W.1, at 8 p.m. "Some electrical properties of rubber," by P. Dunsheath.

- Mar. 7. **INSTITUTE OF CHEMISTRY, Manchester and District Section.** "Plant chemistry," by Prof. E. C. C. Baly.
- Mar. 8. **INSTITUTION OF PETROLEUM TECHNOLOGISTS.** Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m. "Two shallow oilfields in Texas," by Dr. A. Wade.
- Mar. 8. **SOCIETY OF CHEMICAL INDUSTRY, Birmingham and Midland Section.** Annual Meeting. University Buildings, Edmund Street, Birmingham, at 7.30 p.m. "The commercial synthetic resins and their products," by H. W. Rowell. "The chemical oxidation of the constituents of sewage: The action of hydrogen peroxide," and "Studies on the dissolved oxygen absorption test," by E. A. Cooper and W. H. Read.
- Mar. 8. **MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY,** 36, George Street, Manchester, at 5.30 p.m. "A new method of electro-conductivity titration," by E. Butterworth. "Some results obtained with a new atmospheric deposit recorder," by J. R. Ashworth.
- Mar. 9 and 10. **INSTITUTE OF METALS.** Annual General Meeting (For particulars see CHEM. & IND., 1927, p. 106.)
- Mar. 9. **ROYAL SOCIETY OF ARTS,** John Street, Adelphi, W.C.2, at 8 p.m. (Ordinary Meeting.) "The utilisation of gas coke," by Dr. E. W. Smith.
- Mar. 9, 10 and 11. **INSTITUTION OF CHEMICAL ENGINEERS.** Conference and Fifth Annual Corporate Meeting and Annual Dinner. (For further particulars, see the issue for Feb. 18, p. 151).
- Mar. 9. **UNIVERSITY OF LONDON,** University College Gower Street, W.C.1, at 5.30 p.m. "Photography of documents: Object and methods," by Sir W. Schooling.
- Mar. 10. **OIL AND COLOUR CHEMISTS' ASSOCIATION.** Rooms of the National Federation of Paint Manufacturers, 8, St. Martin's Place, Trafalgar Square, London, W.C.2, at 8 p.m. "Recent research on the protection of steel with paint," by Dr. J. A. Newton Friend.
- Mar. 10. **INSTITUTION OF THE RUBBER INDUSTRY, Manchester and District Section.** Textile Institute, 16, St. Mary's Parsonage, Manchester, at 7.30 p.m. "Difficulties of rubber-proofed garment manufacture," by Major N. Blond.
- Mar. 10. **OPTICAL SOCIETY.** Ordinary Meeting. Imperial College of Science and Technology, South Kensington, S.W., at 7.30 p.m.
- Mar. 11. **INSTITUTE OF METALS,** Swansea Local Section. University College, Singleton Park, Swansea, at 7.15 p.m. "The influence of oxygen on copper and other non-ferrous metals," by F. Johnson.
- Mar. 11. **WEST OF SCOTLAND IRON AND STEEL INSTITUTE.** "Sintering of iron ores, Giessecke Process," by C. P. de Buch.
- Mar. 16. **SOCIETY OF CHEMICAL INDUSTRY, South Wales Section.** Technical College, Mount Pleasant, Swansea. "Further notes on pure chemicals," by E. A. Tyler.
- Mar. 16. **SOCIETY OF CHEMICAL INDUSTRY, Liverpool Section.** Annual Section Meeting. "Biochemical aspects of the nature of life," by Prof. J. C. Drummond. (Not on March 18.)

INSTITUTION OF CHEMICAL ENGINEERS

Members Elected February 9, 1927

Members

- Cornelius Philip Finn, B.Sc., F.I.C., Manager, Washeries and Coke Oven Departments, also Brickworks Department of Manvers Main Collieries, Ltd.
- John William Mitchley, M.I.Mech.E., Chemical Engineer and Gas Engineer to Blair, Campbell & McLean, Ltd., Govan.
- Frank Sturdy Sinnatt, M.Sc. (Tech.), F.I.C., Assistant Director of Fuel Research, Department of Scientific and Industrial Research.
- John Dawson Troup, M.I.Mech.E., Editor, "Engineering & Boiler House Review."

Associate-Members

- Clifford Ernest Brooks, Engineer and Draughtsman, United Alkali Co., Ltd.
- Thomas Haworth, Chemist and Assistant Gas Engineer, Oswaldtwistle U.D.C. Gasworks, Church.
- William Hall Simmons, F.I.C., Joint Manager of Plant Dept., Trost Bros., London.
- Alan Speedy, Chemical Engineer to A. G. Spalding & Bros., Ltd., London.
- Francis Colin Sutton, Joint Manager of Plant Dept., Trost Bros., London.
- Douglas Robinson Wattleworth, Assistant Manager, Coke, By-Product and Tar Distillation Works, Harrington Coke Ovens, Ltd.

GLASGOW UNIVERSITY ALCHEMISTS' CLUB

Dr. T. S. Stevens presided over the meeting on February 23, when an address on "Problems of chemotherapy" was delivered by Prof. C. H. Browning.

Chemotherapy, it was explained, was the treatment of infective disease by substances of known chemical constitution in order to destroy the causal agent in the body. The reaction of a drug with the serum of the body had always to be considered, and although a particular compound might be efficient in controlling the growth of one organism, the efficiency might not be general. The work of Koch, Ehrlich and Morgenroth was reviewed, and the progress made with the use of basic dyestuffs was commented upon. The time factor—the so-called "bacteriostatic reaction" of organic antiseptics—was frequently overlooked in evaluating the efficiency of a drug. Under cultural conditions it might prove slow in action, but when administered to the living body the virulence of the causal organisms might be so reduced that the body itself would control the disease. The effect upon bactericidal properties of modifying the chemical constitution of some of the acriflavine substances was shown, and the recent results obtained by the use of metallic salts were given. The outlook was hopeful that substances would be prepared which would prove as successful in the control of diseases of bacterial origin as had been obtained in the case of those due to trypanosomes.

BRITISH ASSOCIATION OF CHEMISTS

The annual dinner of the London Section took place at the Engineers' Club on February 19. Prof. G. T. Morgan, president of the Association, was in the chair.

In his opening speech Prof. Morgan alluded to the necessary place filled by the Association among societies of chemists. He pointed out that the Association was registered as a trade union, not because it desired to employ the strike weapon, but because a seat upon industrial councils could not be held by organisations which did not definitely represent either employer or employed. The Association's work was complementary to that of the Institute of Chemistry. In certain directions the combined efforts of the Association and of the Institute of Chemistry were directed towards the same end—as, for example, in the matter of the title chemist. Too many students drifted into chemistry without a true vocation for it, a circumstance which was overcrowding the profession, and indirectly harming it in other ways. Too often the reply to a question regarding future academic studies came automatically: chemistry, physics and mathematics. This, he felt, was due to the great preference given to the subjects in school curriculums. If more attention were paid a little earlier to other branches, the students would have more to choose from, and a greater freedom in their choice. But in spite of disadvantages chemists were better off than they were thirty years ago, and this was due largely to efforts of such societies as the Institute of Chemistry and the British Association of Chemists, who were doing a great deal to raise the status of the profession.

In proposing the toast of "The London Section," Mr. Hy. T. F. Rhodes (General Secretary) indicated what important work the chemist did for the community, and said the Association had grown up with the chemist's realisation of his duty to the community, and it sought to obtain public recognition for the profession.

Mr. S. R. Price, chairman of the Council, in his reply, summarised the lines upon which the Association had been working. He pointed out that with such a big programme a great deal of hard work was necessary.

Dr. Paul Haas proposed the toast of "Kindred Societies," and Mr. James Stewart, chairman of the London Section of the Institute of Brewing, said in his reply that chemistry was becoming more and more important in its application to industry. He had been struck while abroad with the attention which was being paid to the cultivation of grain, and to agricultural research. The chemist took a great part in that and the results obtained were most remarkable. Again, in this country a great deal more attention was being paid to research, and there was no question at all that money spent on research was well spent. The chemist was coming into his own, and as he deserved, his status was improving. Mr. E. Hinks also replied to the toast of "Kindred Societies" on behalf of the Society of Public Analysts.

Miss W. Wright responded to the toast of "The Ladies," which was proposed by Mr. A. J. C. Cosbie.

PHYSICAL SOCIETY

At the Annual General Meeting on February 11, the Council for the year 1927—28 was elected as follows: President, Prof. O. W. Richardson; Secretaries, A. O.

Rankine and J. Guild; Treasurer, R. S. Whipple; Ordinary Members, R. W. Paul, A. M. Tyndall, T. Smith, A. Ferguson, J. S. G. Thomas, D. W. Dye, Sir Richard Paget, E. N. da C. Andrade, E. Griffiths, and A. B. Wood.

The fourth Duddell Medal was awarded to Mr. F. Twyman, F.R.S., technical and managing director of Messrs. Adam Hilger, Ltd.

In his presidential address, Prof. O. W. Richardson reviewed "The present position of atomic physics." It was, a few years ago, anticipated that the discovery of the electron, Planck's laws of thermal radiation and Bohr's scheme of spectra, had finally stabilised the position of atomic physics. In recent years, however, a number of experimental facts which do not fit into this framework of ideas have been discovered. The principal of these are: (1) Whereas Bohr's scheme contemplates the specification of spectra in terms of quantum numbers which are *whole* numbers, the analysis of some spectra, more especially band spectra, necessitates the introduction of fractional quantum numbers, e.g. $\frac{1}{2}$. (2) Anomalies have been found in the analysis of the complex Zeeman effect exhibited by complex lines subjected to a weak magnetic field. These anomalies cannot be reconciled with the theory of the effect based upon the postulation of 3 quantum numbers. (3) The experimental fact that the mean free paths of argon atoms become extremely *long* when the atomic velocities become *small* cannot be easily reconciled with the theory. (4) There is a contradiction in the properties of radiation discussed in terms of the classical and quantum theories. (5) It is difficult to perceive how in the light of current theory the atoms maintain their respective identities. (6) The structures of atomic helium and hydrogen cannot be definitely assigned. (7) Anomalies have been discovered in (a) magnetic characteristics of the elements; (b) the excitation of soft X-rays; and (c) the reflection of electrons by atoms. In order to resolve some of the difficulties Bohr postulated his Correspondence Principle, which in essence reduces to the assumption that atomic or high-frequency phenomena are governed by the laws of the quantum theory whilst low-frequency phenomena are controlled by the classical theory. This transition from classical dynamical theory to quantum theory cannot be regarded as satisfactory, and nowadays has been replaced by the newer mechanics devised separately by Heisenberg and Dirac. Alternatively the attempt to resolve the difficulties of present-day atomic physics is made along the lines of wave mechanics developed by Schrödinger and by L. de Broglie, which is ultimately based upon work done by Hamilton 100 years ago, in which he directed attention to the use of optical theory in solving the problems of mechanics. de Broglie assumes that just as the corpuscular theory of light breaks down when the physical dimensions involved are comparable with the dimensions of the "waves," so the laws of gross mechanics break down when applied to atomic systems. The mathematical development of the theory is difficult, but bears some resemblance to that characterising classical dynamical theory and has succeeded in eliminating most of the difficulties referred to above.

INSTITUTION OF CIVIL ENGINEERS

At the meeting on February 8, a paper entitled "Applications of power on gasworks" was presented by Mr. H. C. Smith, A.M.I.C.E.

After a brief mention of the uses of pneumatic, hydraulic, and gas power, the applications of steam on a gasworks with an output of more than 15 million therms per annum were detailed. In manufacturing this gas approximately 148,000 tons of coal and 2,700,000 gal. of gas oil are used; 87,000 tons of coke and breeze are obtained as a by-product, of which 18,500 tons of coke are used for the manufacture of water-gas and 8600 tons of coke and 26,700 tons of breeze as boiler fuel. The steam generated on an average day is shown to be at the rate of 44,110 lb. per hour from and at 212° F., or 16,718 h.p. The cost of generation, exclusive of capital charges, but including fuel, labour, water, repairs, and maintenance was shown to be 11.3d. per 1000 lb. of steam, or 25.3d. per ton. The quantity of steam generated is allocated in the following manner to the various pieces of plant and machinery for which it is used:—

	Lb. per hour from and at 212° F.
Carburetted water-gas	3,458
Steaming vertical retorts	1,581
Generating electricity	4,022
General power purposes	33,105
Boiler grates, ejectors, etc.	1,944
	<hr/> 44,110

From a balance drawn up between the steam generated and the h.p.-hr. output obtained by its use, an efficiency of transmission of energy from heat in steam to b.h.p.-hr. was shown to be 3.5%. This low efficiency is due to the fact that steam is used in a large variety of scattered units, the majority of which have been in use for several years and are working under non-condensing conditions.

The savings in labour to be effected by linking up the whole of the boiler plant and by converting certain of the hand-fired boilers to mechanical stoking was shown to be £790 per annum on a capital outlay of £1810. This saving is in addition to any saving in fuel due to the levelling up of the load and to the increase in the proportion of steam made on mechanically-operated boilers and waste-heat boilers.

The generation and use of electrical power on a gasworks was dealt with. The efficiency of the generation of electricity from heat in steam supplied to engines to heat in electricity generated was shown to be 10.1%, the efficiency of the generation and transmission of electricity from heat in steam supplied to engines to brake horse-power developed on works motors being 6.1%, which is comparable with the efficiency of 3.5% given for the use of steam power.

Of the 16,718 h.p. of steam generated, 2647 h.p. is used for gas-making and purposes other than power, and 14,071 h.p. for power purposes. Of the latter,

1524 h.p. is converted into electrical energy, giving 147.8 h.p. of electricity.

The author suggested that in designing a new gasworks of a similar size to the one under review power would be most economically produced and applied as electricity. This could be generated by steam at a central station, the bulk of the steam being produced by waste-heat boilers. Instead of steam being used in small units at scattered points, it would then all be used at one point, the exhausts of engines using it discharging into suitable condensing plant.

Assuming that the mean total power required on a new works would be the same as on the existing works, 494.0 b.h.p. would be required on an average day. If this were applied as electricity with an efficiency from steam to motor of 6.1%, it would be necessary to generate only 8098 h.p. of steam instead of 14,071 h.p. as at present. A plant capable of generating 818 h.p. or 610 kw. would be required.

With this plant a higher efficiency should be obtained than on the 150-kw. plant now in use, and assuming this to be 14%, the steam required would be only 5843 h.p. The saving in steam would amount to 233 tons per diem, which at 25.3d. per ton gives a saving of £8963 per annum.

If only 5843 h.p. of steam were required instead of 14,071 h.p. as at present, it is shown that it would be possible to make 83% of the steam required on the works for gas-making and power purposes (apart from that necessary for the working up of by-products) on waste-heat boilers under average day conditions. Under existing conditions it would only be possible to make 42.1% of the steam required from the waste heat of the various carbonising processes.

The works produce 3000 million cb. ft. of gas per annum, having a calorific value of 500 B.Th.U. per cb. ft. Of this production 25% is water-gas. To make this gas 148,000 tons of coal are required. From each ton of coal carbonised 950 lb. of steam from and at 212° F. can be raised by waste-heat boilers. This equals 385,000 lb. per diem. A quantity of 30 lb. of steam per 1000 cb. ft. of carburetted water-gas, which equals 61,000 lb. per diem, can also be raised. Therefore the total steam available from waste heat is 446,000 lb. per diem. The requirements under present conditions = $44,100 \times 24 = 1,058,640$ lb. per diem. Therefore the percentage that can be raised from waste heat = 42.1%.

Assuming that the whole of the power requirements were supplied as electricity generated at an efficiency of 14%, the requirements for power would be $5843 \times 24/0.379 = 370,000$ lb. of steam per 24 hr. In addition, 167,600 lb. are required for gas-making and other purposes, making a total of 537,600 lb. Under these conditions 83% of the total requirements could be met by waste heat.

MERGER IN THE GERMAN ALCOHOL INDUSTRY

A merger of 10 of the chief German yeast and alcohol plants is reported from Berlin. The new company will pool processes and effect economy in production, lower prices being anticipated.

CORRESPONDENCE

THE TESTING OF DISINFECTANTS

SIR,—I feel obliged to Messrs. S. and E. K. Rideal and A. Seiver for their letter in your issue of Feb. 18, since it definitely establishes p_H 7.6 as the reaction value of Rideal-Walker broth. The main purpose in writing my paper was to draw attention to the effect of differences in the reaction of the broth and to show the necessity for fixing the reaction at some definite value, but I do not think that the wording of my paper can be interpreted as making a positive recommendation for a reduction of the p_H value to 7.0.

I favour the new method of standardising the broth as outlined in their letter, particularly if the titration is conducted with the aid of a comparator and the colour of the indicator is controlled by a standard buffer solution. It may be noted, however, that this method of standardising the broth to p_H 7.6, by direct neutralisation to phenolphthalein, differs from the published technique by omitting the after addition of 1.5% normal hydrochloric acid; this alteration may be responsible, in part, for the discrepancies in the reported results of different operators.

Yours faithfully,

QUINTIN MOORE, JUNR.

SIR,—To those interested in the above subject, the authoritative views of Dr. Rideal and his co-workers, as reported in your issue of Feb. 18, would be very welcome. Now that Dr. Rideal has stated definitely that the reaction of Rideal-Walker broth is p_H 7.6, it is to be hoped that this fact will be included in the next issue of the "Approved Technique."

While this subject is under discussion, it would be interesting to know if investigations have been made as to the effect of variations in the composition and reaction of the agar culture medium. No particulars regarding its preparation are given in the "Approved Technique," and, in view of the remarkable effect on the coefficient shown by Mr. Moore's tests to be caused by variations in the broth, it seems desirable to enquire what, if any, alteration is caused by the use of varying agar media. Even if the resistance to disinfectants of two cultures grown on different agar media is slight, it seems justifiable to assume that the divergence in properties of the two cultures would increase from month to month.

Would it not be advisable to include in the "Approved Technique" a recipe for the preparation of the agar medium; or, perhaps better, stipulate that a fresh agar culture be obtained monthly from the Lister Institute, thus ensuring that all investigators are working with the same culture on any given date?

Yours faithfully,

JAS. GIBSON

PERSONAL AND OTHER ITEMS

Mr. R. E. Palmer, who is the consulting engineer in London to the Rio Tinto Company, has been nominated president of the Institution of Mining and Metallurgy. The nomination is highly appropriate, as Mr. Palmer is a Canadian by birth, and the second Empire and Metallurgical Congress will be held in Canada during his year of office.

Mr. G. M. Nave, B.Sc., assistant chemist in the Engineer's Department of the Newcastle-upon-Tyne & Gateshead Gas Co., has secured an appointment with the Northern Coke Research Committee at Armstrong College, Newcastle-upon-Tyne.

Mr. E. D. Theband, president of the Niagara Frontier Laboratory and at one time chief chemist to the Carborundum Company, has died at Buffalo, aged 54 years.

We regret to learn of the death of Major J. M. Gibson, manager of the Buckley Brick and Tile Company, and responsible for the development of the well-known acid-resistant Buckley clay products. Major Gibson was one of the original members of the Society of Chemical Industry and was an indefatigable worker in the public interest.

With great regret we announce the death of Dr. Luigi Casale, the inventor of the Casale process for the manufacture of synthetic ammonia, at the early age of 45 years. An obituary notice will appear in our next issue.

The death is announced of Dr. Otto Schönherr, known in technical circles in Germany as "Salpetersäure-Schönherr," on account of his arc-process for the fixation of atmospheric nitrogen. Some Schönherr furnaces are in operation in Norway and Germany.

An Imperial Agricultural Research Conference, at which delegates from the various parts of the Empire will be present, is to be held in London, beginning on October 4. The organising committee appointed by the Ministry of Agriculture has already met under the chairmanship of Lord Bledisloe. The Empire Marketing Board is financing the Conference.

The late Mr. T. D. Cooper, managing director and chairman of the Val de Travers Asphalte Co., Ltd., left £7457 with net personalty £6245.

The first congress of the International Association of Soil Science will meet in Washington, D.C., on June 13. Titles of papers to be presented should be sent to Dr. J. G. Lipman, New Brunswick, New Jersey, U.S.A. The conference will include visits, and exhibits relating to soil science, as well as the discussion of papers.

British Industries Fair

The King and Queen visited the Fair on Friday February 25, and stayed for two hours. Their Majesties showed much interest in the exhibit of the Imperial Institute, which includes specimens of plant and animal products and minerals from different parts of the Empire. Of special interest were the exhibits of oilseeds, shea butter, cascara bark, and the samples of Transvaal platinum ores, the examples illustrating the uses of nickel, chromium, and cobalt alloy steels and the interesting exhibit showing the many uses of aluminium.

In the Chemical Section, the King was interested, at the stand of Albright & Wilson, in their "Silicon ester" which is used for preserving and restoring buildings, striking illustrations being given by restorations of pieces of stonework. A recent development is the use of "Silicon ester" as a medium for painting frescoes and other forms of the painter's art.

So far the number of buyers from countries abroad has been much greater than at last year's Fair, an increase of over 60% being recorded for one day. During one day alone over 6000 buyers visited the Fair.

Research in the Paint, Colour and Varnish Industries

A brochure bearing the title "Research," which has been issued by the newly formed Research Association of British Paint, Colour and Varnish Manufacturers, should interest all those engaged in the paint, colour, varnish and related industries, who have not yet become members of the Association. The brochure points out that the industry has emerged but recently from centuries of stagnation into a whirlwind of discoveries and inventions, and in making a powerful plea for research, observes that only the best can be expected when not art alone, but science and art together lead the way. The imposing list of problems in paint, varnish and colour technology that require solution which is given, should convince the most doubtful of the need for research. The Association's address is 8, St. Martin's Place, London, W.C.2, and its Research Station and Laboratories are in Waldegrave Road, Teddington, Middlesex. A strong Technical Advisory Committee is engaged in drawing up the programme of research.

Conference of French and British Industrialists

Following on the recent conference between German and British industrialists, the Federation of British Industries has arranged a similar meeting between French and British representatives of industry. The French delegates include M. Duchemm, president of the General Confederation of French Production and of the Union of Chemical Industries, M. de Peyerimhoff, the head of the coal-producers' organisation, M. T. Laurent, of the "Compagnie des Forges et Aciéries de la Marine et d'Homécourt," M. Fougère, M. J. le Blau, M. C. Dufour, president of the Federation of the Syndicates of Light Metal Industries, M. Gounod, vice-president of the Union of Chemical Industries, M. L. Ribot and M. Roche, president of the Syndicate of Special Chemical Industries. The British representatives include Sir Max Muspratt, Sir Peter Rylands, Mr. (Clive) Cookson, Mr. F. C. Fairholme, and Mr. W. H. Lee. The subjects include the economic and fiscal treatment of nationals and companies of one country admitted to settle in the territory of another, the organisation of production, including, in particular, international agreements, the collection and exchange of statistics relating to production, customs questions, and so on. There will be also a discussion on the question of whether trade fairs and exhibitions should not be limited—whether the value of exhibitions to industry has now become less important than it was shortly after the war.

Canadian Hydro-Electric Developments in 1926

The Dominion Water Power and Reclamation Service has prepared a Bulletin giving a review of hydro-electric and water power development in Canada during 1926, which shows that year to have been one of widespread activity in this important industry. Approximately 266,000 h.p. was added during the year, bringing the total installation in the Dominion to 4,556,000 h.p.

The most important work of the year was that accomplished by the Gatineau Power Co. in Quebec, in the virtual completion of two plants on the Gatineau River, and the initiation of construction on a third, these three plants having a total designed capacity of 530,000 h.p.

Whilst the figure of actual installation is substantial it falls short of indicating the magnitude of constructional activity during the year. Projects are under way, a number being near completion, which will ultimately add to the Dominion's total more than 1,700,000 h.p., whilst others in active prospect promise a further addition in excess of 1,000,000 h.p.

Canadian Coal Output

Canadian coal mines produced 18% more coal in 1926 than in 1925 according to production figures now available. In 1926 the output was 16,105,000 tons compared with 13,134,968 tons in the previous year. The 1926 production was distributed as follows: Nova Scotia, 6,810,000 tons; Alberta, 6,117,000 tons; British Columbia, 2,634,000 tons; Saskatchewan, 376,000 tons; New Brunswick, 168,000 tons.

During 1926 Canada's total importation of coal amounted to 17,520,000 tons, and her total exportation was about 900,000 tons. Of the total imports 17,120,000 tons came from the United States, and the remaining 400,000 tons from Great Britain, Germany and the Netherlands. Total coal made available for consumption during the year, according to the Dominion Bureau of Statistics, was 32,725,000 tons.

Mining in South Africa

The mineral production of the Union during 1926 exceeded £58,500,000 in value, thus establishing a record. The chief features of the past year were the arrival of platinum as an important factor, the increase in diamond production, the revival of corundum exportation, and the activity in asbestos mining. The production of chrome ore declined, and lead-mining has proved a further disappointment. An American company which controls the extensive manganese deposit at Postmasburg is to examine the deposit with a view to future development. (*Min. Mag.*, February, 1927.)

Motalin

The name under which anti-knock motor fuel is being marketed in Germany is "motalin," which consists of benzol containing 0.2 to 0.25% of iron carbonyl. The iron carbonyl is supplied for further dilution in the form of a 50% dilution in benzol. (*Z. für Gewerbehyg.*, 3, 203).

German Chemical Industry

The nominal capital of the A.-G. für Chemische Produkte H. Scheidemandel has been reduced from 25 million to 10 million marks.

Chemical Developments in France

The Etablissements Kuhlmann has decided to offer in Switzerland an issue of 15,000,000 Swiss francs, in 1000 fr. shares bearing 7% interest, to provide funds to carry out a big scheme for the manufacture of synthetic ammonia and for the development of the firm's phosphorus-nitrogen fertilisers in France and Belgium, in conjunction with various coal and coke producers.

REVIEWS

INTRODUCTION TO PHYSICAL CHEMISTRY. By F. B. FINTER, M.A. Pp. xvi + 276. London: Longmans, Green & Co., Ltd., 1926. Price 6s.

This book has been written with the object of supplementing the chemistry text-books which are commonly used by candidates for the Higher School Certificate and University scholarship examinations. It covers the ground which is commonly associated with physical chemistry in an introductory and interesting way, giving some idea of the problems which are conventionally relegated to the more advanced study of general chemistry. The author sets out to write attractively, and in doing so makes frequent use of analogies, some of which are distinctly good and likely to impress the student. The book will undoubtedly make a strong appeal to the type of student whose capacity for appreciating scientific principles seems to be enlivened by the humorous touch, although it must be admitted that the text is somewhat scrappy and the information much condensed. There are some statements which, whilst not absolutely inaccurate, are distinctly unfortunate and some of the illustrations are not well chosen. The action of sunlight in causing hydrogen and chlorine to combine is cited not very appropriately as an instance of the conversion of light energy into chemical energy. Whilst there is a very interesting account of indicators and their use, the treatment of catalysis is exceptionally poor. The book as a whole has, nevertheless, distinct merit and can be recommended warmly to first-year University students who are not specialising in the subject.

H. M. DAWSON

POTASH: A REVIEW, ESTIMATE AND FORECAST. By J. W. TURRENTINE, Ph.D. Pp. ix + 188. New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1926. Price: 15s.

This is a book with a purpose, written entirely from one point of view, which is frankly stated in the preface. It is not a full and unbiassed account of the sources of the world's potash, or of the potash industry, but an account of the sources from which potash may be obtained in the United States, with an estimate, often very optimistic, of the amount of potash which could be obtained from each source, and a forecast of what might be done to render the United States independent of all external, and especially German, sources of potash. The leading theme of the book is stated in the very first sentence, "The ambition and determination to render America independent of foreign countries in respect to her potash supplies resulted immediately upon the realization of that dependence."

Before the war the United States tried to develop its potash resources in the hope of making itself independent of Germany, but under the stimulus of the potash scarcity brought about by the war, the energy with which the U.S. Department of Agriculture and many private firms and individuals set themselves to solve the potash problem was redoubled. An immense amount of pioneering was done in various directions, and in some cases a considerable amount of potash was

produced. All the likely natural sources of potash in brines, salt lakes, and geographical strata were explored, and at the same time the use of seaweed on the large scale was tried, and all manner of by-products from other industries were examined and their value as possible sources of potash considered. In all this work the Bureau of Soils of the U.S. Department of Agriculture took the leading part, and Dr. Turrentine is the official of that Bureau who was in charge of potash investigations. He proposes in this book to put on record for the information and guidance of the future "the relatively enormous amount of work done both by Governmental and private agencies on the technology of extracting potash from the American raw materials." . . . "Only in this way, now that the actual commercial production of potash from most of these sources had been abandoned, can the great expenditure of skill, energy and materials in war-time potash production be made to yield profit for future years."

The first section of the book is a short one, and deals with "Former sources of potash." Like the rest of the book, the point of view is entirely American, and the copious tables given refer only to potash imported into the United States.

Another short section deals with "Foreign potash industries," and dismisses the German potash industry in a few pages, and then shortly refers one after another to French, Polish, Italian, Spanish, and Japanese potash. The Chile nitrate deposits as a possible source of potassium nitrate for the American market are also considered.

The whole of this section, which occupies 37 pages, might well have been omitted or greatly cut down and the space saved devoted to a fuller account of some of the work done in America on new sources of potash and on new processes. The section gives only a superficial account of European sources of potash, which is of little real value either to the expert or to the practical man.

Three-fourths of the book is devoted to the section called "The American potash industry," in which some account is given of the large number of investigations made, chiefly under the auspices of the Bureau with which Dr. Turrentine is connected, into American sources of potash, and of the efforts made to produce potash on a commercial scale in the United States. Much of this section makes interesting reading, but one has an unsatisfied feeling in many cases that more precise and extensive information might have been given as to the details of the investigations, as to the processes tried, and as to the success or otherwise which attended them. The treatment all through is very optimistic, and Dr. Turrentine is thoroughly convinced that, even in peace time, with industries properly organised and carried out on a sufficient scale, with due attention to the production of economic by-products, or to the production of the potash as a by-product from other successful industries, America can make herself independent of European potash, and produce all she requires not only for present conditions, but also for the future, in which great expansion of potash requirements is anticipated.

The sources of potash dealt with in this section are many and varied, and are divided into *kelp*—by which

an American writer means, not seaweed ash, but seaweed itself—surface brines, Continental deposits, silicates and other minerals, industrial wastes organic and inorganic, and subterranean deposits. As a rule, several different sources of potash or several different processes are considered under each of these headings. Thus, under silicates and other minerals, alunite, leucite, feldspar, greensand, and Georgia shales are all considered as sources of potash; and under kelp several different processes and kinds of plant are referred to, though, naturally, the work carried out by the Bureau of Soils receives most attention.

This is a book which was worth writing, and it might be worth the author's while to consider whether it should not be expanded in any future edition. Though, naturally, it is of interest and importance, especially to the fertiliser industry and to agricultural chemists in the United States, there is also much in it which is worth attention in this country. JAMES HENDRICK

LE PROBLÈME DES FERMENTATIONS—LES FAITS ET LES HYPOTHÈSES. By M. SCHOEN, with a preface by Dr. A. Fernbach. Monographs of the Pasteur Institute. Pp. 199. Paris: Masson et Cie, 1926. Price 21-60 fr.

"Le probleme des fermentations a ce privilege singulier de tenir sans cesse en éveil la curiosité des travailleurs de la science." These are the opening words of one of the most vivid scientific monographs we have had the pleasure to read for a long time, and right through the book the author holds the attention of his readers with his dramatic presentation of the "facts and hypotheses" which are combined in the present knowledge of fermentation. Between fact and hypothesis he makes a definite distinction, and the result is a very clear exposition of both.

The headings of the chapters will indicate the idea of the author. Based ultimately on the work of Pasteur, he develops and criticises the theories which have grown up in explanation of the chemical changes occurring in fermentation, showing the invalidity of the experimental basis of some, and clearly marshalling the facts which he believes to be sound. Opening with "Pasteur's theory of fermentation in the light of some new facts"—"The enzyme theory of fermentation," "The enzyme theory applied to bacterial fermentations," and "Alcoholic fermentation and intramolecular respiration," the author passes on to a consideration of the substances which have been regarded as intermediate stages in the conversion of sugar to alcohol. He deals first with "The role of lactic acid in the phenomena of fermentation," and then passes on to the newer views in regard to "The role of pyruvic acid, and of acetaldehyde in alcoholic fermentation,"

"The interpretation of the facts discovered," "The mechanism of bacterial fermentations," and, afterwards, "The bearing of the stereoisomerism of the hexoses on certain phenomena of fermentation," the "Part played by phosphates," and the "Bearing of the reaction of the fermenting medium."

It is understood that an English translation is likely to appear shortly.

PARLIAMENTARY NEWS

Russian Petrol and Kerosene

In reply to Sir Nicholas Gratten-Doyle, Sir P. Cunliffe-Lister stated that imports into the United Kingdom of motor spirit consigned from Russia were, in 1925, 33,111,263 gallons, and in 1926, 55,217,069 gallons. Imports of lamp oil during the same years were 15,796,350 gallons, and 37,494,534 gallons, respectively.—February 15.

Sugar-Beet Factories (Foreign Employees)

Mr. Guinness informed Sir F. Wise that the percentage of foreigners employed in the fourteen beet-sugar factories during the past manufacturing season was 2.3%.—February 23.

COMPANY NEWS

SYNTHETIC AMMONIA AND NITRATES, LTD.

The directors announce an increase in profits for the year 1926, which wipes out the debit balance and leaves a substantial sum to be carried to the credit of the new account. After charging £91,522 for depreciation, the profit was £137,990, compared with £103,647. After deducting the debit balance brought forward of £66,580, there remained £71,410, which it is proposed to carry forward. The daily output of the present plant has been increased from 50 to 65 tons of ammonia, and the sulphate plant has been extended to deal with the larger output. The plants for the manufacture of anhydrous liquid ammonia, ammonium nitrate and sodium nitrate had begun operating. The construction of the 165-ton unit, which has been delayed by the coal strike, will be completed towards the end of this year.

The company was formed in 1920 to undertake the fixation of atmospheric nitrogen and the manufacture of derivative nitrogen compounds. In 1925, additional funds were made available by the issue of £2,000,000 5% debenture stock, guaranteed under the Trade Facilities Act, the whole of the preference and ordinary shares, with the exception of the directors' holdings, being subscribed for by Brunner Mond and Co., so that the total authorised share and loan capital now amounts to £7,000,000.

SOUTH METROPOLITAN GAS CO.

The ordinary general meeting was held on February 23. Mr. Charles Carpenter, D.Sc., M.Inst.C.E. (the President), in the chair. He said that the results of the year's working were not disappointing, although the past year could not be described as a prosperous one. There were three informing tests of success applicable to any business—first, has it gained in volume; second, has it increased in customers; and third, what has it earned? As regards the first two points, the gas supply to South London is mainly a service based upon necessity rather than of luxury. Although theoretically it ought not therefore to be greatly influenced by enhanced prices, it was a fact that these invariably do check gas consumption, while by falling prices the use of gas is stimulated. As the result of the coal strike the company had to raise its charges during the second half of the year by an average of rather less than 15%. Then, too, there was the restriction in shop lighting. These two circumstances account fully for the fact that there was no

actual increase in the gas sold over the last year. But there was a substantial increase in the number of consumers, and in the quantity of appliances in use. The physical laboratory had been conducting some interesting investigations as to which were the best kinds of energy rays from a therapeutic point of view.

Referring to the two great strikes during the year, the chairman said he had often expressed his regret at the wastefulness arising from having to lay down large stocks of coal to provide against these outbursts of industrial unrest. Not only were large sums expended in re-handling the coal thus purchased, but it never produced such good results. When the strike occurred early last spring it soon became evident that even the provision of nearly 250,000 tons would not see the company through the difficulty, and about 800,000 tons of coal were purchased from America, the remainder of the company's requirements being made up from various parts of Europe. The American coal was very good, its freedom from ash showing the care with which it is mined or cleaned. Its yield of gas and tar was higher than that from our own North country coal, for which it formed an admirable substitute in the circumstances. Their gas consumers therefore obtained right through the strike the fullest value for every therm of gas they paid for. This was not less remarkable when it was remembered that the company had never used, except experimentally many years ago, water-gas as a supplement to their coal gas. They were not prejudiced in this matter, but it did not fit in so well to their conditions, and there was therefore no apparatus installed for its manufacture. They had been criticised in this respect, but they were conveniently placed on the Thames to carry on a good trade in coke with Continental customers, who take the surplus which might otherwise have to be used for gas making. During the stoppage the company was able to assist no less than 31 other gas undertakings with supplies of coke for conversion into gas in carburetted water-gas plants. Referring to ammonia and tar, the former had now fallen so low in value that its contribution to reducing the selling price of gas was exceedingly little. Tar, on the other hand, was "suffering" from a boom in price, resulting from the enormous shrinkage in production, brought about by the shutting down during the strike of the metallurgical coking ovens and the very general substitution of water gas for coal gas. Something of the same kind happened in 1920, when the high prices charged for coal tar resulted in an increased use of imported and artificial bitumen for road-making purposes. The company was not going to be a party again to so unsound a policy, and were quoting prices which would allow of the continued use of tar both for macadamising and briquetting. They depended so much upon their returns from tar that it was their duty to do all that they could to assist the stability of the industries using it, so that their customers might rely upon a constant supply at reasonable prices of the material on which they depend. When the price of pitch or creosote is raised beyond their economic value, every effort is made to replace them by substitutes, to the ultimate disadvantage of the company. Referring to the recent development of their co-partnership scheme, the chairman explained its advantages and said it was a

remarkable fact that, after thirty-six years of co-partnership the employees' desire was to strengthen rather than to loosen the bonds which bound capital and labour together in one united whole. The chairman then referred to the dividend, which it was hoped would have been greater, but the events of 1926 had been too much for them. As it was, £98,000 had been drawn from the fund specially authorised by Parliament to meet such contingencies.

A dividend was declared at the rate of 6% per annum. Mr. A. M. Paddon and Mr. F. McLeod were re-elected directors, and Mr. John H. Fry was elected auditor of the company in place of his brother, Mr. George Fry.

An extraordinary general meeting followed for the purpose of considering and approving an agreement made between the South Metropolitan Gas Company and the South Suburban Gas Company. The resolution was unanimously approved.

BORAX CONSOLIDATED, LTD.

The twenty-ninth ordinary general meeting was held on February 23, the Earl of Leven and Melville (chairman) presiding. He referred to the great loss the company had sustained by the death of Lord Chichester, who was its chairman for 12 years. Although the trading result showed a decrease on that of 1925 (£387,858, compared with £425,111), he thought shareholders would consider it as satisfactory, in view of the very serious depression of business in this country owing to the strikes. During its career, the company had had to meet competition, with which it had been able successfully to contend, owing to the favourable position and character of its properties. The competition which was referred to in the report, appeared to have been conducted on an uneconomic basis, and borax had been offered at prices which the directors had every reason to believe were not justified by the cost of production. They were confident that they would be able to meet this competition. The economical production of their raw material—borate ore and improvements in plant and processes, occupied the constant attention of the company's engineers and chemists, and the Board had reason to believe that recent developments which they had undertaken would show a substantial reduction of costs, and so offset the effect of lower prices for the finished products. The introduction of the new regulations on January 1 last, prohibiting the use of boric acid in practically all food products, would cause the company loss of business to a limited extent. The demand for borax and boric acid for industrial purposes was steadily progressing, and this, helped by the new uses which were being found for them, should soon compensate for any loss of business in this country resulting from the food regulations, and should provide for an enlarged business by the company in the near future. A final dividend was declared of 1s. 3d. per share, making 10% for the year. (For accounts, see CHEM. AND IND., February 18, 1927, p. 153.)

MATHER AND PLATT, LTD.

The report for 1926 shows a net profit of £251,636, against £260,885 for 1925. After placing £40,910 to income-tax reserve (same), the directors recommend maintaining the dividend and bonus at 10% and 5% respectively, free of tax, carrying forward £164,458.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

(Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.)

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammonic.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
 Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—2s. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 2d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Good demand. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£7—£10 per ton, according to grade and locality. Quiet.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—1s. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P. Both in good demand.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade. Better demand.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carbohc.—Crystals, 6d.—6½d. per lb. Crude 60's, 1s. 8d.—2s. per gal.
 Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 3d. per gal. Pale, 95% O.P., 1s. 10d.—2s. 2d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 2½d.—1s. 3½d. per gal., ex works in tank wagons; Standard motor, 1s. 11d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 2d.—2s. 6d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 11½d. to 2s. 3d. per gal. Firm. Pure, 2s. 2½d.—3s. per gal.
 Xylol.—2s. 3d.—3s. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal.
 Naphtha.—Crude, 9½d.—1s. 0½d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, 1s. 9d.—1s. 10d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—97s. 6d.—120s. per ton, f.o.b. according to district.
 Pyridine.—90/140.—9s. 6d.—13s. per gal. Nominal. 90/180.—7s. 6d. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4d.—2s. 5d. per lb. Bulk.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 3½d.—1s. 4½d. per lb. Less 5%. Better conditions.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 6d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 1½d. per lb. Less 5%. Firmer market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 3d.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.
 Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium.—1s. 10d.—1s. 11d. per lb. Sodium.—2s.—2s. 2d. per lb. All spot.
 Calcium Lactate.—1s. 4d.—1s. 5d. per lb.
 Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 1½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—6s. 6d.—7s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £33 per ton net.
 Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. not. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.
 Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig. 6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 11d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—15s.—15s. 3d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. 9d.—4s. per lb.
 Phenazone.—5s. 9d.—6s. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 90s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s. per lb. spot.
 Saccharin.—55s. per lb.
 Salol.—3s.—3s. 3d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—77s. 8d.—85s. per cwt. net, according to quantity.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal 1s. 10d.—1s. 11d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonal.—10s.—10s. 3d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s.—2s. 1d. per lb.
 Thymol, Puriss.—11s. 3d.—12s. 6d. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
 Aubepine (*ex Anethole*).—10s. 3d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. 9d. per lb.
 Citronellol.—15s. per lb.
 Citral.—9s. 6d. per lb.
 Ethyl Cinnamate.—10s. per lb.
 Ethyl Phthalate.—3s. 3d. per lb.
 Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb.
 Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol—(*ex Shui Oil*) 12s. per lb.—(*ex Bois de Rose*) 16s. per lb.
 Linalyl Acetate.—(*ex Shui Oil*) 14s. 6d. per lb.—(*ex Bois de Rose*) 18s. per lb.
 Methyl Anthranilate.—9s. per lb.
 Methyl Benzozate.—4s. 6d. per lb.
 Musk Ketone.—30s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—11s. per lb.
 Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpincol.—1s. 6d. per lb. Vanillin.—17s.—19s. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—11s. 3d. per lb.
 Camphor.—63s. 6d. per cwt. Cananga, Java, 20s. per lb. Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 20s. 9d. per lb. Lemon.—9s. 6d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb.
 Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 20s. 9d. per lb. Japanese, 8s. 6d. per lb. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Apr. 23rd. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Mar. 10th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Baier and Hammer. Grinding-mills. 4208. Feb. 15.
 Capra. Filter press. 4108. Feb. 14.
 Déo. Apparatus for combustion, drying, etc. 4341. Feb. 16. (Fr. 20.2.26.)
 Davis. Dyeing-machines. 4712. Feb. 19.
 Fritsch, Fritsch, and Fritsch & Co. Devices for mixing etc. liquids etc. 4134. Feb. 14.

Gewerkschaft Sachtleben and Klippers. 4641. See X.
 Jeremiassen. Crystallisation apparatus. 4151. Feb. 14.
 Johnson (I.-G. Farbenind.). Continuous evaporation etc. of difficultly distillable liquids. 4484. Feb. 17.
 Osman. Continuous kilns. 4681. Feb. 19.
 Prior, Riley, and Priorsells, Ltd. Apparatus for determining colour and density of liquids. 4273. Feb. 15.
 Scherbaum. Grinding-mill. 4220. Feb. 15. (Ger., 15.2.26.)

I.—Complete Specifications

28,176 (1925). Shaw and Pickard. Filtration. (265,674.)
 28,279 (1925). Metallbank und Metallurgische Ges. Reactivating adsorption media. (242,986.)
 3742 (1926). Marks (Grasselli Chemical Co.). Apparatus for drying and heating. (265,771.)
 15,046 (1926). Nestle & Anglo-Swiss Condensed Milk Co. Atomising and desiccating liquids or solutions. (265,840.)
 17,840 (1926). Fox and Fox. Filters. (265,856.)
 21,714 (1926). Svensson and Norling. Centrifugal treatment of liquids. (264,130.)
 24,360 (1926). Lacore and Piron. Rotary furnaces. (259,238.)
 24,669 (1926). Internat. Gen. Electric Co., Inc. Rotary hearth furnaces. (259,570.)
 *1492 (1927). Artner. Production of platinum contact bodies. (265,938.)
 *4229 (1927). Scherbaum. Grinding-mill. (266,009.)

II.—Applications

Allgem. Ges. f. Chem. Industrie. Continuous treatment of hydrocarbons. 4618. Feb. 18. (Ger., 1.11.26.)
 Asiatic Petroleum Co., and Vincent. Refining mineral lubricating oils. 4628. Feb. 18.
 Croad (Zieley Processes Corp.). Distillation of carbonaceous material. 4036. Feb. 14.
 Déo. 4341. See I.
 Herzberg. Producing gaseous mixture from pulverised coal. 4372. Feb. 16. (Ger., 19.2.26.)
 Lambert. Prevention of fire in gas scrubbers etc. 4251. Feb. 15.

Moeller. Treatment of peat. 4700. Feb. 19.
 Potts (Mineral A.-G. Brig). 4332. See IX.
 Salerni. Distillation of carbonaceous materials. 4499. Feb. 17.
 Still. Recovery of by-products in coke oven etc. plants. 4130. Feb. 14. (Ger., 15.2.26.)
 Travers. Apparatus for low-temperature distillation of coal etc. 4217. Feb. 15.

II.—Complete Specifications

22,657 (1925). Copley. Manufacture of gas. (240,440.)
 29,884 (1925). Wilhelm. Working-up acid resins into neutral bitumens. (254,674.)
 30,610 (1925). Deutsche Erdöl A.-G. Conversion of heavy into lighter hydrocarbons. (244,107.)
 3882 (1926). Chavanne. Gasification of solid fuels. (247,571.)
 14,069 (1926). Bataafsche Petroleum Maatsch., and Brey. Separating a mixture of volatile liquid and gaseous hydrocarbons. (255,428.)
 27,585 (1926). I.-G. Farbenind. Recovering volatile organic substances from gas mixtures. (262,404.)
 *25,298 (1926). Verein f. Chem. Industrie. Producing or reactivating inactive or exhausted active carbon. (265,916.)
 *3887 (1927). N. V. Silica en Ovenbouw Mij. Recovery of benzenes from coal gas. (265,984.)
 *3903 (1927). I.-G. Farbenind. Decomposition of hydrocarbons by means of water vapour. (265,989.)
 *3926 (1927). Nederlandse Mijnbouw en Handel Maatsch. Making a highly-active alkaline coke. (265,993.)
 *4130 (1927). Still. Recovery of by-products in coke-oven or like plants. (266,003.)

III.—Complete Specification

*3887 (1927). N. V. Silica en Ovenbouw Mij. *See* II.

IV.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of azo dye-stuffs. 4402. Feb. 16. Dyestuffs. 4626. Feb. 18.

Haller and Kappeler. Condensation products of aryl-amines. 4478. Feb. 17. (Ger., 24.1.27.)

Johnson (I.-G. Farbenind.). Manufacture of vat dyestuffs. 4073. Feb. 14. Production of ketones of the anthracene series. 4369. Feb. 16.

IV.—Complete Specifications

19,938 (1925). Ransford (Cassella & Co.). Manufacture of aromatic compounds and dyestuffs. (265,641.)

2756 (1926). Carpmael (I.-G. Farbenind.). Manufacture of monazo dyestuffs. (265,787.)

*3559 (1927). I.-G. Farbenind. Manufacture of vat dyestuffs. (265,904.)

*3889 (1927). I.-G. Farbenind. Manufacture of solid diazo-salts. (265,985.)

*3890 (1927). Geigy A.-G. Manufacture of acid dyestuffs of the phenolphthalein series. (265,986.)

V.—Applications

Achille Serre, Ltd., Allott, and Hatfield. Cleaning processes. 4275 and 4277. Feb. 15.

Dux Chemical Solutions Co. Rendering canvas rot and waterproof. 3596. Feb. 18.

Gillis. Degumming flax straw. 4285. Feb. 15

McLaughlin. Preservative for silk etc. fabrics. 4193. Feb. 15.

Soc. Civile des Proc. Masse. Treating stalks of ramie. 4239. Feb. 15. (Fr., 22.2.26.)

V.—Complete Specifications

28,315 (1925). Neumann. Manufacture of viscose solutions. (265,685.)

28,778 (1925). Lynn and Leyst. Production of cellulose material. (265,697.)

*3991 (1927). Vereinigte Glanzstoff Fabr. Treating artificial silk. (265,996.)

VI.—Applications

Oberrheinische Handelsges. Treating yarns etc. 4514. Feb. 17. (Ger., 17.2.26.)

Thies. Mercerisation of piece goods. 4606. Feb. 18.

VI.—Complete Specifications

30,473 (1925). Berg and Imhoff. Weighting of fibres. (265,727.)

12,731 (1926). Schlumpf. Apparatus for dyeing or washing textiles. (253,500.)

VII.—Applications

Barrett and Bonniksen. Manufacture and storage of phosphine. 4246. Feb. 15.

Carpmael (I.-G. Farbenind.). Manufacture of alkali and alkaline earth hydroxides. 4401. Feb. 16.

Coles. Production of caustic soda and silica. 4021. Feb. 14.

Johnson (I.-G. Farbenind.). Manufacture of salts of alkaline-earth metals. 4072. Production of calcium formaldehyde sulphonylate. 4074. Feb. 14. Production, treatment, and storage of hydrogen peroxide. 4368. Feb. 16.

Monsanto Chemical Works. Contact sulphuric acid process. 4153. Feb. 14. (U.S., 15.2.26.)

Sharp (Soc. Gén. Métallurgique de Hoboken). Manufacture of sulphuric acid. 4731-2. Feb. 19.

VII.—Complete Specifications

18,150 (1926). Gallardo y de Sotto. Manufacture of sulphuric acid. (265,857.)

23,947 (1926). Meyerhofer. Producing metal compounds. (265,880.)

30,283 (1926). Laine. Apparatus for the manufacture and delivery of hydrocyanic acid gas. (262,423.)

*4153 (1927). Monsanto Chemical Works. Contact sulphuric acid process. (266,007.)

VIII.—Applications

Fitzgerald. Binding materials for refractory etc. substances. 4069. Feb. 14.

Rainforth. Non-splintering glass. 4082. Feb. 14.

VIII.—Complete Specification

16,022 (1926). Haddon (Corning Glass Works). Refractory articles or castings. (265,847.)

IX.—Applications

Abrey. Manufacture of artificial stone. 4101. Feb. 14.

Aerni. Manufacture of artificial stone. 4509-10. Feb. 17. (Switz., 20.2.26.)

Atthenont. Building material. 4045. Feb. 14 (Fr., 27.7.26.)

Brown. Mixture for construction of cold asphalt pavements. 4524. Feb. 17.

Eckel. Cement. 4110. Feb. 14. (U.S., 31.3.26.)

Gall and Peake. Compositions for making etc. roads. 4215. Feb. 15.

Goodall. Drying, fireproofing, etc. timber. 4701. Feb. 19.

I.-G. Farbenind. Priming wood etc. supports. 4485. Feb. 16. (Ger., 17.2.26.)

Potts (Mineral A.-G. Brig). Artificial asphalt. 4332. Feb. 16. Manufacture of artificial rubber asphalt etc. 4452. Feb. 17.

IX.—Complete Specification

20,571 (1925). Smith and Phipps. Treatment of wood etc. (265,643.)

X.—Applications

Bogdandy and Polanyi. Determining composition of copper and zinc alloys. 4516. Feb. 17. (Ger., 24.3.26.)

Coles. Protection of metallic surfaces from corrosion. 4022. Feb. 14. Protecting iron and steel surfaces from corrosion. 4666. Feb. 19.

Dietzsch. Treatment of ores. 4371. Feb. 16.

Gewerkschaft Saetlehen and Kippers. Rotating muffle furnace. 4641. Feb. 18. (Ger., 24.3.26.)

Jessup. Manufacture of magnesium. 4511. Feb. 17. (Fr., 30.3.26.) Electrolytic production of magnesium etc. 4512. Feb. 17. (U.S. 30.3.26.)

Jones. Galvanising metal sheets. 4322. Feb. 16.

Lucas. Purifying iron scale. 4112. Feb. 14

Neumark. Producing pig iron in blast furnaces. 4373. Feb. 16.

New Jersey Zinc Co. Metallurgical operations. 4262. Feb. 15. (U.S., 25.3.26.)

Siemens und Halske A.-G. Apparatus for electrodeposition of chromium. 4754. Feb. 19. (U.S., 20.2.26.)

Williams. Refining lead bullion. 4529-30. Feb. 17. (Australia, 6.3.26.)

X.—Complete Specifications

31,455 (1925). Preston. Soldering aluminium or its alloys. (265,733.)

12,431 (1926). Dechesne. Cupola furnaces. (265,827.)

12,642 (1926). Appel. Electrolytic separation of chromium. (265,833.)

27,365 (1926). Bořak. Cementation of iron and steel. (260,980.)

*1492 (1927). Artner. *See* I.

XI.—Applications

British Battery Co., and Reynolds. Electric batteries. 4383. Feb. 16.

Campbell, and General Electric Co. Gas-filled photo-electric cells. 4211. Feb. 15.

Jessup. 4512: *See* X.

- Mouillefarine. Dielectric product. 4598. Feb. 18. (Fr., 18.2.26.)
 Siemens und Halske A.-G. 4754. See X.
 Standard Telephones and Cables, Ltd. (Western Electric Co.). Magnetic core material. 4748. Feb. 19.
 Thomson. Electric accumulators. 4427. Feb. 17.
 Trotter. Electric accumulators. 4690. Feb. 19.
 Williams. Electric accumulators. 4723. Feb. 19.
 Wright. Light-sensitive cells etc. 4096. Feb. 14.

XI.—Complete Specifications

- 28,031 (1925). Field. Electrolytic oxidation of organic compounds. (265,672.)
 12,642 (1925). Appel. See X.
 *26,456 (1926). Hagspiel. Electrodes for electric accumulators. (265,918.)
 *2663 (1927). British Thomson-Houston Co., Ltd. Electric furnaces. (265,950.)
 *3588 (1927). Bayer. Producing porous insulating materials. (265,968.)

XII.—Application

- Achille Serre, Ltd., Alliot, and Hatfield. Manufacture of soaps. 4276. Feb. 15.

XII.—Complete Specification

- 29,559 (1925). Flammer and Kelber. Manufacture of soap. (265,714.)

XIII.—Applications

- Carrier Engineering Co., and Robertson. Varnishes lacquers, etc. 4494. Feb. 17.
 King and Threlfall. Materials for painting etc. 4370. Feb. 16.

XIII. Complete Specification

- 5015 (1926). Chughlan. Ingredient for printing-ink. (265,787.)

XIV.—Applications

- Dicker (Rubber Latex Research Corp.). Production of rubber articles. 4147. Feb. 14.
 Glascoine. Ascertaining hardness of vulcanised industrial rubber etc. 4097. Feb. 14.
 Nyrop. Preparing latex for rubber manufacture. 4282. Feb. 15.
 Potts (Mineral A.-G. Brig). 4452. See IX.
 Silesu. Verein Chem. Fabr. Accelerating vulcanisation. 4643. Feb. 18. (Ger., 4.5.26.)

XIV.—Complete Specifications

- *28,917 (1926). Goodyear Tire and Rubber Co. Vulcanising rubber. (265,920.)
 *32,895 (1926). Grasselli Chemical Co. Vulcanisation of rubber substances. (265,930.)

XV.—Complete Specifications

- 4456 (1926). Deutsche Kunsthorn-Ges. Manufacture of horn-like materials from albuminous substances. (247,955.)
 27,712 (1926). Deutsche Kunsthorn-Ges. Manufacture of artificial horn from albuminous substances. (261,009.)
 *3645 (1927). Massin. Depilating skins and hides. (265,972.)

XVII.—Application

- Carpmael (I.-G. Farbenind.). Manufacture of depolymerisation products from carbohydrates. 4264. Feb. 15.

XVII.—Complete Specification

- 12,607 (1926). Jackson (Larowe Construction Co.). Recovery of substances from residual liquors of the beet-sugar industry. (265,831.)

XVIII.—Applications

- Johnson (Bücher). Production of yeast. 4747. Feb. 19.
 Murphy, and Murphy & Son. Manufacture of beer etc. 4633. Feb. 18.

XIX.—Applications

- Calder. Concentrated fruit products etc. 4706—7. Feb. 19.

XIX.—Complete Specifications

- 16,446 (1926). Stassano. Sterilising or pasteurising putrescible liquids. (254,725.)
 20,201 (1926). Gewalt. Improving the qualities of coffee. (265,865.)
 *10,742 (1926). Hoefelmayr. Manufacture of invalid food from milk. (265,910.)

XX.—Applications

- Chem. Fabr. vorm. Schering. Manufacture of aliphatic auromercapto-carboxylic acids. 4265. Feb. 15. (Ger., 17.2.26.)
 Haller and Kappeler. 4478. See IV.
 I.-G. Farbenind. Production of urea. 4746. Feb. 19. (Ger., 19.2.26.)
 Lilly and Co. Purified pneumococci antitoxin. 4140. Feb. 14. (U.S., 10.2.26.)
 Merck. Antirachitic preparations. 4765. Feb. 19. (Ger., 14.1.27.)

XX.—Complete Specifications

- 28,031 (1925). Field. See XI.
 28,193 (1925). Bourgoin. Acetylation of fatty and other substances. (265,677.)
 4305 (1926). Carpmael (Chem. Fabr. vorm. Schering). Manufacture of organic auromercapto acids and salts thereof. (265,777.)
 18,338 (1926). Roessler and Hasslacher Chemical Co. Production of amide acid sulphates from nitriles. (255,886.)
 *32,897 (1926). Grasselli Chemical Co. Aldehyde amine condensation products. (265,931.)
 *1695 (1927). Hoffmann-La Roche & Co. Manufacture of a glucoside of *Adonis vernalis*, L. (265,941.)
 *2400 (1927). Soc. Franc. de Catalyse Généralisée. Production of methyl alcohol by catalysis. (265,948.)
 *3427 (1927). Riedel A.-G. Producing adipic acid and its substitution products. (265,959.)
 *3430 (1927). I.-G. Farbenind. Manufacture of primary amines. (265,960.)
 *3928 (1927). Komlos, Komlos, and Engelke. Manufacture of compounds of carbon and sulphur. (265,994.)

XXI.—Application

- Trist. Photographic plates. 4532. Feb. 17.

XXI.—Complete Specification

- 3261 (1926). Wade (Wadsworth Watch Case Co.). Photographic processes. (265,769.)

XXIII.—Application

- Adams. Sewage-purification plant. 4314. Feb. 16.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—
Belgium: Leather (177). *Brazil*: Iron, galvanised sheets (197). *British India*: Iron and steel (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Canada*: Sanitary ware (B.X. 3261). *Egypt*: Hides, soap, palm-oil (Egyptian Government, 41, Tothill Street, London, S.W.1. Refs. Muh. 1926/63/1 and Muh. 1926/65/1, and Ref. C. 2210). *France*: Tinplate, galvanised sheets, iron, steel (178); Leather (179). *Holland*: Iron, steel,

tin (184). *Italy*: Raw materials for the pottery industry (188). *Luxemburg*: Leather (177). *Norway*: Galvanised sheets (189); Chemical and tanning extracts (190). *Rumania*: Flattening varnish, turpentine, siccativ, zinc white, linseed oil, chrome yellow, ultramarine, Paris blue, lamp black, ochre, white petroleum jelly, white starch, glue, orange shellac, paraffin wax, caustic soda, sand-paper (B. 3267). *South Africa*: Steel, cast-iron (A.X. 4281). *United States*: Steel (A.X. 4262).

Vat Colours on Wool

The vogue for pale and bright shades in wool materials has revealed a weakness in colours which have hitherto been considered to be of sufficient fastness. The possibility of using vat colours, which have already obtained a world-wide renown when used on cotton goods, has therefore suggested itself. In consequence, the British Dyestuffs Corporation, Ltd., has recently issued a pattern card illustrating the application of vat colours on wool. These Duranthrene and Caledon colours (anthraquinone vat colours) which can be used on wool are of excellent fastness to light and milling, and are extremely level dyeing. Details are given of the dyeing process employed with these colours. Durnedone colours, which are vat colours of the indigoid type, and as such possess a somewhat better affinity for wool than the anthraquinone brands, are also described. These come more into use for heavier shades. They possess very good all-round fastness, but are not suitable for mixing with Duranthrene or Caledon brands in dyeing.

Valves

A catalogue (No. 100) which has been published recently by J. Blakeborough & Sons, Ltd., Woodhouse Works, Brighouse, Yorks, describes the firm's valves and auxiliaries for steam power plant. The firm makes valves for every service, in any size, material or purpose, and the publication will be of interest to all who require to control the movements of liquids or gases. The catalogue is well illustrated and produced, and conveniently arranged for reference.

PUBLICATIONS RECEIVED

PHYSICO-CHEMICAL GEOLOGY. By R. H. Rastall, Sc.D., F.G.S. Pp. vii + 248. London: Edward Arnold & Co., 1927. Price: 15s. net.

ATOMIC THEORY.—AN ELEMENTARY EXPOSITION. By A. Haas, Ph.D. Translated by T. Verschoyle, M.C., Ph.D., A.R.C.S. Pp. xiv + 222. London: Constable & Co., Ltd., 1927. Price: 10s. 6d.

TEXTILE BLEACHING, DYEING, PRINTING AND FINISHING MACHINERY. By A. J. Hall, B.Sc. Pp. xvi + 320. London: Ernest Benn, Ltd., 1926. Price: 50s. net.

THE NATIONAL PHYSICAL LABORATORY. - COLLECTED RESEARCHES. Vol. XIX, 1926. Pp. v + 443. H.M. Stationery Office, 1926. Price: 18s. 6d. net.

A SURVEY OF AMERICAN CHEMISTRY. Vol. I. July 1, 1925, to July 1, 1926. Including Reports from Scientific Committees, Division of Chemistry and Chemical Technology, National Research Council. Edited by W. J. Hale in co-operation with C. J. West. Pp. 257. New York: The Chemical Catalog Co., Inc., 1927. Price \$2.00.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF MINES. Washington: Government Printing Office, 1926: Antimony in 1925. By J. W. Furness. Mineral Resources of the United States, 1925, Part I: 2. Pp. 7—15. Price 5 c. Arsenic in 1925. By V. C. Heikos. Mineral Resources of the United States, 1925—Part I: 4. Pp. 31—34. Price 5 c. Bauxite and Aluminium in 1925. By J. M. Hill. Mineral Resources of the United States, 1925—Part I: 3. Pp. 17—29. Price 5 c. Bureau of Mines Safety Labels. By L. C. Ilsley. Information Circular 6005. Pp. 14. Price 5 c. Index of Bureau of Mines Publications. Pp. 47. Petroleum in 1924. By G. B. Richardson and A. B. Coons. Mineral Resources of the United States, 1924—Part II: 20. Pp. 385—458. Price 15 c. Metal-Mine Accidents in the United States: 1924. By W. W. Adams. Bulletin 264. Pp. 98. Price 15 c. Annual Report of the Director of the Bureau of Mines to the Secretary of Commerce for Fiscal Year ended June 30, 1926. Pp. v + 46. Asphalt and Related Bitumens in 1925. By G. R. Hopkins and A. B. Coons. Mineral Resources of the United States, 1925—Part II: 4. Pp. 29—37. Price 5 c. Carbon Black produced from Natural Gas in 1925. By G. R. Hopkins. Mineral Resources of the United States, 1925—Part II: 7. Pp. 53—55. Price 5 c. Feldspar in 1925. By J. Middleton. Mineral Resources of the United States, 1925—Part II: 5. Pp. 39—46. Price 5 c. Graphite in 1925. By J. Middleton. Mineral Resources of the United States, 1925—Part II: 6. Pp. 47—52. Price 5 c. Platinum and Allied Metals in 1925. By J. M. Hill. Mineral Resources of the United States, 1925—Part I: 6. Pp. 53—63. Price 5 c. Fuel Briquets in 1925. By James E. Black. Mineral Resources of the United States, 1925—Part II: 1. Pp. 1—5. Price 5 c. Rare Metals, Cobalt, Molybdenum, Nickel, Tantalum, Titanium, Tungsten, Radium, Uranium and Vanadium in 1924. By Frank L. Hess. Mineral Resources of the United States, 1924—Part I: 22. Pp. 451—476. Price 5 c. Talc and Soapstone in 1924. By L. M. Prindle and B. H. Stoddard. Mineral Resources of the United States, 1924—Part II: 27. Pp. 339—346. Price 5 c. Coke-Oven Accidents in the United States during the Calendar Year 1925. By W. W. Adams. Technical Paper 408. Pp. 40. Price 10 c. Lead in 1925 (Smelter Report). By J. A. Stader and A. Stoll. Mineral Resources of the United States, 1925—Part I: 12. Pp. 195—210. Price 5 c. Iron Ore, Pig Iron and Steel in 1925. By H. W. Davis. Mineral Resources of the United States, 1925—Part I: 8. Pp. 89—126. Price 10 c. Phosphate Rock in 1925. By W. M. Weigel and B. H. Stoddard. Mineral Resources of the United States, 1925—Part II: 16. Pp. 147—164. Price 5 c. Production of Explosives in the United States during the Calendar Year 1925, with Notes on Mine Accidents due to Explosives. By W. W. Adams. Technical Paper No. 406. Pp. 39. Price 10 c.

WORLD CONDITIONS AS TO MINERAL RAW MATERIALS FOR THE FERTILISER INDUSTRY. Addresses delivered at the meeting of the Institute of Politics at Williamstown, Mass., August 12—14, 1926. Pp. 180. Washington, D.C.: The National Fertiliser Association, 1926.

ANNUARIO PER LE INDUSTRIE CHIMICHE E FARMACEUTICHE. Anno viii, 1925. Ministero Dell'Economia Nazionale. Comitato Autonomo Permanente per le Industrie Chimiche e Farmaceutiche. Pp. L + 653. Rome: Provveditorato Generale dello Stato Libreria, 1926. Price: 30 L.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW SERIES**

LONDON, MARCH 11, 1927

NO. 10

EDITORIAL

Chemistry and the Public

THE British Industries Fair has run its appointed course, and, from all we are able to gather, it seems probable that the Fair has been the most successful yet held. In the Chemical Section, the exhibitors appeared to wear a certain feeling of satisfaction, and although it is yet too early to judge the full effect of the Fair, the news of many important inquiries and orders warrants optimism. Certainly the Chemical Section was most attractive, and though we do not wish to pick or choose where there was so much excellence, special praise was certainly due to Imperial Chemical Industries, Ltd., and their architect for the attractive edifice which they erected to the glory of British chemical industry. As in previous years, the Fair was open to the public in the evenings, and the attendance showed that the man in the street, and particularly his wife, is interested in such displays. Indeed, towards the close of the Fair the attendance of the public seemed—though we may be wrong—to have overflowed into the hours reserved for the serious business which was the main object. To us, as to anyone in the least chemically-minded, the Fair was really a huge demonstration of the prowess of British chemistry. Chemicals there were in the Chemical Section, but their uses under skilled guidance were clear in the other Sections for anyone to see who could. Glassware, pottery in all the beautiful colours of the modern potter, indiarubber articles, moulding products, cleansing materials, foodstuffs, insulating materials in the wireless section, textiles and clothing, all these depend in one way or another on the chemical manufacturer and the chemist. Pity 'tis that the tale has been so little told. Excellent books have been written—witness "Chemistry in the XX Century"—chemists are providing excellent popular articles for the daily newspapers, but the public has still too little grasp of the real significance of chemistry, still less does it comprehend the universal chemical basis of modern civilisation. Exhibitions such as Wembley and the British Industries Fair help, however, very greatly, and we are glad that they combine their undoubted value to industry with a little educational demonstration for the public.

Research in the Woollen Industry

Another method of demonstrating the value of science in modern industry has been employed by the British Research Association for the Woollen and Worsted Industry. Last week Lord Balfour opened an exhibition in the Science Museum, South Kensington, which illustrates how the Research Association has applied science to the study of wool in all its stages from the sheep to the finished fabrics. The long series of cases provides striking evidence of the value of chemical research in the industry. Wool grease, the removal of vegetable matter from wool by carbonising, the structure of the fibres, the absorption of alkali in scouring and its effects, methods for avoiding the trouble caused to the trade by tar, the bleaching of wool, the production of unshrinkable wool by chlorination, a study of the sulphur content of wool and a series of compounds—cystine, tyrosine, glycine, alanine, valine, and so on—obtainable from wool substance: these were some of the exhibits, in addition to specimens showing the action of bacteria on fabrics and the fading of dyes on wool. We have no space to mention all the exhibits, which included some interesting apparatus, but we hope that the exhibition will have many visitors. In opening the exhibition, Lord Balfour said he did not think the public realised that if the nation is to be progressive, this can only be accomplished by the application to industry of science and of the fundamental principles of science, investigated probably with no thought of their commercial application. We were glad to note that Lord Balfour paid a merited tribute to the successful work of the Research Association, and we hope that other Research Associations may find it possible to organise exhibitions to show to the public the unceasing contributions of science to the material well-being of mankind.

Remuneration

Mr. (or Miss) E. M. Hull's novel, "The Sheik," has, we were insistently informed, passed the million mark a year ago. Conrad would have been amazed, or amused, had the total of all his works reached that figure. The first edition of Hardy's "Far from the Madding Crowd" was, except for the forty copies actually sold, disposed of

as a "remainder." But it is only fair to add that more of us have learnt to read since that date, and even we who read neither Hardy nor Conrad will place these, amongst the immortals, higher than our own fancy, Mr. (or Miss) E. M. Hull. Few of us read the Bible, or even Shakespeare, and it is not so many months since we crowded out the boxes and stalls of "No, No, Nanette," what time poor Mr. Ainley played an excellent "Much Ado about Nothing" to shrinking houses. Our great organist composer bewails the lack of support in England for good music; but think of the urgent lithograph machines pouring out hot copies of "Show me the way to go home." The remuneration which these people and many others receive is a rough measure of the "use" the public has for them. Slow-footed posterity may do them justice—but posterity pays no royalties. Now, the British Public has little interest in chemistry (except during a war), and less understanding of it. If you are proposing to join the trade you will find that your kinswomen and acquaintances, when you inform them of it, will casually but vocally expect you in a week or so to be ready to announce your first earth-shaking discovery: but your remuneration will reflect in some degree the light in which our public regards you. Your employers' can interfere greatly neither way. But don't be bitter about it: you are one of the same happy-go-lucky, careless, unbalanced, inappreciative public neglecting and sweating disillusioned artistic and other men in their several crafts, professions and occupations. If you are one of those people for whom happiness can be accurately measured in terms of the exchangeable possessions, you had better avoid the career of research or process chemist, where prizes are rare and part of the wages is earned in terms of satisfaction for a good thing well done. You were better advised to tickle the vanity or palate of the Imperial public, to mesmerise them into buying what they would as soon not buy, or to sell them some nostrum warranted to push back the day when they must quit the world they make unremitting efforts to forget. But since not all of us have facial muscles facile in registering contorted emotions; since not all of us can be manufacturers of sweetmeats any more than we can all become laundresses; and since the might of England cannot be wholly sustained by the efforts of publicity agents, some of us must even be content to become chemists. And when, forgetting that we as individuals are indistinguishable from the rest of the great public, we sigh over the uncertainty of the rewards showered out or doled out, we should remember that our quarrel is not as much with social and economic conditions as with our own blundering choice of parents. Let us, then, adapting Celia's remedy, sit and mock the good housewife Fortune from her wheel, that her gifts may henceforth be bestowed equally.

THE ANNUAL REPORTS, 1926

It is pleasant to turn to the new volume of the Annual Reports of the Progress of Applied Chemistry for 1926, which has just been published, and find that research has been no less active during the past year, and that

steady progress has been made in various branches of industry, despite the industrial depression.

In the section dealing with "Plant and Machinery," Mr. S. G. M. Ure records a welcome resumption of orders in the engineering industry, and has many new developments to record in the production of chemical plant. The scientific utilisation of fuel assumes ever-greater importance, and in "Fuel," Mr. H. J. Hodsman provides an interesting discussion of the large mass of work relating to the use and treatment of coal. "Gas, Destructive Distillation, and Tar Products" are dealt with by Dr. J. G. King and Mr. R. A. A. Taylor, and much new work is considered in relation to carbonisation, gas purification, combustion, calorimetry, and so on. Dr. A. E. Dunstan has contributed the account of the work on "Mineral Oils," and records some important advances in the chemistry of petroleum distillates.

Mr. C. Hollins, in "Colouring Matters and Dyes," points to a brighter outlook for the industry, and in discussing intermediates shows the growing interest of the dyemaker in synthetic alcohols and other aliphatic compounds. Developments in the production of benzene derivatives are commented upon and the copious publications relating to dyes are treated systematically. "Fibres, Textiles, Cellulose, and Paper" are dealt with by Mr. D. J. Norman, who has many interesting studies on textile fibres to consider, particularly in relation to the problems presented by cellulose silks. Mr. A. J. Hall, in "Bleaching, Dyeing, Printing, and Finishing," considers that little of outstanding importance can be recorded in the industries covered by his report. Work on the treatment of textile fibres has been active, however, and is fully discussed.

Messrs. P. Parrish and F. C. Snelling, in "Acids, Alkalis, Salts, etc.," discuss the nitrogen industry in its various aspects, and record, amongst other subjects, the difficulties of the sulphuric acid and superphosphate industries. The report on "Glass" is due to Mr. A. Cousen, who finds that, although the volume of work on glass technology has not decreased, advance has been somewhat unequal in its various branches. Problems dealt with have been mainly on the practical side, such as the melting and durability of glass, and these are considered fully. A similar tendency to deal with the more practical problems is traceable in the report on "Refractories, Ceramics, and Cement," by Mr. A. T. Green. The properties of clays continue to attract attention, and there has been much work on the spalling, erosion, testing, etc. of refractories, whilst the important subject of kilns and kiln-firing receives consideration.

From the report on "Iron and Steel," by Prof. C. O. Bannister, it appears that the industry has been mainly concerned with problems of fuel economy, cementation and case hardening, though more attention is being given to physico-chemical investigations both on a laboratory and an industrial scale. An ever-increasing application of scientific methods is revealed in the report on "Non-ferrous Metals," by Mr. H. F. Richards, who discusses the many problems relating to non-ferrous alloys. In the "Electrochemical and Electrometallurgical Industries," Mr. A. G. Lobley finds steady progress in nearly all branches, and increasing application of electrolytic and electrothermal methods in industry.

Mr. H. M. Langton records unfavourable economic conditions in the industries covered by "Oils, Fats, and Waxes," but reports interesting work on fatty oils, and remarks on the steady progress made in understanding the technique of soap boiling. Members of the Oil and Colour Chemists' Association have provided the report on "Paints, Pigments, Varnishes, and Resins," which covers a vast amount of work, Mr. A. A. Drummond dealing with drying oils, varnishes and driers, Mr. J. A. F. Wilkinson with cellulose ester varnishes and enamels, and Mr. J. Parrish with pigments and paints.

In the section on "India-rubber," Mr. R. W. Lunn notes that the problem of the mechanical structure of rubber is gradually yielding to new methods of examination, and discusses work on latex, the constitution and testing of rubber, and so on.

Mr. D. Woodroffe, in "Leather and Glue," reports that employment in the leather industry has increased slightly, and gives a full discussion of work on tanning and tanning materials, and cognate subjects.

The report on "Soils and Fertilisers" is contributed by Mr. H. J. Page, who has much to record about the situation of the fertiliser industry and the investigation of soil problems.

Messrs. L. Eynon and J. H. Lane, in "Sugars, Starches, and Gums," deal with both the cane and the beet sugar industries, and record some interesting work on miscellaneous sugar products and starches. Mr. H. Lloyd Hind deals exhaustively with the progress in

"The Fermentation Industries," and includes a section on starch and its conversion products. Vitamins and nutrition loom large in the report on "Foods" by Mr. F. S. Aumonier, who also treats of dairy, cereal, fruit and vegetable products, preservatives, and the analysis of foods.

In "Sanitation and Water Purification," Mr. J. Haworth records more work on the activated sludge process for sewage disposal, and contributes a section on trade wastes which is of wide interest.

Important progress is recorded by Messrs. W. H. Gray and H. Paget in their report on "Fine Chemicals, Medicinal Substances, and Essential Oils." The synthesis of thyroxin, insulin-like substances, carbohydrate metabolism, alkaloids, antiseptics, are amongst the subjects treated. The work on "Photographic Materials and Processes" is summarised by Dr. W. Clark, who records steady, but not sensational, progress.

The final report, on "Explosives," is by Dr. J. Weir, who discusses the work done during the last two years. Advances in the use of lead azide as an initiator and in the use of low-freezing explosives for civil work, and the small progress made by liquid oxygen explosives are recorded.

As in previous years, the various reports complete each other, and outstanding questions, such as particle size, cellulose varnishes and silks, synthetic fuels, nitrogen fixation, and many more, are treated from different points of view by different authors. The volume of work in every direction is steadily increasing, and the Annual Reports of the Progress of Applied Chemistry become each year still more essential to those who wish not only to judge of the progress made in a particular industry, but realise the importance of studying the methods employed in other industries.

FERROUS METALLURGY AND CORROSION

It need hardly be pointed out that to all industries which utilise metals an advance in our metallurgical knowledge often constitutes a real and important advantage. In particular, the advantage of obtaining vessels and appliances of metals which, in addition to being strong, ductile and readily worked, possess high resistance to the attack of corrosive media, will not require emphasis to chemical engineers. The modern tendency in many industrial processes to push up, for reasons of efficiency and economy, the working temperature and pressure places a further exacting demand on the properties of the metals used in plant construction. Whilst it cannot be claimed that our knowledge and ability to produce metals suitable for resisting corrosive conditions under high temperature and stress are far advanced, much valuable data are beginning to take form, and certain of the recently developed steels and ferrous alloys show considerable promise, which may result in improvements in chemical processes and even the application of new principles.

It has long been known that high silicon iron alloys containing about 14 to 18% of silicon show high resistance to the corrosive action of various acids; for example, citric, acetic, sulphuric, nitric and hydrochloric acids, and mine waters. These alloys are, however, hard and brittle, and cannot be machined. Attempts have been made to render these alloys tougher and more readily worked by the addition of small percentages of copper or other ductile metal, but with doubtful success. The addition of 2½% of nickel is said to increase the resistance to nitric acid. Certain practical difficulties are also encountered with castings, so that plane surfaces and rectangular shapes are avoided, and as a general rule these alloys are not recommended for high temperature work owing to their liability to warp and crack.

Although the action of chromium in attributing incorrodible properties to steel has been at least suspected for a long time (it will be remembered that Faraday included it among the additions to iron in his experiments to discover an untarnishable metallic mirror), its value and possibilities in this connexion were comparatively unexplored twenty years ago. Since that time, however, a considerable part of metallurgical progress has been connected with this element. To call it the master element of this century may be an overstatement, but its use will undoubtedly increase as the properties of the newer high chromium and nickel-chromium steels become more widely appreciated and enter more extensively into practice.

It is interesting to note that chromium plating can now be successfully accomplished and is resistant to a number of corrosive influences. The process may be carried out by heating the steel in a mixture of alumina and powdered chromium in nearly equal proportions to a temperature of 1300 to 1400° C. *in vacuo*, or a neutral atmosphere. The depth of penetration of the chromium amounts to about 0.18 mm. in 3 hrs. and 0.34 mm. in 6 hrs. As is well known, however, coatings and platings have certain disadvantages of their own; for example, if they crack or flake the subjacent material is attacked, and there is also a tendency at high temperatures for the surface layer to diffuse into the body of the material.

Prior to the war, the anti-corrosive and high-temperature properties of certain chromium steels were already attracting attention. The steel containing 12 to 14% chromium with about 0.3% carbon achieved popular favour on account of its application to cutlery. Its non-scaling properties were found to be satisfactory up to about 850° C. Whilst possessing good mechanical properties, this steel needs to be put into a suitable hard condition and possess a polished surface to develop its anti-corrosive properties to the full. In addition to resisting ordinary weathering, it is not attacked by many food acids, cold nitric acid (1.20 S.G.), and glacial acetic acid, vinegar, lemon juice, oleic and stearic acids, acid copper sulphate solution, caustic alkalis and ammonia, and is being used in soap and sugar works. On the other hand, it is even inferior to carbon steel as regards its resistance to sulphuric and hydrochloric acids. In certain applications this steel has not given the complete satisfaction that there was reason to expect; for example, valve spindles and pump rods are sometimes found to wear in contact with damp packing containing asbestos, graphite, etc., but it has a useful, if somewhat limited, sphere from the point of view of the chemical engineer. Up to a point it is resistant to superheated steam, and is used for turbine blades and steam valves.

Something of an advance was made when a chromium iron alloy of about the same chromium content was introduced—partly due to a low carbon ferro-chrome being placed on the market and partly to improvements in steel manufacturing processes—as generally speaking the lower the carbon content the better the resistance to corrosion. This rustless iron does not air-harden, and heat treatment and surface condition do not have as important a bearing on its corrosion resistance. Moreover, it is more readily rolled, drawn and pressed.

Further work showed that anti-corrosive properties were improved as the chromium content was increased to 17 or 18%, the material becoming immune to electrolytic corrosion when in contact with brass or other dissimilar metal. These steels are, however, martensitic, have a coarse crystalline structure, and are brittle under shock. They are unworkable and unmachinable, but their physical properties are improved by the addition of 2 or 3% of nickel, and then they can be hardened and possess a high yield point ratio.

Chromium-iron alloys of even higher chromium content have valuable heat-resisting and anti-corrosive properties. A type which is meeting with industrial application contains 25 to 30% of chromium and 0.1 to 3.0% carbon. Naturally these alloys are mainly used as castings, but it is claimed that they are machinable with 1% or even 1.5% carbon.

Tests on an alloy containing 29% of chromium showed that it was not oxidised up to 1150° C., not attacked in a reducing atmosphere up to 1100° C., and unattacked in sulphurous gases up to 1000° C., but at higher temperatures the alloy deteriorated along the grain boundaries. It is resistant to sea water, mine waters, and some acids. In America this type of alloy steel has been used as moulds for centrifugal castings. It has been suggested as a suitable material for the construction of plant for low-temperature carbonisation of fuel, but is at least equalled in resistance to oxidation and even surpassed

in retention of strength at high temperatures by some of the nickel-chromium steels described below.

Fig. 1 shows diagrammatically the increase in resistance, in this case to oxidation, with chromium content. An interesting metallurgical point is that above 14% chromium, at which a sudden increase in resistance occurs, the α - γ iron transformation is suppressed, α and δ iron being continuous and identical. Raising the chromium content to 20% increases the resistance to salt water as well as oxidation. To resist nitric acid the chromium must be over 10%, for salt solution over 15%, and for moist sodium chloride over 20%. The addition of a small percentage of copper is said to improve the resistance of these high chromium steels to corrosion. Silicon and manganese are sometimes added to improve

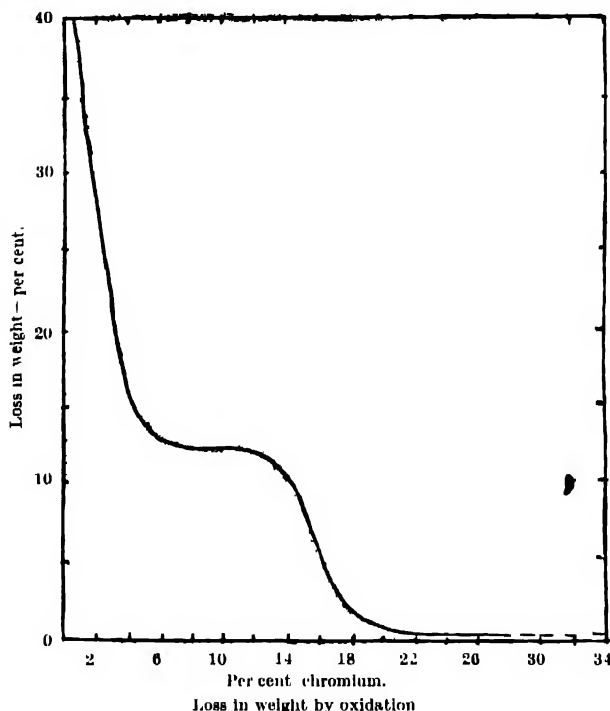


FIG. 1.

the physical properties and ease of working and welding. Steels containing over 20% chromium have been used for sulphide roasting furnace parts, stills, retorts, nitric acid plant and mine pumps.

Before leaving alloy steels with a preponderating percentage of chromium, reference may be made to the influence of silicon additions, which are claimed to increase the resistance to oxidation and certain corrosive media. In America, partly on account of their ease of working, steels of this type have been used for the construction of plant in explosive works for the manufacture and storage of nitric acid. Castings are also said to show good non-corroding properties. From another source chromium-molybdenum steels are stated to be comparatively immune to attack by mineral acids.

Although the Chinese, centuries ago, used an alloy containing nickel which resisted corrosion well, and it has been known for some time that the addition of nickel to steel tended to increase its resistance to sulphuric

and even hydrochloric acid, also that with increasing chromium content steel was rendered more immune to nitric acid, the development of incorrodible steels of the nickel-chromium group is among the latest achievements of ferrous metallurgy. This class of alloy steels, which seems the most promising for extreme cases of high temperature use under oxidising and corrosive conditions, is usually austenitic in structure, and to this extent completely reverses the normal conception of steel behaviour. These steels contain a relatively high content of both nickel and chromium to which is sometimes added a smaller percentage of tungsten, silicon, copper, aluminium or molybdenum or several of these elements. Far from being a simple type they comprise a wide group, with constitutions which may be as complex as modern high-speed steels, which has not yet been fully explored, and on which a good deal of research still remains to be performed before the best alloy for each highly specialised application will be found. Sufficient has been done, however, to show that they open up new and wide possibilities.

On the theoretical side little is known yet about the inter-relation of chemical resistivity and structural constitution. Practice has run ahead of theory. The resistance of chromium and nickel-chromium steels to corroding influences is thought, however, to be due to their low solution pressures and the formation of inert protective coatings, even if only a thin film, by the products of the corroding action itself, which effectively prevents further corrosion. In this connexion some metallurgists advise the use of a pickling solution which forms a resistant oxide coating.

A distinguished metallurgist, writing recently on these steels, divided them into two groups, viz., high nickel-low chromium, and high chromium-low nickel steels, but the range of composition appears to be very wide, i.e., from 7 to 35% chromium, 2 to 60% nickel, and 75 to 25% of iron. From the first group, steels are said to have been developed which are resistant to sulphuric acid, hydrochloric acid and many salts. Recently published German results indicate that an advantage is derived in this connexion by the addition of a few per cent. of molybdenum, as this element is very resistant to both sulphuric and hydrochloric acids. The second group is particularly immune to nitric acid, sea water and contaminated atmospheres. It seems advisable to add a third group to the above classification, viz., steels relatively high in both nickel and chromium. This type, in fact, gives more general resistance to oxidation and chemical attack at high temperatures. In practice, the type most suitable to a particular use is often a matter of trial, and in this connexion the additional elements referred to above may be employed to obtain the beneficial quality desired.

Faced with a choice of one of these steels the chemical engineer will give first consideration to the purpose in view, i.e., the liquor or material to be handled. After this the ease of manufacture or working up into the desired plant will necessitate careful attention. It is interesting to know, therefore, exactly what can be done with the nickel-chromium type of corrosion-resisting steels. Experience shows that they can be forged, hot rolled and pressed, cold pressed and drawn,

riveted, soldered, brazed and cast into fairly intricate shapes, though a high order of technique is required. Difficulties of welding have been overcome, and ductile incorrodible welds can now be produced by the electric arc and oxy-acetylene processes. The austenitic type of steels, however, harden up under cold work which from a construction point of view is not an advantage. They also have rather low proportional limits and yield points at about 50% of the breaking loads. The nickel-chromium non-corroding steels are not dependent on surface finish for their properties. It has, however, been advised in some quarters to retain a polished surface under the most severe conditions.

Whilst it would neither be practicable nor desirable to give a list of the reagents to which the nickel-chromium group of steels has been found resistant—as such lists can be found in the literature of the various makers—it may be of interest to note a few of the industries in which they are either in service or in which they should be of value. It may be anticipated that, at least in some directions, these non-corroding steels will replace non-metallic materials which suffer from fragility, such as porcelain, pottery, and silica, in the construction of chemical plant, and also certain non-ferrous metals on the grounds of greater strength and resistance to heat.

It must be remembered, however, that if a chemical engineer uses a metal he usually requires it to be completely immune, and not merely capable of a high degree of resistance. In some cases it is not so much a question of the corrosive medium not attacking the container as of the container not contaminating the medium, and so spoiling its colour or some other quality. This may account for some slowness in the introduction of the new steels which from the above point of view need to be tested over long periods, so that some of them have hardly yet emerged from the experimental stage.

Immunity to nitric acid, whether hot or cold, of some nickel-chromium steels can be relied on, and their use has been suggested for towers and storage tanks, outlet pipes for stills, condensers, etc. Steel wagons and barrels for the conveyance of nitric acid may be expected in commission in the near future. Vessels of these steels have also been used for the nitration of cellulose by mixed acids. They resist cold sulphuric acid up to a concentration of about 20% and are immune to boiling sulphurous acid, so that they are not attacked by paper pulp liquors. They may be used for acid-mixing tanks and pipe lines and as evaporators for citric and tartaric acids. They resist oleic, oxalic and fatty acids, and also acetic acid, so may be used for vinegar brewery plant.

These steels have given satisfactory service as impellers in rotary pumps, pump rods and cylinder linings, in handling a number of media, including mine waters containing ferrous and ferric salts, and acid solutions. They are also suitable for impeller blades of fans handling corrosive gases, such as the exhaust from pickling rooms. Nickel-chromium steels of the type under consideration are not attacked by caustic alkalis or ammonia and its salts. They successfully withstand bleach liquors, and are suitable for the construction of laundry machinery, for dyeing vats and machinery, and for pumps in dye works and the woollen industry.

On account of the resistance of these steels to food acids they are specially suitable for containers in the food-preparing industries. It has been reported by a Swedish investigator that quantities of copper, tin, nickel, aluminium and enamelware pass into solution with food, whilst rustless iron tested by the same methods showed no metal at all passing into solution. In industries such as flour milling, cocoa, chocolate, margarine, sugar and confectionery making, the new steels should be of utility in various processes. These incorrodible steels are suitable for brewing plant and accessories, yeast churns, etc. Their use is recommended in the milk and dairy industry and for sterilisers, also plant used in the manufacture of pickles and preserves, fruit juices, and so on.

Obviously, all the possible applications of these new alloy steels, or even those which have already been investigated, cannot be dealt with here, but as regards those involving high-temperature conditions, the following may be sufficient to indicate their scope. They are resistant to molten lead, brass and other metals, but complete immunity to molten aluminium still appears to offer some difficulty. They have proved to be the best materials to resist the effect of superheated steam either from the corrosion or erosion point of view, so that their increasing use in this direction, in view of the modern tendency towards the use of higher temperatures and pressures, is to be expected. There is also promise that from among them will emerge a material which will make the gas turbine a practical success.

They should prove of service in gas works, not only for furnace and other parts subjected to heat, but for by-product operations, such as for drying ammonium sulphate. These steels might also be used for the construction of retorts for the medium-temperature carbonisation of coal, and it is not without the bounds of possibility that they will be developed to be of service in ordinary high-temperature coking operations. Steels from among these types are also satisfactory in use for tar heaters, stills, and dehydrators. They are, moreover, coming into use in the oil and petroleum industries. On account of their resistance to sulphur and sulphurous gases, they are being applied to mechanical roasting furnaces handling pyrites and other sulphide ores.

It is well known that the effect of chemical action on metals is intensified by high temperature. The immunity of these steels, at least as regards some of the mineral acids, has been found to fall off rapidly with increase in temperature. Probably the severest conditions to which metals can be subjected is exposure to high temperature, stress, and corrosive action at the same time. Prolonged exposure to heat has a deleterious effect on the structure of ordinary steel, which may be accelerated by corrosive influences, so that if the steel does not fail by gradual movement or flow under stress, inter-crystalline cracking may occur. The class of special steels under consideration shows promise, however, of meeting even these exacting conditions, and is said to be used in the production of synthetic ammonia, in which a mixture of nitrogen and hydrogen is subjected in the presence of a suitable catalyst to high temperature and pressure, stated to be 600° C. and 200 atmospheres for the Haber process and 550° C. and 900 atmospheres

for the Claude process. Certain of these steels are also suitable for low-temperature work, as they do not become brittle in liquid air.

It may be concluded that the full possibilities resulting from the adoption of incorrodible steels do not yet seem to be appreciated, but the development of these ferrous alloys in chemical use and practice will be very interesting to watch.

CANADIAN INDUSTRIAL NOTES

The estimated profits of the Consolidated Mining and Smelting Co. for 1926, after deductions made for depletion, depreciation, contingent account, taxes and \$2,274,771.66 for additions to properties through profit and loss, were \$8,615,735.64. Profits, computed in the same way, for 1925 were \$6,219,843.14.

The annual financial statement of the Dominion Glass Co., Ltd., for the fiscal year ended September 30, 1926, shows net profits of the year, after deductions for interest charges, depreciation, etc., amounting to \$661,586.00 compared with \$607,037 for 1925. After deduction of bond interest, \$170,000, and preferred dividends amounting to \$182,000, there was left a balance of \$309,586 applicable to common dividends; this is equivalent to 7.28% on the \$4,250,000 common stock outstanding, as compared with 6.0% in 1925, and 9.44% in 1924. Common dividends absorbed \$297,500, leaving a surplus of \$12,086. The profit and loss balance now stands at \$1,078,342.

The Hiram Walker distillery at Walkerville, Ontario, has been acquired by interests connected with the Gooderham & Worts Distillery Co., Toronto. The price paid for all rights and property is stated to be \$15,000,000.

The Distillers Co., Ltd., has formed a Canadian subsidiary company which has now been registered. The provisional directorate consists chiefly of well-known residents of Great Britain interested in distillery products. The intended activities of the new company have not been announced to the public.

The Canadian Celanese, Ltd., at Drummondville, Quebec, expects to start the weaving department in a few weeks, but the spinning department will not be prepared to operate until some time later. Meanwhile, the yarns will be obtained from the British and American plants of the associated companies. The initial output of the new Canadian plant, of one ton a day, will not be able, it is believed, to meet the demand.

Canada is fast building up a profitable foreign trade. Since 1922 the sales to foreign countries, other than the United States and Great Britain, have increased from \$77,000,000 in 1922 to \$149,000,000 in 1926. The imports from these same foreign countries, for the same periods, have increased from \$45,000,000 to \$61,000,000. Chemical and allied products form a considerable part of the general export trade of Canada.

The rated daily output of the Canadian newsprint mills for 1927 is expected to be 8,500 tons, compared with 7,500 tons in 1926 and 4,750 tons at the close of 1924. The newsprint output for 1927 is expected to exceed 2,000,000 tons, thus placing Canada in the premier position as a producer.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

BRITISH CHEMICAL ABSTRACTS INDEX, 1926

In accordance with intimation previously made, the Index to the Abstracts for 1926 will cover both Pure and Applied Chemistry. Members of the Society of Chemical Industry who are also Fellows of the Chemical Society will receive only one copy of the combined Index.

The Index is in active preparation, and will be issued as soon as possible.

DEATHS

Crossley, Arthur W., C.M.G., C.B.E., F.R.S. (elected 1894), of Thorngrove, Alderley Edge, Cheshire, Director of the British Cotton Industry Research Association. On March 5, 1927.

Liebmann, Dr. A. (original member), of The Whim, Weybridge, Surrey, Consulting Chemist. In February, 1927.

Newlands, W. P. R. (original member), of 10, Cricklade Avenue, Streatham Hill, London, S.W., Sugar Chemist. On November 3, 1926.

Remsen, Ira, M.D., Ph.D. (elected 1903), of Johns Hopkins University, Baltimore, Maryland, U.S.A., Emeritus Professor of Chemistry and President of the University, President (1909-10) of the Society of Chemical Industry.

Whowell, Fred (elected 1884), of Croich Hey, Tottington, Bury, Lancs., Bleacher. On January 5, 1927.

Yoshitake, Einoshin (elected 1900), of Nishihara-Machi, Koishikawa, Tokyo, Japan, Chemist. On January 2, 1927.

BRISTOL SECTION

The annual meeting of the Bristol Section of the Society of Chemical Industry was held on March 3 at the University of Bristol, when Mr. George Gray (chairman) presided. Mr. J. Bernard was elected as chairman for the ensuing year. Professor F. E. Francis was re-elected vice-chairman, Mr. M. W. Jones was reappointed as hon. treasurer, and Mr. Marsden was re-elected hon. secretary. The committee was reappointed, Mr. Gray filling the vacancy caused by the elevation to the chair of Mr. Bernard.

Mr. Gray then read a paper on "Science and industry." He said that science might be defined as "systematised knowledge," and industry might be defined as "the steady application to any business or pursuit." He believed that in the future it was only the industry built on the more scientific foundation that would continue to prosper. Others would be swallowed up by the competition which their apathy was certain to attract. Industry was full of opportunities for the use of analysis and synthesis. Like any concrete science it could only be based on measurement, whilst the powers of deduction inherent in the well-trained chemist found immeasurable scope in its midst.

Up to the present the chemist had shown too little appreciation of the value of his scientific training in formulating methods of control in industry. Matters had been left either in the hands of the accountant, who must necessarily base his scheme on accountancy methods, unless he was given the help and co-operation of the chemist. The man with the capacity for pure research was rare, although it would appear that, given the en-

couragement and the opportunity, the supply of workers might exceed the demand.² He was quite sure it was the duty of industry to associate itself more closely with pure research work, and whilst results could not be expected to provide an immediate commercial return, they must undoubtedly provide an insurance for the future, yielding a high return to industry in years to come.

MANCHESTER AND LIVERPOOL SECTIONS

The joint meeting of the Manchester and Liverpool Sections of the Society of Chemical Industry was held at the Textile Institute, Manchester, on March 4, Mr. L. Guy Radcliffe, the chairman of the Manchester Section, presiding. The meeting was preceded by a visit to the Shirley Institute, Didsbury, Manchester, by the courtesy of the British Cotton Industry Research Association, after which there was a dinner at the Manchester Limited Restaurant. A paper entitled "Chemical control in the cotton bleaching industry" was read by Dr. Clibbens, B.Sc.

Dr. Clibbens discussed the sub-divisions of academic science, and said that in applied science, or technology, these divisions had certain disadvantages. It was usually the task of the industrial chemist to sift the experiences and observations of an industry, to fit them into a scientific framework, and to convert an applied art into an applied science. In this sense the industrial chemist was very often a Jack of all the scientific trades—chemist, physicist, engineer, microscopist, and so on. Among the purer scientists there were still some who ignored, or who almost resented, the existence of problems which could not be interpreted solely in terms of their own field of specialised knowledge; but the industrial chemist, Jack-of-all-trades though he might be, certainly possessed the larger share of the true scientific spirit. It might be, in the course of time, that our teaching institutions would realise that a very special and highly qualified training was necessary to fit a man for a technical career. It might be that our Industrial Research Institutions would realise that a university pattern of research organisation was the very least adapted to the purpose, and might well result in failure. This was a point of view which would be appreciated by every working chemist who was engaged in the cotton industry.

The simplest conception of cotton bleaching was of a process designed to produce pure white material from originally brown or grey raw cotton; actually the process was something very much more intricate and delicate. The practical aims of the bleaching industry were, first of all, the production of pure white cotton which was permanently white in all the conditions under which cotton was stored, and, further, to do this without sacrificing any of its other textile qualities. Secondly, it was to produce material in the very best condition for subsequent processing, *i.e.*, printing, dyeing and finishing. For example, the material must exhibit perfectly definite and predictable behaviour towards all classes of dyestuffs, a condition only fulfilled by efficiently bleached cotton, or, again, the material must wet rapidly and uniformly. To understand the importance of this property, it was only necessary to consider those finishing processes akin to parchmentisation designed to

produce a stiff linen-like feel in cotton. In these processes cotton was treated with concentrated sulphuric acid solutions. It lay within the nature of things that the duration of such treatment must be measured in seconds only. During a very short time the cotton must wet perfectly with a viscous liquid; any wetting failure would result in local soft patches and would ruin the finish. Thirdly, the finishing qualities were very much influenced by the nature of the bleaching process.

Before any complete system of bleaching control could be established, it was necessary to isolate every factor which affected the attainment of these objects, and quantitatively to specify its effect. This consideration set the proper lines for industrial research into the process. Work along these lines very soon conveyed the conviction of the impossibility of defining the practical aims of bleaching in purely chemical terms. Variations in the structure of a material affected the textile qualities to at least as great an extent as did variations through chemical composition.

Raw cotton freed from mechanical impurities contained, apart from its natural moisture content, 90 to 95% of cellulose and 5 to 10% of substances other than cellulose. The effect of bleaching was to produce a progressive purification of the cellulose, in the sense that it eliminated from the cotton substances other than cellulose. Bleaching invariably produced a chemical change, however slight, in the properties of the cellulose itself, and different bleaching processes differed in the extent of this chemical modification of the cellulose.

Turning to the oxidising agents, Dr. Clibbens stated that normal pure cotton possessed little or no reducing action under ordinary circumstances. Cotton which had been treated with hypochlorites exhibited, however, to a greater or less extent pronounced reducing action, depending upon the conditions of the treatment. This enhanced reducing power could nearly always be detected in commercially bleached cotton. In the same way, treatment of cotton with hypochlorites might increase the acidic properties of the cotton. These changes of increased reducing power and acidity had been ascribed to the formation of a primary oxidation product of cellulose to which the name oxy-cellulose had been given, but the term was simply an academic cloak of ignorance. It was highly probable that the reducing power and the acidic properties of oxydised cotton were due to a complicated mixture of high physical and chemical complexity.

OTTAWA SECTION

There was a good attendance at the meeting held on February 17, presided over by Mr. A. E. MacRae. Dr. L. F. Goodwin spoke, his subject being "On the chemistry of lignin."

It was pointed out that this title did not signify a lecture on the constitution of lignin, but rather a review of the evidence of what constituents have been shown to exist in the molecule as well as those which are probably there. Lignin may be defined as that which is removed from wood when this is cooked with sulphite, etc. Most investigations of lignin have been performed on what at the best cannot be considered a pure, unchanged substance owing to the far from mild methods employed to remove cellulose. Empirical

formulae proposed for lignin are quite complex, and are based mainly on results of analyses of a substance of doubtful primary purity; also for these bodies of high molecular weight analytical results will fit many different figures. Methoxy, acetyl and hydroxyl groups are certainly present in the molecule, and among the debatable questions are the presence of aldehyde, ketone (or carbonyl) groups, and an ethylene linkage. Attempts have been made to sulphonate lignin and purify the ligninsulphonic acid; this proves difficult from the colloidal nature of the product. Klason obtained a crystalline salt with β -naphthylamine and demonstrated two different acids corresponding to what are generally termed α - and β -lignins.

Dr. A. E. Macintyre, in the ensuing discussion, suggested that it is of interest to consider how lignin is formed in nature. He thought that probably the glucoside coniferin in the cambial sap hydrolysed to coniferyl alcohol, which was successively modified to vanillin and proto-catechuic aldehyde, the necessary methylating agent being the formaldehyde always present in plants.

CALENDAR OF FORTHCOMING EVENTS

- Mar. 11. INSTITUTE OF CHEMISTRY, 30, Russell Square, London, W.C.1, at 8 p.m. "The growth of the profession of chemistry during the past half-century," by A. Chaston Chapman.
- Mar. 14. INSTITUTE OF CHEMISTRY, *Leeds Area Local Section*. "The chemist in the food industry," by B. G. McLellan. (*Postponed from Feb. 14.*)
- Mar. 14. INSTITUTE OF BREWING, *London Section*. Engineer's Club, Coventry Street, Piccadilly, W.1, at 8 p.m. "A review of the Institute of Brewing Research," by H. Lloyd Hind. (*Not on Mar. 8 as previously announced.*)
- Mar. 14. INSTITUTION OF THE RUBBER INDUSTRY, *London Section*. Engineers' Club, Piccadilly, W.1, at 8 p.m. "Rubber pigments from the point of view of the manufacturer," by C. A. Klein.
- Mar. 14. INSTITUTE OF METALS, *Scottish Local Section*, 39, Elmbank Crescent, Glasgow, at 7.30 p.m. Annual General Meeting. "Moulding sands," by G. W. Tytoll.
- Mar. 14. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Cantor Lecture) "Some industrial applications of electrothermics," by G. I. Finch. (*Also on Mar. 21 and 28.*)
- Mar. 15. HULL CHEMICAL AND ENGINEERING SOCIETY, Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m. "Hydro-electric power in the Argentine," by H. Peek.
- Mar. 16. SOCIETY OF CHEMICAL INDUSTRY, *South Wales Section*. Technical College, Mount Pleasant, Swansea, at 7.30 p.m. "Further notes on pure chemicals," by E. A. Tyler.
- Mar. 16. SOCIETY OF CHEMICAL INDUSTRY, *Liverpool Section*. Annual Section Meeting. The University, Liverpool, at 6 p.m., to be followed by a joint meeting with the Liverpool and North-Western Section of the Institute of Chemistry. "Bio-chemical aspects of the nature of life," by Prof. J. C. Drummond. (*Not on the 18th.*)

- Mar. 16. **ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY**, Northampton Polytechnic Institute, St. John Street, Clerkenwell, London, E.C.1, at 8.15 p.m. Discussion on "Electrodeposition of alloys."
- Mar. 16 **SOCIETY OF GLASS TECHNOLOGY**. Meeting in Birmingham.
- Mar. 16. **INSTITUTE OF CHEMISTRY**. *London Section*. 30, Russell Square, W.C.1, at 8 p.m.
- Mar. 17. **INSTITUTE OF METALS**, *London Local Section*. Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, London, S.W.1, at 7.30 p.m. "The works' chemist," by C. E. Barts.
- Mar. 17. **INSTITUTE OF BREWING**, *North of England Section*. Midland Hotel, Manchester. "Notes on bacterial infection of beers, and a special case," by C. G. Matthews and G. C. Matthews.
- Mar. 17. **CHEMICAL SOCIETY**, Burlington House, Piccadilly, W.1, at 8 p.m. *Ordinary Scientific Meeting*. "Tetrachloro - (triaminopropane - γ - monohydrochloride)-platinum, a new type of optically active complex salt," by F. G. Mann.
- Mar. 18. **CHEMICAL ENGINEERING GROUP AND THE INSTITUTION OF CHEMICAL ENGINEERS**. Joint meeting with the Coventry Engineering Society. "The importance of chemistry to the engineer," by Prof. J. W. Hinchley.
- Mar. 18. **SOCIETY OF DYERS AND COLOURISTS**, *Manchester Section*. 36, George Street, Manchester, at 7 p.m. "Cotton cellulose and cellulose artificial silks: A comparison of some fundamental physical and chemical properties," by A. J. Hall.
- Mar. 18. **BIOCHEMICAL SOCIETY**. University College, Gower Street, W.C.1. (1) "Carbohydrate metabolism of the brains of normal and diabetic animals," by B. Holmes and E. Holmes. (2) "Phosphagen," by P. Eggleton and M. G. Eggleton. (3) "The phosphorus of caseinogen," by C. Rimington and H. D. Kay. (4) "Observations on the sulphhydryl-disulphide system," by R. K. Cannan and B. C. J. G. Knight. (5) "Estimation of adrenaline," by L. C. Baker and G. F. Marrian. (6) "Observations on the adrenals of rats with relation to vitamin B," by L. C. Baker, G. F. Marrian and J. C. Drummond. (7) "The relation of vitamin B deficiency to inanition in the pigeon," by S. Kou and J. C. Drummond. (8) "The relation of certain dietary factors in yeast to growth on diets rich in protein," by A. Hassan and J. C. Drummond. (9) "The presence of calcium salts of glyceridephosphoric acids in the ether extract of cabbage leaf cytoplasm," by H. J. Channon and A. C. Chibnall. (10) "Some sterol colour reactions in their relation to vitamin A," by O. Rosenheim. (11) "Some observations on the dual nature of vitamin B," by M. H. Roscoe. (12) "A simple automatic apparatus for the rapid, quantitative removal of ammonia from solutions," and (13) "The pulsating bubble: a device for preventing 'bumping' in boiling liquids," by R. V. Stanford. From 3 to 4 p.m., the following demonstrations will be given:—(1) "An apparatus for propelling air round small enclosed circuits," by F. M. Haines. (2) "The chemistry of phosphagen," by P. Eggleton and M. G. Eggleton. (3) "The bacterial pigment pyocyanine," by R. K. Cannan and B. C. J. G. Knight.

CHEMICAL SOCIETY

Important announcements were made at a meeting on March 3 concerning the Annual General Meeting and Anniversary Dinner, to be held on March 24 at 4 p.m. and 7 for 7.30 p.m. respectively.

The President, Prof. H. Brereton Baker, C.B.E., F.R.S., announced that, no ballot being necessary, the following would then be declared elected: Vice-President who has filled the office of President, Prof. H. B. Dixon, C.B.E., F.R.S.; Vice-Presidents, Prof. G. G. Henderson, F.R.S., and Prof. A. Smithells, C.M.G., F.R.S.; Members of Council, Mr. E. R. Bolton, Prof. J. C. Drummond, Prof. J. F. Spencer, Mr. M. P. Applebey, Prof. J. E. Coates, O.B.E., and Dr. E. K. Rideal, M.B.E. The Presidential Address would be entitled "Experiments on molecular complexity."

Tickets for the Dinner to be held at the Hotel Victoria, King Edward VIIth Rooms, Northumberland Avenue, W.C.2, can be obtained from the Assistant Secretary, price 12s. 6d. each. It was announced that the Presidents of the following societies have accepted the invitation of the Council to attend the Dinner:—

The Royal Society.
The French Chemical Society.
The German Chemical Society.
The Italian Chemical Society.

The President expressed the hope that a large and representative gathering would be present to welcome these and other distinguished guests.

Fellows desiring to receive a copy of the List of Fellows for 1927 must make application by July 31, 1927.

Mr. R. W. Lunt described:—

The Decomposition of Carbon Monoxide in the Corona due to Alternating Electric Fields. Part II. [With R. Venkateswaran.]

A PRELIMINARY quantitative investigation has been made of the properties of the substance which is formed when carbon monoxide, at pressures from 200 to 690 mm., is subjected to ionisation by collision produced by alternating electric fields of frequency two hundred and fifty cycles per second. It has been shown that this substance reacts with water forming carbon dioxide, a brown solution containing oxalic acid and colloidal particles, and a dark coloured insoluble residue; and that, when removed from the vessel in which it had been produced, it has the empirical composition represented by $C_5O_3 \cdot x H_2O$.

The President remarked that the presence of water could be accounted for by the evolution of adsorbed water from the glass surface. He had used electric discharge for driving out such moisture from parts of apparatus which could not be heated strongly. He suggested that the author might have made a more important discovery than the one he had claimed. It seemed possible that the substance was a mixture of carbon with the often sought oxalic anhydride, C_2O_3 .

Mr. Lunt replied that experiments were in progress to determine how far the water might be ascribed to the presence of adsorbed moisture. He did not claim that the substance of empirical formula C_5O_3 was necessarily

an individual compound, but it was noteworthy that the composition remained the same over a wide range of pressure.

Prof. T. M. Lowry discussed:—

The Properties of the Chlorides of Sulphur. Part I. Freezing Points. [With L. P. McHatton and G. G. Jones.]

(a) Samples of sulphur chloride, which have been heated to 100° in sealed tubes in order to bring about a condition of equilibrium, give a freezing-point curve which exhibits not only the familiar maxima due to the crystallisation of S_2Cl_2 and SCl_2 , but also two well-defined breaks which are attributed to the crystallisation of SCl_2 and of a trisulphur tetrachloride, S_3Cl_4 .

(b) Although an equilibrium-mixture having the composition of sulphur dichloride deposits sulphur tetrachloride on freezing, freshly-prepared mixtures of sulphur monochloride with an over-chlorinated sample of sulphur dichloride exhibit a maximum freezing-point at the composition SCl_2 , which disappears when the mixture is brought to a condition of equilibrium. This is attributed to a rapid production of sulphur dichloride, followed by a slower process of destruction, perhaps $S_2Cl_2 + SCl_4 \rightarrow 3SCl_2$ and $2SCl_2 \rightarrow S_2Cl_2 + Cl_2$.

(c) Sulphur dichloride has been frozen out from freshly prepared mixtures, prepared as under (b), and has been recrystallised from light petroleum by cooling the solution with liquid air.

In reply to Mr. M. Zvegintzov, Prof. Lowry agreed that no indication would be obtained of the presence of any liquid lower chloride which was miscible with the solvent.

SOCIETY OF PUBLIC ANALYSTS

The annual general meeting was held at the Chemical Society's Rooms, Burlington House, on March 2, when the President, Mr. E. Richards Bolton, delivered his annual address.

The following were elected as officers and council for the year 1927: President, E. Richards Bolton; Past Presidents, serving on the Council, Leonard Archbutt, A. Chaston Chapman, Bernard Dyer, P. A. Ellis Richards, Alfred Smetham, G. Rudd Thompson, E. W. Voelcker, J. Augustus Voelcker. Vice-Presidents, R. L. Collett, C. H. Cribb, John White. Hon. Treasurer, Edward Hinks. Hon. Secretary, F. W. F. Arnaud. Members of Council, L. K. Boseley, H. E. Cox, John Evans, J. Golding, J. T. Hewitt, H. T. Lea, E. K. Rideal, W. H. Roberts, E. H. Merritt, W. H. Simmons, M. S. Salamon, James Wood.

An ordinary meeting of the society then followed, the President, Mr. E. R. Bolton, being in the chair.

Certificates were read for the first time in favour of:— Alfred George James Lipscomb, B.Sc. (Lond.), A.I.C., William L. Matthews, Sydney John Rogers, B.Sc., F.I.C., Ernest Fred Waterhouse, Harold William Webb, Arthur Samuel Wood, M.Sc., Ph.D., A.M.I.Chem.E.

Certificates were read for the second time in favour of:— W. G. Carey, F.I.C., W. F. Elvidge, B.Sc., A.I.C., L. S. Fraser, B.Sc., A.R.C.Sc., A.I.C., F. P. Hornby, B.Sc., A.I.C., G. R. Lynch, O.B.E., M.B., D.P.H., E. C. Martin, G. G. Philip.

The following were elected members of the society:— Solomon Greenberg, F.I.C., Frank Crafer Ray, M.A., F.I.C., and Geoffrey Charles Matthews, B.Sc., A.I.C.

The President, Mr. E. Richards Bolton, F.I.C., in his address, gave a blessing to the new Preservatives Regulations, which, he said, placed both the public analyst and the manufacturer in a much happier position than they were in before, because they prevented an unreasonable analyst from extremes of unreasonableness, and confined each and every manufacturer within limits beyond which his competitors could not reap an unfair advantage without risk of punishment. He complimented the free press, which by its habit of continually depreciating our actions spurs us on to better things; but he warned us not to be led astray by alarming articles magnifying a few cases of adulteration, thus causing the public to think that we live in the year 1820 when Accum wrote "Death in the Pot." He gave figures to show how the adulteration of food was steadily decreasing, which he attributed partly to the activity of the authorities, and partly to the efficiency of the public analysts. He urged the manufacturers to avail themselves of the services of a chemist to maintain the purity of their products and advise them in order to enable them to avoid any contravention of the law. Finally, he gave it as his opinion that the food of the country was never in a purer state than it now is.

A paper on "Cacao butter substitutes and their detection" was read by A. W. Knapp, B.Sc., J. E. Moss, M.Sc., and A. Melley. The most useful single test is the determination of the "titre" of the fatty acids, and, in the absence of certain other fats (e.g., coconut oil), this test enables the amount of Borneo tallow in admixture with cacao butter to be approximately determined after reference to a curve. A new method of determination has been based on the fact that the green colour of Borneo tallow is not bleached by ultra-violet light, whereas the yellow colour of cacao butter is readily bleached. A weighed quantity of the fat is exposed for six hours to the rays of a standardised quartz mercury vapour lamp, and the colour then compared with the colours of a set of standards containing definite amounts of Borneo tallow.

"The determination of illipé butter in chocolate" was discussed by H. W. Bywaters, D.Sc., F. T. Maggs, M.Sc., and C. J. Pool. A method is based on the fact that melted illipé butter becomes turbid at a much higher temperature than cacao butter, and that the turbidity temperature determined under definite conditions is practically constant for different specimens of the two fats. The method enables the amount of illipé butter in a mixture of the two fats separated from chocolate to be determined with a fair degree of accuracy. If a third fat (e.g., milk fat) is also present, the percentage of illipé butter may still be found by reference to a curve, provided that the amount of the third fat can be ascertained.

In a "Study of the determination of saccharin colorimetrically and by the ammonia process," A. F. Lerrigo, B.Sc., F.I.C., and A. L. Williams, A.I.C., described work done under the Analytical Investigation Scheme. The authors have studied five colour reactions of saccharin under variable conditions, and have found

that none of them gives quantitative results. On the other hand, the ammonia process (in which saccharin is converted into the ammonium salt of sulphobenzoic acid, the ammonia in which is determined by distillation) has been adapted to the determination of small quantities of saccharin.

INSTITUTE OF CHEMISTRY

At the 49th annual general meeting, held at 30, Russell Square, Prof. G. G. Henderson, the President, remarked that there appeared to be some abatement of the enthusiasm for chemistry as a career which was noted immediately after the war, although the roll of membership had increased by 242 during the year, to a total of over 5,200. It had not been the policy of the Institute to adjust the stringency of its regulations and examinations on any principle of supply and demand, but rather to indicate to those who believed that they had a bent for the science that it does not necessarily lead to fortune, that it calls for hard work and sacrifices, and, since the supply of chemists at present exceeds the demand, more than average ability is required for even moderate success. The industries of the country did not sufficiently absorb the scientific talent supplied by the universities, and it was to be deplored that many graduates had to turn to other callings.

The President then referred to the loss sustained by the death of Sir William Tilden, Past President, Sir John Burchmore Harrison, Prof. E. H. Rennie, Dr. J. J. Acworth, Mr. J. Webster and others, and reviewed the work of the various committees. He referred to the substantial legacy of about £5,000 bequeathed to the Institute by Sir Alexander Pedler.

The Legal and Parliamentary Committee had made representations to the Departmental Committee on the Poisons and Pharmacy Acts regarding the use of the title *chemist*, which in this country, as in no other, is confused with the profession and craft of pharmacy, and expressed the hope that the public would come to realise that it should be applied to those who seriously pursue the science and practice of chemistry in the investigation of the secrets of nature and in its application to the arts and manufactures. He knew that the difficulties were great, but hoped that the pharmacists, who were so fortunate in alternative designations, would realise how seriously the profession, to which they must acknowledge much indebtedness, was hampered by the existing confusion, and how far-reaching was the effect of this confusion in hindering the proper recognition by the community at large of the importance of the chemist and his science to industry and trade.

In October the Institute will celebrate its Jubilee, and a medal and prize have been established in honour of the first President, Sir Edward Frankland, who held office from 1877 to 1880; the award will be made to a registered Student for the best essay on a set subject of professional, as opposed to technical or purely chemical, importance. The subject for the first essay will be "The importance of chemistry to the welfare of the people."

The Public Appointments Committee is reviewing the position of public analysts under the Sale of Food and Drugs Acts, having particular regard to the increasing

duties and responsibilities imposed upon these officers, in respect of which local authorities in general had allowed very little or no additional remuneration.

Discussions on the subject of registration were proceeding at meetings of the local Sections of the Institute, which had been invited to submit concrete suggestions for the consideration of the council. The Institute had been given authority in 1885, by Royal Charter, to examine, to grant certificates of competency, and to register persons qualified to practise chemistry, and the council had done everything that reasonably could be done to provide for the admission to the ranks of the Institute of all who could claim to be trained and competent chemists. It was felt by many that the time had come to prepare some form of wider register of chemists of various grades, possibly with the ultimate object of securing powers for the restriction of practice to those who are duly qualified.

The position of the Institute was becoming steadily consolidated, and its place in the affairs of the country more and more definitely acknowledged. Its sections in all parts of the country were united in striving to secure adequate recognition of the national importance of chemistry. He hoped that when industrial activity was more fully restored, chemists would have greater opportunities of showing what they could do to help in maintaining the economic position of the country, and would themselves participate in the results, on a scale more representative of their deserts than they had done in the past.

On the completion of his term of three years in the office of President, Prof. Henderson acknowledged his appreciation of the support which he had received from the council and officers, and extended a welcome to Prof. Arthur Smithells, C.M.G., F.R.S., who is to succeed him in the chair.

The officers and council for the ensuing year were duly elected as follows:—

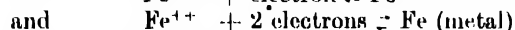
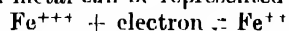
President—Prof. Arthur Smithells, C.M.G., F.R.S.
Vice-Presidents—Mr. E. R. Bolton, Dr. H. G. Colman, Mr. E. M. Hawkins, Prof. G. G. Henderson, D.Sc., F.R.S., Dr. R. H. Pickard, F.R.S., Prof. J. F. Thorpe, C.B.E., F.R.S. *Hon. Treasurer*—Mr. Patrick H. Kirkaldy. *General Members of Council*—Mr. F. W. F. Arnaud, Dr. T. Lewis Bailey, Mr. H. C. L. Bloxam, Mr. Arthur J. Chapman, Dr. F. D. Chattaway, F.R.S., Dr. G. C. Clayton, C.B.E., M.P., Dr. W. Clayton, Prof. J. W. Cobb, C.B.E., Dr. W. M. Cumming, Prof. J. C. Drummond, D.Sc., Dr. Bernard Dyer, Mr. A. Vincent Elsdon, M.B.E., B.Sc., Mr. A. G. Francis, B.Sc., Prof. Thomas Gray, D.Sc., Prof. I. M. Heilbron, D.S.O., D.Sc., Mr. Edward Hinks, M.B.E., B.Sc., Dr. H. H. Hodgson, M.A., Mr. Bernard F. Howard, Prof. C. K. Ingold, D.Sc., F.R.S., Mr. A. W. Knapp, B.Sc., Mr. T. Macara, Mr. B. G. McLellan, Mr. L. G. Radcliffe, M.Sc., Dr. Alfred Rée, Dr. E. K. Rideal, M.B.E., Mr. W. Rintoul, O.B.E., Mr. F. Scholefield, M.Sc. *District Members of Council*—Dr. D. F. Twiss, Mr. Frank Southerden, B.Sc., Dr. Richard Thomas, Mr. L. Eynon, B.Sc., Mr. William Marshall, Dr. P. E. Bowles, Mr. J. A. Watson, A.C.G.I., Mr. W. H. Coleman, Mr. C. M. W. Grieb, B.Sc., Mr. J. W. Totton, B.A., B.Sc., Dr. A. G. G. Leonard, B.Sc., F.R.C.Sc.I., Dr. F. Dent, M.Sc.

CORRESPONDENCE

OXIDE CATALYSIS

SIR,—In connexion with the specific subject of oxide catalysis as distinct from general surface action, can any of your readers say whether any quantitative measurements have been (or can be) made to determine the nature of the electrical charges on solid surfaces or gaseous masses due to the alternate reduction and re-formation of oxides?

I have in mind the marked activity of such oxides as those of iron, manganese, cobalt, vanadium, copper, etc., where it is possible to have the metal atom (or ion) in various degrees of oxidation. If, for instance, the conversion (in solution) of ferric compounds into ferrous compounds and metal can be represented by the expressions



or if, generally, we regard oxidation as a matter of electron losses, then in any reducible metallic oxide mass or surface which is acting as a catalyst for oxidation-reduction reactions, there will most likely be momentarily free electrons due to the equilibria $\text{Fe}_2\text{O}_3 \rightleftharpoons \text{Fe}_3\text{O}_4 \rightleftharpoons \text{FeO} \rightleftharpoons \text{Fe}$.

The appropriation of these electrons by reacting atoms would seem to be intimately wrapped up with the abnormal velocity of chemical reactions which we know as catalysis using the concept of reaction as pictured by G. N. Lewis, I. Langmuir, and others.

Even the mysterious and useful word "activation" might be pinned down if we could get hold of a measurement of the rate of liberation and appropriation of electrons due to alternate oxidation and reduction of the metallic atom (or even non-metallic atom) of which the catalyst is made up. Failing this, a quantitative relationship between charge, rate of charging upon the surface of the catalyst and the amount of reaction produced per gram molecule or gram atom of matter converted would be of value.

I am aware that the question of the hen, the egg and their relative claims to priority may be raised in this connexion by healthy sceptics and first cause enthusiasts, but I am also of the opinion that to raise it is unnecessary.

So far, the only work which has caught the eye of the writer is the valuable qualitative work done by Bone and his co-workers in connexion with the Gas Engineers' Fellowship at Leeds University and some interesting work done recently on the charges remaining on gases after partial and complete combustion. The products of complete combustion (not necessarily "surface" combustion) are electrically neutral, whilst the products of an incomplete reaction are not neutral.

Such work as is known does not, however, so far as one can see, throw light on the specific point raised here, which is that the cloud of electrons possibly produced by the rapid, alternating reductions and oxidations of the catalytic surface might serve as the active influence in promoting vigorous reaction at the surface of oxidisable catalysts. It is quite possible that the term "oxidisable" may have to be made quite elastic so as to include such things as the silver oxygen complex.

If any of your readers can help and are willing to do so it might prove to be a matter of great interest and possible general utility.

Yours faithfully,

H. H. GRAY

AN ABSORBENT FOR OXYGEN

SIR,—In the JOURNAL for February 18, Mr. H. F. Taylor enquired about the action of carbon monoxide on Hartshorne and Spencer's reagent for absorbing oxygen, viz., a chromous chloride amalgamated zinc mixture. This reagent has been used in this laboratory for removing oxygen from carbon monoxide, carbon dioxide and nitrogen, for which purpose it has proved rapid and effective. When brought into contact with carbon monoxide in the absorption vessel of a Bone and Wheeler gas analysis apparatus no measureable absorption occurred. Thus it might serve as a reagent in flue gas analysis. There are indications, however, of a slow evolution of hydrogen on standing, but this is perhaps negligible for many purposes.

Yours faithfully,

H. T. ANGUS

Department of Coal Gas and Fuel Industries,
The University, Leeds

THE SPACE FORMULA OF DIPHENYL

SIR,—My attention has been drawn to the article in your issue of November 12, 1926, on "The Space Formula of Diphenyl," by Messrs. Turner and Le Fèvre, and to subsequent correspondence by Messrs. Bell and Kenyon, Mills, and the first-mentioned writers. Dr. Christie has also forwarded me a copy of his letter in reference to the same subject.

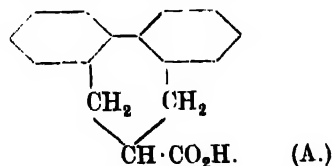
This contribution must arrive much later, but I may perhaps also be permitted to indicate my attitude towards the problem. This is the more desirable since a series of circumstances have latterly prevented me from finally preparing a quantity of results for publication, and it now appears that Messrs. Bell and Kenyon have taken the very unusual course of entering a field of work opened up by my collaborators and myself, without any inquiry as to our plans for future work. Messrs. Turner and Le Fèvre have given an impartial expression on this aspect of the matter, whilst Dr. Christie has referred to the overlapping which, as might have been anticipated, has immediately resulted. It is therefore unnecessary for me to comment further in this direction.

The unprecedented character of the isomerism represented by the optically active forms of the diphenic acids decided me at the outset to do nothing more than indicate in the most general manner possible alternative explanations, and to seek a decision between them by experiment rather than to express definite preference. It was, however, pointed out to me by Sir William Bragg, immediately after the first publication on the subject, that the crystal structure of diphenyl is definitely in disagreement with the Kaufler formula, and the data bearing on this point have since been published (X-rays and Crystal Structure, 1924, page 251). In 1922 it seemed to me that the comparisons between the results of X-ray analysis of crystals and those of stereochemical investigation were not sufficiently numerous to render the evidence of crystal structure conclusive in regard to separate molecules. Since that time, however, apart from definite expressions of opinion on the point (compare, for example, Annual Reports of the Chemical Society, 1923, 20, 232; 1924, 21, 220), the gradually increasing weight of experimental evidence has suggested

that in the great majority of cases, if not in all (and this is at the moment the subject of active controversy), there is close correspondence between the two. For this reason, I had for some time past discarded the Kaufler formula as a basis of investigation, and the work of Messrs. Turner and Le Fèvre has provided a welcome confirmation of the correctness of this attitude.

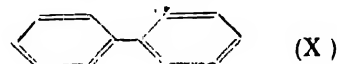
As indicated in the first paper on the subject of the optically active diphenic acids, the simplest alternative is a formula in which the planes of the two benzene nuclei are inclined to each other about a common axis. As Messrs. Turner and Le Fèvre have emphasised, all instances of asymmetry among these compounds so far recorded are those of structures which have either three or four of the 2, 2', 6, and 6'-positions occupied by substituents, and I may add that further instances of this kind have been observed in 6-nitro-, 4:6:4':6'-tetrabromo-, 4:4'-dicarboxy-6:6'-dinitro-, and 6:6'-dimethoxy-diphenic acids, as well as 2:2'-dinitro-6:6'-dichlorodiphenyl-4:4'-dicarboxylic acid. The last case shows that carboxyl groups in the 2:2'-position are not essential to the occurrence of isomerism. On the other hand, no resolution of 4-nitro-, 4:4'-dinitro-diphenic acids or of certain other similarly constituted compounds has so far been achieved, although further experiments are always desirable in such cases.

These results, together with the repeated use I have made of steric conceptions in other directions, had predisposed me in favour of a view such as has now been enunciated by Dr. Mills as a basis of explanation of the observed asymmetry. Again, however, before committing myself to this fairly obvious hypothesis, I have proposed to test it experimentally by the examination of (a) other compounds with only three of the positions in question occupied; (b) 3:5:3':5'-compounds analogous to the 2:6:2':6'-derivatives already mentioned. Unfortunately in this connexion, 5:5'-dinitrodiphenyl-3:3'-dicarboxylic acid is not accessible by the usual procedure, but the synthesis of other acids and bases of this type is in progress; (c) derivatives of fluorene and diphenylene oxide in which the plane configuration of the five-membered ring might be expected to inhibit isomerism of the type in question. The case of 6:6'-dimethoxydiphenic acid is the logical preliminary, and my plans in this direction had already been made when the work of Mills and his collaborators on fluorenone-4-carboxylic acid was published; (d) diphenyl-2:6:2':6'-tetracarboxylic acid and its derivatives, and thus to obtain indications whether, as seems probable, the planes of the two benzene nuclei are at right angles; (e) 6:6'-difluorodiphenic acid as a compound with two substituents of small "atomic volume."



There is still another avenue of approach to this matter which, whilst perhaps less direct, is nevertheless that by which the problem was first revealed, and that is in connexion with the formation of seven-membered

rings from 2:2'-ditolyl. At the time of these observations, I suggested they were explicable in terms of the ordinary strain theory on the basis of a plane configuration of the seven-membered ring, and experiments are now in progress to test this by the resolvability or otherwise of the acid (A) and its derivatives with substituents in the benzene nuclei. The interest of this lies in the fact that a consideration of the strainless form of the seven-membered ring indicates that such a structure might, though perhaps improbably, be attached to the two benzene nuclei of diphenyl if these are twisted relatively to each other as might be the case in diphenyl derivatives; but that in that case the acid would be asymmetric in structure, and this latter would be sufficiently rigid (as contrasted with the lability of the free strainless seven-membered structure) to permit of the application of the ordinary tests. Quite apart from its intrinsic interest in connexion with the ordinary theory of ring structure, this matter has a direct bearing on the diphenyl problem, for there are indications, on which I once commented in discussion at a meeting of the Chemical Society, but which I have so far been prevented from examining more closely, that substitution affects the ease of formation of the seven-membered rings in question. Whereas the acids which have been shown to be asymmetric in structure are easily convertible by the usual procedure into their chlorides, this is not the case with diphenic acid itself, which under ordinary



conditions yields the anhydride. This would easily be explained if the plane structure of (A) be verified, by assuming that the presence of one or more substituents in the 6- and 6'-positions militates against the attainment of a plane molecular configuration. Reasons of this kind render me doubtful whether diphenic acid or its derivatives will prove to be resolvable. The results of the two lines of inquiry would thus converge towards the same conclusion.

I need only refer to the possibility of obtaining still further evidence from a study of derivatives of diphenylmethane and dibenzyl in order to mention that experiments on the synthesis of the latter have also engaged my attention.

Pending the outcome of these various investigations, the simple steric explanation makes a greater appeal to me than that put forward by Messrs. Turner and Le Fèvre. It seems to me improbable that their formula (X) represents as saturated, and therefore as stable, a condition as the ordinary one. In applying, too, conceptions of mutual saturation of residual affinities, regard must be paid to the kind of these. From this point of view, it would seem doubtful whether carboxyl groups would tend to stabilise a plane configuration in the manner suggested. Accepting, however, this proposition for a moment, and its derivation from Flürscheim's theory, nitro-groups might also be expected to exert a similar influence. Yet 6:6'-dinitrodiphenic acid is asymmetric. In fact, my object in studying the variety of compounds previously referred to was to ascertain whether the nature, in the sense referred to by Messrs.

Turner and Le Fèvre, of the substituents has any influence. It is seen that, in conjunction with the carboxyl or nitro-groups, both *ortho-para* and *meta-directive* groups can give rise to the isomerism. From this point of view, it only remains to examine compounds with four *ortho-para* directive substituents in the effective positions.

I trust, Sir, this discussion may have indicated not only my general position, but also that I am actively interested in regard to the problem first brought to light by my work. I venture, therefore, to hope that its further investigation along the lines indicated may be left in the hands of my co-workers and myself.

Yours faithfully,

J. KENNER

University of Sydney,
Department of Organic Chemistry

OBITUARY

DR. A. W. CROSSLEY, F.R.S.

With deep regret we record the death of Dr. A. W. Crossley, F.R.S., whose resignation of his post as Director of Research for the British Cotton Industry Research Association was announced only last week. Dr. Crossley, who was born in 1869, was educated in Owens College, Manchester, and also at Würzburg and Berlin, became Professor of Chemistry to the Pharmaceutical Society in 1904, and later Daniell Professor of Chemistry at King's College, London. In 1915 he was appointed Secretary to the Chemical Warfare Committee of the Ministry of Munitions, and became liaison officer for chemical warfare between the British and French Armies. In 1916 he was appointed Commandant of the experimental station of the Royal Engineers, and for his extremely important work was made C.M.G., C.B.E., and an officer of the Legion of Honour. After the war he was invited to become Director of Research to the British Cotton Industry Research Association and organised the well-known Shirley Institute in Manchester.

Dr. Crossley was elected to the Royal Society in 1907, and in 1918 was Longstaff Medallist of the Chemical Society. He had been foreign secretary of the Chemical Society for several years, and was elected to the presidency in 1925, but felt himself unable to continue in office owing to continued ill-health, which, in the last few months, prevented him from keeping in full control of the Shirley Institute.

To him was due the success and growing accomplishment of the Shirley Institute, and he was no less successful in gaining the confidence and esteem of the leaders of the British cotton industry than he was in co-ordinating the wide range of researches necessary in an industrial research association. In him were combined to an unusual degree the abilities of a chemist and an administrator, and British chemistry is all the poorer for his loss.

DR. LUIGI CASALE

The late Dr. Casale was born at Langosco (Lomellina) on November 22, 1882. In 1908 he graduated in chemistry at the Royal University of Turin, and obtained, in 1909, the Postgraduate Degree of the Royal Polytechnic of Turin. From 1909 to 1912 he acted as Assistant

Professor at the Institute of General Chemistry at Turin University, and in 1912 and 1913 took a special course of physical chemistry with Professor Nernst at Berlin. From 1913 to 1915 he was head of the Laboratory of Organic Synthesis in the Institute of General Chemistry at the University of Turin, and from 1915 to 1917 was head of the Laboratory of Pharmaceutical Chemistry at the University of Naples. While head of this laboratory he was principally engaged in the manufacture of poison gas for the Italian War Office.

It had been realised in official circles in Italy towards the close of the war that, owing to the absence of coal resources in Italy, special measures should be taken to develop the production of fixed nitrogen from sources



Dr. Casale (from a sketch made at a dinner in London in May, 1925).

other than coal. Italy is rich in water-power resources, and the important work of harnessing these resources for the manufacture of synthetic ammonia was entrusted to Dr. Casale. He commenced this research in 1917, when, owing to an attack of gas-poisoning, he had to relinquish the war-work on which he had previously been engaged. As a result of his researches ammonia was first produced in his laboratory in 1920, and within the short space of three years commercial plants capable of producing 3 tons and 7½ tons of ammonia respectively were in commercial operation on his process. In 1921 the Ammonia Casale Company, with a capital of 12,000,000 Swiss fr., was incorporated for exploiting the patents for the production of synthetic ammonia taken out by Dr. Casale.

Since 1923 the progress of the Casale process has been extraordinarily rapid. Manufacturing rights have been granted in most countries of the world, and plants are now in operation or in course of erection in some 15 countries. The remarkable development of the process will be obvious from the fact that the total capacity of the plants completed or in course of construction on Dr. Casale's system exceeds 250,000 tons of ammonia, or some 1,000,000 tons of ammonium sulphate per annum. It is interesting to note in this connexion that the world output of synthetic ammonia in 1925 was approximately 350,000 tons. The latest technical development for which Dr. Casale was responsible was the construction of large single units for ammonia synthesis, each unit being capable of producing over 20 tons of ammonia daily. At a conference, a week before his death, of the International Consultative Committee, which he formed some two years ago to advise his company, he stated that the size of this unit must not be taken as marking finality, as he was ready to produce units considerably larger immediately the demand for them arose. Units with an output of 20 tons per day designed by him, it may be added, are now installed in France and in Japan. During the past few years Dr. Casale has been engaged in the large industrial research laboratory equipped by him at Terni in Italy, on researches in connexion with the syntheses of methyl alcohol and of urea, and industrial plants based on these researches are expected to be in operation shortly.

It is fortunate that, notwithstanding the early death of this distinguished scientist, the principal work with which his name is associated, namely, the production of synthetic ammonia, can be regarded as being, from a technical point of view, complete. With rare foresight he had also, with a view to securing continuity of technical service for his company, appointed the International Consultative Committee, to which reference has already been made. The work of Dr. Casale was distinguished by exceptional thoroughness, by simplicity of design of the apparatus produced under his direction, and by the great care that was devoted to detail. Few men have been able to achieve so much in such an important field in so short a time. One of the tragedies of Casale's early death is that it prevented him from witnessing the realisation of his latest discoveries in the plants which have been built under his direct supervision at the works of the Società Italiana Ricerche Industriali at Terni, Italy, where he had erected his industrial research laboratory.

Dr. Casale's high qualities, personal charm, and exceptional ability gained for him a large number of friends, including many of distinction, and his achievements in applied chemistry have placed his name on the distinguished roll of eminent scientists which is one of the glories of his country.

J. F. CROWLEY

PERSONAL AND OTHER ITEMS

Last week Lord Balfour opened an exhibition in the Science Museum, South Kensington, which illustrates some of the work of the British Research Association for the Woollen and Worsted Industries.

Prof. D. A. Gilchrist, Professor of Agriculture at Armstrong College, Newcastle, and Director of the famous Northumberland County Agricultural Experiment Station at Cockle Park, has resigned his post on reaching the retiring age.

The Vice-Chancellor of Cambridge University, Dr. G. C. Lamb, Mr. C. T. Heycock, Sir William B. Hardy, Mr. F. F. Blackburn, and Mr. G. H. A. Wilson have been appointed a syndicate for the extension of the Low-Temperature Station for Research in Biochemistry and Biophysics.

The Department of Scientific and Industrial Research is considering the appointment of a Director of Research into the prevention of water pollution and cognate problems.

Mr. F. B. Guthrie, whose death, at the age of 65 years, is announced, had been chemist in the New South Wales Department of Agriculture for some thirty years.

We regret to learn of the death, at the age of 81, of Prof. Ira Remsen, who was one of the pioneers of American chemistry, both pure and applied. He was the author of several text-books and of numerous papers, and was the founder of the *American Chemical Journal*, which he edited until 1914, when he transferred it to the American Chemical Society, whose *Journal* took its place. Prof. Remsen was President of the Society of Chemical Industry during the year 1909—1910.

Prof. L. Spiegel, who died recently at Charlottenburg, aged 62, was the discoverer of the drug yohimbin, and had contributed largely to the literature of the alkaloids. He was a member of the editorial board of the "Chemische Centralblatt" for many years, and had published several books on pharmacology.

Technical Data

M. Ch. Marie, General Secretary of the International Committee responsible for the publication of the "Annual Tables of Constants and Numerical Data," announces the publication of a volume entitled "Numerical Data for Engineering—Metallurgy," extracted from Vol. V of the "Annual Tables." The volume, which is by M. L. Descroix, and contains a preface by Sir Robert Hadfield, Bart., F.R.S., includes all the data relating to engineering and metallurgy for the years 1917—1922 inclusive. The price of the volume is, paper backed, 105 francs, bound 126 francs, but to members of the Society of Chemical Industry the price is reduced to 78.75 francs and 94.50 francs, respectively.

A similar volume, also extracted from Vol. V of the "Annual Tables," and entitled "Numerical Data for Electricity, Magnetism, Electrochemistry," by M. G. Malapert, Dr. A. Buffat, Dr. G. I. Higson and Dr. K. Gordon, has also been published. The price—paper backed 56 francs, bound 77 francs—is reduced for members of the Society of Chemical Industry to 42 francs and 57.75 francs, respectively.

Analysis of British Standard Bull Head Rails

The British Engineering Standards Association announces an alteration to the chemical composition specified in the British Standard Specification No. 9, 1922, for bull head railway rails, an increase of 0.01%

for sulphur and phosphorus having been agreed to for "ordinary carbon" and "higher carbon" rails made by the acid open-hearth process, and also for phosphorus for "higher carbon" rails made by the acid Bessemer process. The revised figures are as follows:—

Steel made by the acid open-hearth process (ordinary carbon).	Phosphorus 0.07% max. Sulphur 0.07% max.
Steel made by the acid open-hearth process (higher carbon).	Phosphorus 0.06% max. Sulphur 0.06% max.
Steel made by the acid Bessemer process (higher carbon).	Phosphorus 0.07% max.

A slip giving the revised figures for insertion in existing copies of the specification may be obtained from the Association by forwarding a stamped addressed envelope to the British Engineering Standards Association (Publications Department), 28, Victoria Street, London, S.W.1.

Survey of the Rubber and Paint and Varnish Trades in 1924

"Preliminary Reports No. 2" of the Third Census of Production (1924) give information regarding the rubber, paint, colour, and varnish trades, from which we extract the following data:—

The rubber trade return shows a high production in motor-car and cycle tyres, rubber boots and shoes, and rubber-proofed garments. During the census year 1,907,500 rubber proofed garments, valued at £1,610,000; 7,237,400 inner tubes, valued at £1,218,000; and 1,927,100 motor-tyre covers, valued at £4,913,000, were produced. The total value of the rubber goods made and the work done is returned as £23,309,000, compared with £8,908,000 in 1907. Between 25 and 30% of the output of various classes of motor-tyre covers and inner tubes were exported, while imports exceeded exports in quantity, largely in motor-tyre covers, and to a small extent in inner tubes. The imports of cycle-tyre covers were 13% of the number made. Exports of solid rubber tyres were 15.5% of the total made, and the net imports amounted to 18%, and of the total production of rubber boots and shoes 26% were exported, the net imports being nearly 23%. £11,503,000 was the net output of the establishments which made returns, and the net output per person employed was £247, as compared with £124 in 1907. In 1924, 46,565 persons were employed, and in 1907 the number totalled 24,039.

In 1924 the total value of the output in the paint and varnish trades was £17,062,000, compared with £8,562,000 in 1907. Exports of boiled and refined linseed oil in 1924 amounted to 14,746 tons, and were about 70% of the recorded output. Exports of ochre, oxides, and earth colours were 9,800 tons, about 44% of the quantity produced, and of paints and enamels 36,900 tons, or about 22% of the output, were exported. About one-seventh of the total production of varnish, i.e., 1,378,000 gallons, was exported. The net output of the factories was £7,739,000, and per person employed £413, as against £198 in 1907. On an average 18,761 persons were employed in the industry during 1924, compared with 13,840 in 1907: the largest number of working staff employed in the industry in any week was 12,964 in June, and the smallest, 12,353, in January.

PARLIAMENTARY NEWS

Sugar Beet Factories

Mr. Guinness informed Mr. Thurtle that the total amount of subsidy on sugar and molasses received by the British beet-sugar factories in the manufacturing season 1925—26 was £1,124,207, and in the season 1926—27 up to February 28, 1927, was £3,041,083. The number of persons employed in the factories during these same periods was 4,613 and 7,194 respectively. With regard to adequate methods of treating the effluents from sugar-beet factories, arrangements had been made by the Department of Scientific and Industrial Research for certain investigations to be set on foot at the Rothamsted Experimental Station, by which it was hoped that the solution of this difficult problem might be advanced.—March 2.

Glaze Testing in Pottery Manufacture

In reply to Mr. Clowes, Sir W. Joynson-Hicks said that it was not the practice to take a sample of the glaze for testing purposes immediately after a pottery firm changed from lead glaze to leadless or low solubility glaze, but before the change took place the inspector must be satisfied that the glaze would conform to the prescribed standard. After that, reliance was placed mainly upon systematic routine sampling. The total number of samples taken under the Regulation was, in 1924, 83; in 1925, 97; and in 1926, 84.—March 3.

Paint (White Lead)

In answer to Mr. Viant, Sir W. Joynson-Hicks said that the explanatory letter issued with the draft Regulations under the Lead Paint Act stated that the terms of the Regulations had been discussed at a series of conferences with the industry, at which a complete agreement was arrived at. The reference here was to certain conferences held in 1922 for the purpose of determining what Regulations could be made in the event of the Geneva Convention being ratified. Conferences had not been held subsequently to the passing of the Act, and the draft Regulations were not the outcome of a fresh agreement. The sole object of the circular was to remind the industry of the previous discussions and the agreement then reached, which applied not only to external painting, but also to internal painting during the interval before the prohibition was to take effect. Since the issue of the draft Regulations there had been a further meeting with the representatives of the industry. This resulted in general agreement on the points discussed.—March 3.

Palm Kernels and Palm Oil from British West Africa

Mr. Amery informed Mr. Kelly that the total value of the exports of palm kernels and palm oil in 1914 was about £4,850,000, in 1924, £9,752,307, in 1925, £10,521,280, and in 1926, £10,500,000. The tonnage of these exports for the same years was 280,908 in 1914, 452,777 in 1924, and 475,941 in 1925.

COMPANY NEWS

JOSEPH CROSSFIELD AND SONS, LTD.

The accounts for the year to November 30, 1926, in which associated companies have been treated as branches of the business, show a profit of £398,611, including

£55,589 brought forward, after charging all repairs, renewals and alterations, depreciation and insurance. The profit for 1925 was £383,089. The dividends on the preference shares absorb £227,500, and the dividend of 10% on the ordinary shares (same for 1925) absorbs £100,000. The sum of £60,560 has been transferred to general reserve, leaving £10,551 to be carried forward. Reference is made in the report to the loss sustained by the company by the retirement of Mr. C. F. Huffam from the chairmanship. Mr. G. H. K. Kingdon has been elected as chairman.

WALKERS, PARKER AND CO., LTD.

The profit for 1926 amounted to £33,376, against £39,184 for 1925. The dividend is 11½% (same), and after placing £3,000 to employees' fund (same), there remained £64,094 to carry forward, against £62,967 brought in. Trade uncertainties still exist, but the directors point out that, owing to the policy of financial strength, the company is in an excellent position to meet abnormal circumstances.

LONDON AND THAMES HAVEN OIL WHARVES, LTD.

The profit for 1926, including £58,361 brought in, was £169,617, compared with £149,525 for 1925. A final dividend has been recommended on the ordinary shares of 5%, free of tax, making 10% for the year, and a bonus of 5%, free of tax, being the same as for the previous year, leaving £79,154 to be carried forward. The capital is to be increased to £1,000,000 by the creation of 500,000 £1 ordinary shares, of which £250,000 are to be offered to ordinary shareholders at £1 per share premium in the proportion of one new share for each two held.

BRITISH METAL CORPORATION

The net profit for 1926, after transferring £50,000 to reserve, amounted to £81,791, against £80,182 for 1925. A dividend has been recommended of 8% (same), leaving £23,278, compared with £19,967, to be carried forward. Mr. W. S. Robinson has been elected to the Board in succession to the late Mr. F. A. Govett. Besides being managing director of the Australian Board of the Broken Hill Associated Smelters Proprietary, Mr. Robinson is a director of several metallurgical companies, including the British Australian Lead Manufacturers.

INDESTRUCTIBLE PAINT AND STANDARD VARNISH CO., LTD.

The net profit for 1926 was £21,242, plus £2,264 brought in, compared with £23,300 for 1925. The directors recommend transferring £3,000 to reserve for income-tax, writing down goodwill £2,000, placing £2,500 to reserve account, and £5,000 to depreciation reserve. A final dividend has been recommended of 5% actual, less tax, making 10%, carrying forward £3,506.

NEW TRANSVAAL CHEMICAL CO., LTD.

For the year ended June 30, 1926, the net profit was £28,370, plus £28,686 brought in, after charging depreciation for the year, which compares with a profit of £47,897 for 1925. A dividend has been recommended of 10% on the ordinary shares, carrying forward £7,426. The effect of the agreement with the Associated Enterprise is not reflected in the accounts for 1926, as the scheme only came into operation as from July 1, 1926.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime—£7 10s. per ton, packages extra.
Bleaching Powder—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
Borax, Commercial—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
Copper Sulphate—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate—£38 per ton d/d.
Nickel Ammon. Sulphate—£38 per ton d/d.
Potash, Caustic—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
Salt Cake—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%—£21 per ton. Sod. Bicarbonate (refined)—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
Sod. Phosphate—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt)—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide—Golden.—6d.—1s. 5½d. per lb., according to quality.
Crimson—1s. 3d.—1s. 7½d. per lb., according to quality.
Arsenic, Sulphide, Yellow—2s. per lb.
Barytes—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide—2s. 9d. per lb.
Carbon Bisulphide—£20—£25 per ton, according to quantity.
Carbon Black—5½d. per lb., ex wharf.
Carbon Tetrachloride—£46—£55 per ton, according to quantity, drums extra.
Chromium Oxide, Green—1s. 2d. per lb.
Diphenylguanidine—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. R.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£7—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; ½s. per gal. 24° Tw.
 Red Liquor.—9d.—1s. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 6d.—6½d. per lb. Crude 60's, 1s. 8d.—1s. 9½d. per gal.
 Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 3d. per gal. Pale, 95%, 1s. 10d.—2s. 2d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 2½d.—1s. 3½d. per gal., ex works in tank wagons; Standard motor. 1s. 11d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 2d.—2s. 6d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 11½d. to 2s. 3d. per gal. Firm. Pure, 2s. 3d.—3s. per gal.
 Xylol.—2s. 3d.—3s. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%, 10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal.
 Naphtha.—Crude, 9½d.—1s. 0½d. per gal., according to quality. Solvent 90/160, 2s.—2s. 1d. per gal. Solvent 95/160, 1s. 9d.—1s. 10d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—95s.—110s. per ton, f.o.b. according to district.
 Pyridine.—90/140.—9s. 6d.—13s. per gal. Nominal. 90/180 — 7s. 6d. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£75 per ton d/d.
 Dinitrotoluenec.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—7d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4½d.—2s. 6d. per lb. Brisk.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots 1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 4d.—1s. 4½d. per lb. Less 5%. Firm.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 6d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 1½d. per lb. Less 5%. Firmer market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 3d.—11s. 6d. per lb.
 Animon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.
 Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d.—2s. 6d. per lb. Potassium.—1s. 11d.—2s. 1d. per lb. Sodium.—2s. 2d.—2d. 4d. per lb. All spot.

Calcium Lactate.—1s. 4d.—1s. 5d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Cresotic Carbonate.—6s. per lb.

Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—6s. 6d.—7s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £33 per ton net.

Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.

Mercurials.—Red oxide, 6s. 5d.—6s. 7d. per lb., Levig, 6s. 1d. per lb.; Corrosive sublimate, Lump, 4s. 8d.—4s. 10d. per lb., Powder, 4s. 3d. per lb.; White precip., Lump, 4s. 10d.—5s. per lb., Powder, 5s. 1d. per lb., extra fine, 5s. 1d.—5s. 2d. per lb.; Calomel, 5s. 3d.—5s. 5d. per lb.; Yellow Oxide, 5s. 10d.—5s. 11d. per lb.; Persulph B.P.C., 5s. 1d.—5s. 2d. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb.

Methyl Salicylate.—1s. 8d. per lb.

Methyl Sulphonal.—15s.—15s. 3d. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. 9d.—4s. per lb.

Phenazone.—5s. 9d.—6s. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 94s. per cwt., less 2½% for ton lots. Dearer.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb.

Salol.—3s.—3s. 3d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—77s. 6d.—82s. 6d. per cwt. net, according to quantity.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal 1s. 10d.—1s. 11d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—10s.—10s. 3d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 1d. per lb.

Thymol, Puriss.—11s. 6d.—12s. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (ex Anethole).—10s. 3d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.

Cinnamic Aldehyde.—Natural, 17s. 6d. per lb.

Coumarin.—10s. 9d. per lb.

Citronellol.—15s. per lb.

Citral.—9s. 6d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—3s. 3d. per lb.

Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—10s. per lb. Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 10d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol (ex Shui Oil) 12s. per lb.—(ex Bois de Rose) 16s. per lb. Linalyl Acetate.—(ex Shui Oil) 14s. 6d. per lb.—(ex Bois de Rose) 19s. per lb.

Methyl Anthranilate.—9s. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—36s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—11s. per lb.

Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—17s.—19s. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—11s. 3d. per lb.

Camphor.—63s. 6d. per cwt. Cananga, Java, 22s. 6d. per lb. Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 20s. 9d. per lb. Lemon.—9s. 6d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 20s. 9d. per lb. Japanese, 8s. 6d. per lb. Firmer. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and ~~as~~ ⁱⁿ opposition not later than April 30th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on ~~Mar. 11th~~ ^{Mar. 17th}. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted ~~as~~ ⁱⁿ.

I.—Applications

Blythe. Furnaces. 5210. Feb. 24.
Brown and Son (Alembic Works), Ltd., and Easterbrook. Mixing etc. apparatus. 5389. Feb. 25.
Carrier. Refrigeration. 4929. Feb. 21.
Chem. Fabr. Pott & Co. Producing solvents etc. 5402. Feb. 25. (Ger., 25.2.26.)
Haddan (Oliver Continuous Filter Co.). Pulp thickeners etc. 5146. Feb. 23.

Hayward. Apparatus for effecting reactions between solid materials and gases. 5052--3. Feb. 22.

Henshaw, Parker, and Holmes & Co. Drying gases. 5264. Feb. 24.

Higginbottom. Pulverisers. 5233. Feb. 24.

Howard. Devices for separation of liquids or gases. 5077. Feb. 23.

McDougal. Heat-treatment. 4901. Feb. 21.

Pare Engineering Co., Ltd., and Player. Means for mixing gases and liquids. 5122. Feb. 23.

Raw. Separation of solid materials of different specific gravities. 5479. Feb. 26.

Sainty. Treating divided materials. 5393. Feb. 25.

Salerni. Grinding etc. machines. 5478. Feb. 26.

Scaman and Titterton. Rotary vacuum filters etc. 5259. Feb. 24.

Vernay. Extracting solid matters in suspension in a liquid. 5015. Feb. 22. (Fr., 24.2.26.)

Wisner. Lubricants. 5410. Feb. 25.

I.—Complete Specifications

20,230 (1925). Pattison (Mount). Kilns. (265,654.)

20,230 (1925). Foster. Optical pyrometers. (266,060.)

30,642 (1925). Callebaut and Blicquy. Heating of liquids. (266,075.)

32,419 (1925). Halls. Estimating the quantity of a gas in a mixture of gases. (266,091.)

80 (1926). Taylor and Shaw. Apparatus for treating gases. (266,097.)

310 (1926). Surtees. Emulsifying, mixing, or grinding machines. (266,098.)

443 (1926). Carborundum Co., Ltd. (Carborundum Co.). Heat-exchangers. (266,100.)

5045 (1926). Johnson (I.-G. Farbenind.). Manufacture of porous adsorbents. (266,133.)

6140 (1926). Carborundum Co. Furnaces. (266,140.)

6558 (1926). Mond (Metallbank und Metallurgische Ges.). Recovering volatile solvents. (266,145.)

9517 (1926). Robertson (Power Specialty Co.). Furnaces. (266,166.)

12,452 (1926). Schmidt and Dyckerhoff. Heat-insulating process and materials. (266,177.)

21,320 (1926). Martyn. See X.

II.—Applications

Baume. Drying etc. carbonaceous etc. materials. 5258. Feb. 24.

Coley. Apparatus for manufacture of gas. 5229. Feb. 24.

Hovois. Washing coal ores. 5061. Feb. 22. (Belg., 25.2.26.)

Humphrey, and Synthetic Ammonia and Nitrates, Ltd.

Production of methane. 4942. Feb. 22. Production etc. of semi-coke etc. 4943. Feb. 22.

Johnson (I.-G. Farbenind.). Manufacture of liquid hydrocarbons from olefines. 5017—8. Feb. 22.

Laing and Nielsen. Distillation of carbonaceous materials. 4842. Feb. 21.

Lessing. Fuel briquettes. 4915. Feb. 21.

Salerni. Apparatus for distillation of carbonaceous materials. 5380. Feb. 25.

Slade, and Synthetic Ammonia and Nitrates, Ltd. Steam distillation of coal etc. 4788. Feb. 21.

Urbain. Simultaneously producing water-gas, phosphoric acid, and high-alumina cement. 5296. Feb. 24. (Fr., 20.1.27.)

Wilberg. Reducing to carbon monoxide, carbonic acid content in gases. 5165. Feb. 23. (Sweden, 27.2.26.)

Wisner. 5410. See I.

II.—Complete Specifications

20,232 (1925). Mount. Continuous filtering. (265,679.)

29,256 (1925). Chem. Fabr. Griesheim-Elektron. Process for the production of methane. (244,076.)

32,419 (1925). Halls. See I.

1684 (1926). Humphreys & Glasgow, Ltd., and Stelfox. Manufacture of gas. (266,108.)

8099 (1926). Gray Processes Corp. Distilling or cracking hydrocarbons and purifying the vapours. (249,871.)

16,162 (1916). Abbott. Low-temperature distillation retort. (266,193.)

19,786 (1926). Neumann and Steinschneider. Distilling mineral oils, tar, and the like. (257,257.)

28,891 (1926). Siemens und Halske A.-G. Gas-testing apparatus. (262,092.)

*23,543 (1926). Collin und Co., and Schaefer. Coking retorts. (266,286.)

*2425 (1927). Gaertner. Converting coal into hydrocarbons. (266,311.)

*4372 (1927). Herzberg. Production of a gaseous mixture from pulverised coal. (266,354.)

III.—Complete Specification

19,786 (1926). Neumann and Steinschneider. See II.

IV.—Applications

Carmichael (I.-G. Farbenind.). Converting cyanaphthalene-sulphonic acids etc. 4887. Feb. 21.

I.-G. Farbenind. Manufacture of dyestuffs. 4844. Feb. 21. (Ger., 20.2.26.)

Diazo-sulphamic acids. 5009. Feb. 22. (Ger., 22.2.26.)

Imray (Soc. Chem. Ind. in Basle). Manufacture of aromatic tetrahydronaphthylamine derivatives. 5245. Feb. 24.

Johnson (I.-G. Farbenind.). Process for production of benzanthrone derivatives. 4841. Feb. 21. Manufacture of *n*-dihydro-1.2.1'.2'-anthraquinoneazine etc. 5020. Feb. 22.

IV.—Complete Specifications

30,024 (1925). Meister, Lucius, and Brüning. Manufacture of azo-dyestuffs and process of dyeing wool therewith. (243,758.)

*4478 (1927). Haller. Manufacture of condensation products of arylamines. (266,358.)

*4844 (1927). I.-G. Farbenind. Manufacture of vat-dyestuffs of the 2-thionaphthene-2'-indolindigo series. (266,382.)

*5009 (1927). I.-G. Farbenind. Obtaining diazo-sulphamic acids of the cyclic series. (266,388.)

V.—Applications

Coles. Production of paper. 5423. Feb. 26.

Naaml. Vennoots. Handelsmaatschappij Fibra. Production of wood pulp. 4880. Feb. 21. (Ger., 5.3.26.)

Nobel Industries, Ltd. (Du Pont de Nemours and Co.). Manufacture of nitrocellulose compositions. 3265. Feb. 24.

Non-Inflammable Film Co., Ltd., and Mallabar. Production of films of cellulose esters. 5272. Feb. 24.

Pathé Cinéma. Manufacture of threads, filaments, etc. 5167. Feb. 23. (Fr., 3.3.26.)

Soc. Chimique des Usines du Rhône. Colouring cellulose esters etc. 5381. Feb. 25. (Fr., 3.8.26.)

V.—Complete Specifications

28,989 (1925). Eichengrün. See XIII.

30,544 (1925). Badische Anilin- und Sodafabr. Preparations for washing and cleaning. (244,104.)

792 (1926). Cadgene. See VI.

10,878 (1926). Marr, and Ramar Syndicate, Inc. Manufacture of pulp or fibrous material. (266,168.)

*704 (1927). Soc. Lyonnaise de Soie Artificielle, and Chevalet. Cellulose product. (266,300.)

*4239 (1927). Soc. Civile des Procédés Masse. Treating stalks of ramie. (266,344.)

VI.—Applications

Farrell. Mercerisation of textile materials. 5334. Feb. 25.

I.-G. Farbenind. Dyeing etc. vegetable fibres. 5008. Feb. 22. (Ger., 22.2.26.)

Soc. des Condenseurs Delas. Dyeing, cleaning, tissues, etc. 5283. Feb. 24. (Fr., 10.11.26.)

VI.—Complete Specifications

30,024 (1925). Meister, Lucius, and Bruning. See IV. 792 (1926). Cadgene. Weighted artificial silk. (259,899.) 10,530 (1926). Naugatuck Chemical Co. See XIII. 21,530 (1926). Callebaut and Bliouy. Dyeing. (266,227.) *4514 (1927). Oberrheinische Handelsges. Treating yarns and fabrics. (266,367.)

*5008 (1927). I.-G. Farbenind. Producing combined shades from sulphur dyes and ice-colours on vegetable fibre. (266,387.)

VII.—Applications

Beckett, Harris, Thomas, Wylam, and Scottish Dyes, Ltd. Sulphuro-anhydride compounds. 5398. Feb. 25.

Carpmael (I.-G. Farbenind.). Manufacture of alkali iodates. 5045. Feb. 22. Manufacture of compounds containing active oxygen. 5046. Feb. 22.

Collin A.-G. Discharging ammonia sulphate from saturating-tanks. 4881. Feb. 21.

I.-G. Farbenind. Treatment of crude nitrate of soda. 5251. Feb. 24. (Ger., 24.2.26.) Treatment of crude nitrates of soda. 5378. Feb. 25. (Ger., 25.2.26.)

Johnson (I.-G. Farbenind.). Manufacture of hydrated chromic chloride. 5019. Feb. 22.

Urbain. Producing hydrogen and phosphoric acid. 5295. Feb. 24. (Fr., 7.12.26.)

Urbain. 5296. See II.

VII.—Complete Specifications

20,231 (1925). Mount. Causticising units or apparatus. (265,669.)

12,681 (1926). Urano and Imai. Manufacture of basic calcium hypochlorites. (266,180.)

12,682 (1926). Urano and Imai. Manufacture of pure calcium hypochlorite. (266,181.)

17,145 (1926). Comp. Gén. des Prod. Chim. de Louvres, and Pipereaut. Manufacturing chromates and manganates. (255,078.)

23,509 (1926). Johnson (I.-G. Farbenind.). Manufacture of copper sulphate. (266,237.)

*2453 (1927). Rosenheim. See XXIII.

VIII.—Applications

Armitage. Unsplinterable glass. 4938. Feb. 22.

Bennion, Clarke, and Plant. Pottery etc. ovens. 5191. Feb. 24.

Quartz et Silice. Manufacture of silica glass articles. 4837. Feb. 21. (Fr., 24.2.26.)

VIII.—Complete Specifications

7686 (1926). Cornelius. See XI.

9449 (1926). Carborundum Co. Manufacture of refractory articles. (266,165.)

13,760 (1926). Jackson (Hartford-Empire Co.). Forming sheet glass. (266,182.)

27,489 (1926). Aluminum Co. of America. Refractory articles. (262,403.)

IX.—Applications

Edser. Waterproofing building etc. materials. 5345. Feb. 25.

Murphy. Material for constructional purposes. 5336. Feb. 25.

Parry, and Parry & Sons, Ltd. Rotary cement kilns. 4889. Feb. 21.

Urbain. 5296. See II.

IX.—Complete Specifications

7686 (1926). Cornelius. See XI.

*32,046 (1926). Rütgerswerke-A.-G. Wood preservatives. (266,296.)

*3906 (1927). Chassevent. Tempering plaster. (266,335.)

*4509 (1927). Aerni. Manufacture of artificial stone. (266,364.)

X.—Applications

Allan, Haguc, and Cammell, Laird & Co. Alloy steels. 5449. Feb. 26.

Harris. Treatment of impure metals etc. 4925. Feb. 21.

McDougal. 4901. See I.

Maybrey, and Stone & Co. Aluminium alloys. 5451. Feb. 26.

Picard and Sulman. Extraction of tin. 5231. Feb. 24.

Selz. Aluminium alloys. 3035. Feb. 22. (Ger., 27.2.26.)

X.—Complete Specifications

28,511 (1925). Rushen (Gelsenkirchener Bergwerks A.-G.). Eliminating phosphorus from pig-iron. (266,033.)

28,762 (1925). Mond Nickel Co., Ltd., and Atkinson. Extraction of precious metals. (266,040.)

28,872 (1925). Würker. Electrolytic separation of chromium. (266,045.)

29,383 (1925). Smith and Garnett. Magnetic alloys. (266,066.)

29,432 (1925). Barrett Co. Flotation agents for use in concentrating minerals. (243,383.)

3894 (1926). Hilbert. Increasing the production and the phosphoric acid content of Thomas slag. (247,946.)

21,320 (1926). Martyn. Wet separation of the constituents of mineral and other pulp. (264,129.)

*26,143 (1926). Smith. Reducing metallic oxides. (266,289.)

*4754 (1927). Siemens und Halske A.-G. Electrodeposition of chromium. (266,370.)

XI.—Applications

Campbell, and General Electric Co. Gas-filled photo-electric cells. 5364. Feb. 25.

Draisma. Leaden plates for accumulators. 5000. Feb. 22.

Féry. Electric battery. 5030. Feb. 22.

Hart Accumulator Co., Ltd., and Schofield. Electrodes of secondary batteries. 5057. Feb. 22.

XI.—Complete Specifications

28,872 (1925). Würker. See X.

7686 (1926). Cornelius. Electric furnaces for melting or producing glass, cement, etc. (249,554.)

8292 (1926). British Thomson-Houston Co., Ltd. Electric furnaces. (249,880.)

25,291 (1926). Internat. General Electric Co., Inc. Electric arc furnaces. (259,615.)

*4598 (1927). Mouillefarine. Dielectric product. (266,370.)

*4754 (1927). Siemens und Halske A.-G. See X.

XII.—Complete Specifications

5858 (1926). Owe. Production of vitaminised oils. (266,139.)

*26,544 (1926). Schou. Manufacture of soap. (266,291.)

XIII.—Applications

British Thomson-Houston Co., Newbound, and Warren. Resinous condensation products. 5407. Feb. 25.

Johnson (I.-G. Farbenind.). Production of coloured masses. 5253. Feb. 24.

Kunstharzfabrik Dr. F. Pollak Ges. Manufacture of phenol-formaldehyde condensation products. 5171. Feb. 23. (Austria, 17.3.26.)

Pollak. Condensation products of carbamide with formaldehyde. 5058. Feb. 28. (Austria, 1.10.24.)

XIII.—Complete Specifications

27,884 (1925). British Cyanides Co., Ltd., and Rossiter. Manufacture of artificial resins. (26,028.)

28,989 (1925). Eichengrün. Solutions for lacquering, impregnating, coating, etc. (243,031.)

10,530 (1926). Naugatuck Chemical Co. Manufacture of waterproofing compositions. (251,961.)

19,500 (1926). Marks (Monk and Irwin). Producing titanium pigments. (266,211.)

19,904 (1926). Takemura and Oiwa. Varnishing preparation. (266,214.)

*5058 (1927). Pollak. Treatment of condensation products of carbamide or its derivatives with formaldehyde. (266,389.)

XIV.—Application

Soc. Ital. Pirelli. Vulcanisation of rubber. 5178. Feb. 23. (Italy, 24.2.26.)

XIV.—Complete Specification

28,698 (1925). K. D. P., Ltd. Concentration of latex. (255,014.)

XVII.—Applications

Farnell. Extraction of sugar from beet. 5071. Feb. 23.

Ott. Treatment of sugar cane. 5151. Feb. 23.

XVII.—Complete Specification

14,759 (1926). Steffen. Extraction of sugar from molasses. (266,187.)

XVIII.—Applications

Johnson (Bücher). Manufacture of yeast. 5352. Feb. 24.

Scott. Apparatus for treating yeast. 4960. Feb. 22.

XVIII.—Complete Specification

20,248 (1925). Kahu and Schaffer. Treatment of yeasts by autolysis. (243,373.)

XIX.—Applications

Bartmann. Treatment of vegetables etc. for recovery of endosperm. 5255. Feb. 24. (Ger., 27.2.26.)

Coles. Production of milk products. 5207. Feb. 24.

Soc. des Moulins de la Coudre. Manufacture of flours. 5041. Feb. 22. (Fr., 25.2.26.)

XIX.—Complete Specifications

30,146 (1925). Nesbitt, Butler, and Drumm. Treating vegetable produce. (266,069.)

5858 (1926). Owe. See XII.

XX.—Applications

Bloomfield, and Boake, Roberts, & Co. Manufacture of acyl halides. 5330. Feb. 25.

Bloomfield, Gower, and Boake, Roberts, & Co. Manufacture of acyl halides. 5331. Feb. 25.

Chem. Fabr. vorm. Schering. Manufacture of compounds for combating vagotomy. 5155. Feb. 23. (Ger., 25.2.26.)

Pollak. 5058. See XIII.

Suida. Recovery of acetic acid etc. 4916. Feb. 21. (Austria, 31.7.26.)

XX.—Complete Specifications

*1140 (1927). Lilly & Co. Purified pneumococcal anti-toxin. (266,341.)

*4265 (1927). Chem. Fabr. vorm. Schering. Manufacture of aliphatic auromercapto carboxylic acids. (266,346.)

*4478 (1927). Haller. See IV.

*4746 (1927). I.-G. Farbenind. Manufacture of urea. (266,378.)

XXI.—Application

I.-G. Farbenind. Photographic silver halide emulsions. 5372. Feb. 25. (Ger., 14.5.26.)

XXII.—Application

Nobel Industries, Ltd. (Du Pont de Nemours & Co.). 3265. See V.

XXIII.—Application

Jackson. Apparatus for treatment of sewage. 4827. Feb. 21.

XXIII.—Complete Specification

*2453 (1927). Rosenheim. Production of base-inter-changing substances. (266,313.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has

received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Steel blooms (A.X. 4320). *British India*: Steel, iron (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, London, S.E.1): Red and white lead (Madras and Southern Mahratta Railway Co., Ltd., 25, Buckingham Palace Road, London, S.W.1). *Canada*: Steel strip (A.X. 4335): Tiles, sanitary equipment, rubber flooring (C.X. 2217). *Chile*: Asbestos packing, rubber hose, chemical products, hydrochloric and sulphuric acids, alcohol, disinfectant, ferrocyanide of potassium, disinfectant, lubricating and illuminating oils, paint, varnish and painting utensils, iron and steel, metal cables, ingots in antimony, tin, iron, lead and foundry materials, glass, galvanised and black tubes, copper tubing (C.X. 2206). *Colombia*: Air compressors, centrifugal pumps (A.X. 4307). *Finland*: Sugar, cattle foods, fertilisers (216). *Germany*: Drugs, chemicals, medicines, perfumery (219). *Greece*: Tin, tinplate, galvanised sheets (220). *Poland*: Artificial silk (224). *Rumania*: Boiler and gas pipes (A.X. 1316). *South Africa*: Toilet preparations (211): Mild steel boiler tubes (A.X. 4333). *United States*: Steel (A.X. 4262).

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during February, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 498, of which 382 were from merchants or importers. To these should be added 11 cases outstanding on January 31, making a total for the month of 509. These were dealt with as follows:—(Granted 149 (of which 137 were dealt with within 7 days of receipt). Referred to British makers of similar products—12 (of which 36 were dealt with within 7 days of receipt). Referred to reparation supplies available—8 (all dealt with within 2 days of receipt). Outstanding on February 28, 1927—10. Of the total of 509 applications received, 481, or 94 per cent., were dealt with within 7 days of receipt.

News from Advertisements

A works manager and production manager are wanted for large English Visco Silk Works.

A chief chemist is wanted for large English Visco Silk Works.

An American firm is open to furnish capital for new or established enterprise of merit.

Messrs Harrison are quoting most attractive rates for binding the JOURNAL.

PUBLICATIONS RECEIVED

ARTIFICIAL FERTILISERS; THEIR CHEMISTRY, MANUFACTURE, AND APPLICATION. By P. Parrish, A.I.C., M.I.Chem.E., and A. Ogilvie, A.M.I.Mech.E.; with a foreword by Dr. H. C. Brown. Vol. 1. Pp. 355. London: Ernest Benn, Ltd., 1927. Price 45s. net.

THE ALCHEMIST. Vol. 2, No. 4. February, 1927. Pp. 49—64. Glasgow: The Glasgow University Alchemists' Club.

JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

VOL. 46 NEW SERIES

LONDON, MARCH 18, 1927

No. II

EDITORIAL

The Chemical Engineers

THE Chemical Engineers' banquet on Friday last was very good. This is a vague statement, which carries no conviction; we will be more precise. Such a banquet must be considered from two points of view, the actual dining and the post-prandial oratory. So far as the dining is concerned, one Lucilius, many years ago, described a dinner as well-cooked, well-served, with good talk and everyone quite at his ease. That was his idea of what a dinner should be, and no bad idea either. Well, we were fortunate enough to get all this on Friday; having had what was once described as "a dinner not severely plain, a pint or so of really good champagne," let us consider the after-dinner speaking. This is a difficult matter; after-dinner speeches should neither be too serious nor too frivolous; after a few oysters, soup, fish, and what-nots, you do not care to face those who, with fire in each eye and papers in each hand, are forced to speak or burst, nor does the scientific mind desire that the jests be obviously dragged in and fit badly into their surroundings. Many of us have been educated at great expense; think of what our parents contributed, and of what we then endured! how did the Oxford classical don put it? "Think of the claims of the Natural Sciences, all of them rolling their separate logs; think of the millions we spend on appliances, chemists and botanists, rabbits and frogs." We who have had these experiences rightly regard ourselves as the salt of the earth, and we should be treated accordingly. On Friday we were treated accordingly; the speeches were really good: Sir Herbert Samuel is a finished speaker; he is skilful and pleasant, and has an agreeable voice and something to say; he should be kept in mind and his name marked with a white stone; we should like to hear him more frequently. All the other speeches were good; we wish we had space to comment on many of them; they deserve a better fate than either our comments or our lack of them; still, we intend to take note of a few observations by Sir Arthur Duckham, who discussed the education and training of the chemical engineer. He is after men who have an adequate knowledge of the fundamentals of their science with administrative ability to back it up. He has a difficulty in finding them; we are not surprised; it is no light task to know the fundamentals of chemical engineering, and it is given only to a few men to have administrative ability. Sir Arthur would like a closer touch during

the training of the student between the university and the industry. He would like the student to visit the industry and the industrialist to visit the university; he would like the teacher to visit the industry and the industrialist and the teacher to confer together on the training of the chemical engineer. Of course, the chemical engineers are not chemists; they are not quite so salty as we are; we feel, except when the prospect of their dinner is immediate or our recollection of it fresh, the difference between us, and yet it is possible that they will grapple with this problem more speedily, will, in fact, set about the work with no proper deliberation, and do it. They seem to have a knack of doing the thing somehow, and doing it quickly and doing it very well. Why, they have only been going four or five years, and they are already getting ahead with great rapidity. Well, let us not be envious, nor ungrateful; we spent a very pleasant evening and heard some very good speeches. Sir Frederic Nathan is to be congratulated, not only on two years of progress during his Presidency, but on a closing ceremony which was very distinguished and worthy of emulation.

Chemical Trade with the Empire

The range and quality of British chemical products recently exhibited at the British Industries Fair give us just cause for satisfaction, a satisfaction which is subscribed to by Empire and foreign buyers in a very practical fashion. At the same time we cannot chase away from our mind some speculations as to the future of chemical trade with the countries of the Great Commonwealth. Chemicals play such an important part in the complex civilisation of to-day, and, in the stages of settlement and development which follow colonisation, it is natural that the Empire should look to British factories for essential materials. It is a feeling which should be encouraged in every possible way. But it is natural, too, that as a country progresses to full development, an internal supply of necessary chemicals be demanded and created. Nowhere is this better demonstrated than in Canada, which is fast becoming almost self-supporting in the matter of chemical supplies. In 1925, the year in respect of which the latest figures are available, Canada produced over £20,000,000 worth of chemicals, and only imported from this country and the United States—the main sources of imported chemicals—£5,000,000 worth. She produced about £4,000,000 worth of paints, pigments and varnishes, and

a like amount of soaps, washing preparations and toilet preparations. £2,500,000 worth of medicinal and pharmaceutical preparations were made within the Dominion as well as a like amount of explosives, ammunition and matches. The heavy chemical industry, called into being in large degree by the virile and ever-expanding paper industry, produced over £5,000,000 worth of acids, alkalis and compressed gases, whilst fertilisers, adhesives, celluloid, artificial leather, insecticides, dyes, coal tar products, and wood distillation products were manufactured in smaller but by no means inconsiderable quantities. New industries sprang into existence in 1926, and more are contemplated during the present year. A large plant for the manufacture of cellulose acetate silk is being erected in Quebec, and the enterprising Canadian Electro Products Co. is entering new fields in the production of synthetic solvents for the new pyroxylin lacquers. We had the opportunity of observing from a privileged position the development of the manufacture of synthetic acetic acid and acetone from calcium carbide, via acetylene and acetaldehyde, during the war years, and if such efforts of the Electro Products Co. are typical of the Canadian chemical industry the Dominion is truly blessed. The production of heavy chemicals within the countries of the Empire may render it difficult, then, for British manufacturers to compete, especially in view of the high transport charges, and it is all the more gratifying to find that the proportion of our alkali exports going to the Empire countries has been well maintained in recent years. There is, perhaps, a greater opportunity for English makers of fine chemicals and speciality products and for chemical plant manufacturers. It is with no disrespect to overseas chemists that we say that such materials as synthetic thyroxin, borocaine, soluble vat dyestuffs, "levelling" dyes, insulin and the like can probably be made more cheaply in the home country, where research and production are more concentrated and the interworking of factories grouped within great organisations facilitates the development and economical prosecution of new processes. British chemical plant manufacturers are coming to the fore with plant for the carrying through of chemical engineering unit processes, so that filter presses, centrifuges, stills, evaporators, grinding mills, driers, pumps, and much else should find their way not only into Empire chemical factories, but also into sugar works, mining establishments, oil extraction mills, and a host of works devoted to general industrial operations throughout the Empire. By intensive propaganda, true salesmanship, and a study of specific requirements, British manufacturers may well hope to capture a greater proportion of those orders which the countries of the Empire find it necessary to place without their own borders. In spite of the nearness of the United States to Canada, it should be possible for this country to place more chemical products in the Dominion. In 1926, Canada imported more than £4,000,000 worth of chemicals from the States and only spent £1,000,000 in this country. The technical and commercial strength of the British chemical industry has been well displayed in the difficult times of the past few years, and we have every confidence that the problems of the future will be faced with that courage and enterprise which won general approval during the dark months of 1926.

LIQUID CHLORINE—ITS MANUFACTURE AND USES*

By D. A. PRITCHARD and J. H. HUBEL†

The two essential factors in selecting Sandwich, Ontario, as the site for the electrolytic plant of the Canadian Salt Company were cheap salt and cheap power.

Salt.—Underlying the south-western part of Ontario and portions of Michigan are salt deposits of vast extent in the salina formation of the Silurian age. The approximate area of this salt basin in Canada alone is about 3,000 square miles. These beds vary in thickness from 30 to 230 ft., the upper and thinner layers being interstratified with dolomite and shale. To give some idea of what this deposit means, a square mile of it, 250 ft. deep, would contain over 400 million tons.

Power.—The Sandwich Plant is at the extreme western end of the Ontario Hydro-Electric Commission's distribution of Niagara Falls power, there being 276 miles of transmission lines between Windsor and Niagara Falls stations. The energy is brought to Windsor at 110,000 volts and delivered at 26,400 volts to the plant, where it is converted to direct current at 250 volts. The company takes 4000 h.p. from the Commission and can generate as much as 8000 h.p. by means of its modern power plant. The last addition to the power plant consists of 700 h.p. powdered-fuel fired, 350-lb. pressure boilers in conjunction with 2000 h.p. Parsons turbo-generators. The fuel supply is brought in by boat and unloaded at the company's own docks on the Detroit River.

THE BRINE AND ITS ELECTROLYSIS

The first salt is struck at 1000 ft., but drilling is continued until the "deep salt" is reached at 1600 ft. Two iron pipes, one within the other, are run the full length of this drill hole. Water is forced down between the outer casing and inner pipe and the concentrated brine is brought to the surface in the smaller pipe. Before this brine can be utilised it must be treated to remove lime salts, which would otherwise precipitate in the diaphragm and thereby increase the resistance of the electrolytic cell. This purification is accomplished by first heating the raw brine to 180° F. and mechanically adding the calculated amount of sodium carbonate solution. The resulting precipitate of calcium carbonate is settled out by means of Dorr thickeners, and the clear, hot brine is fed automatically and by gravity to the electrolytic cells, where it is decomposed into sodium and chlorine. This sodium, in turn, reacts with excess water present to form a dilute solution of caustic soda with the evolution of hydrogen.

The electrolytic cells used at Sandwich are of the cylindrical diaphragm type, and are the invention of an Englishman, Arthur E. Gibbs. The process is one of the most efficient of its kind in operation to-day. A large plant consuming about 10,000 h.p. is located at Wyandotte, Mich., and possibly the largest installation in the world to-day is that of the United Alkali Company of Great Britain, both using the Gibbs cell.

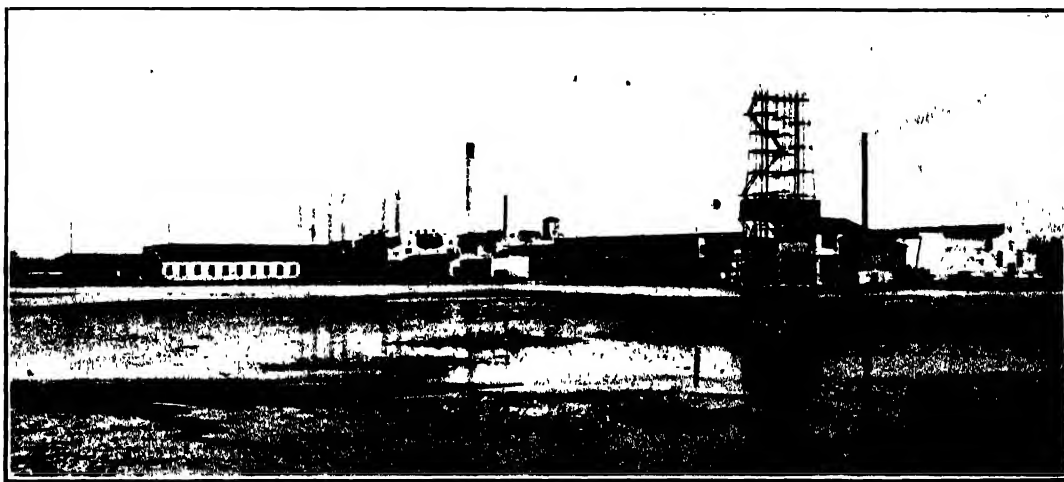
* Paper presented before the February meeting of the Montreal Section.

† Works Manager and Chief Chemist respectively of the Canadian Salt Company, Limited, Windsor, Ontario.

The cell itself is enclosed in an upright iron container, cylindrical in shape, and is assembled by placing inside this container a cylindrical and perforated cathode sheet on the inner side of which is secured a diaphragm of a special grade of long-fibre asbestos paper. Inside the cylindrical cathode and as near to it as practicable are placed 24 graphite sticks, 2 by 2 by 36 in. long, suspended in a circle from a dome-shaped head. The head, the ring it fits, and the bottom around which the cathode with its diaphragm is formed are made by the company from a mixture of cement and asbestos. The joints between the various divisions of the cell are so designed that they can be made gastight by a chlorine-resistant putty. These cells are arranged in a series of 70 individual cells placed in two parallel rows of 35 each, and are connected so that the current must travel in series through the whole 70 under an applied voltage of 250 volts. Each cell will take approximately 3.57 volts and a current of 1000 amperes. Practically the only

LIQUID CHLORINE

Although liquid chlorine has been made by the compression system for many years, it has been by the so-called tower system that the recent expansion of the industry in Canada and the United States has been brought about. Chlorine derived from the cells is drawn through a cooler and thence through two 40-ft. drying towers, counter-current to a flow of strong sulphuric acid to remove the moisture from the gas. The cooler and tower remove at a maximum 50 lb. of water per ton of gas passing through them. This renders possible the liquefaction of the gas in iron equipment, for dry chlorine does not attack iron. Induced from the drying equipment by a Nash pump operating in sulphuric acid, the dry gas is delivered to the towers of the liquefying plant at a pressure above 3 lb. It is there entrained through a suitable suction head with a falling column of strong sulphuric acid contained in a 4-in. line, or "leg," as it is called. Falling through a distance of 90 ft. into a



Sandwich plant of the Canadian Salt Company

departure from the original design has been in the manner of feeding the brine. By an ingenious arrangement, the cell is kept full of hot brine and at the same time the continuity of the brine fed to the cell is broken in an effective manner, thereby eliminating current losses.

The chlorine gas generated is removed through a stoneware pipe into a gas main kept under slight suction. The caustic soda, together with some undecomposed brine, trickles down the outside of the cathode sheet to the bottom of the cell container and thence through a receiving line into storage tanks, which supply the evaporator department.

The cell operates at a current efficiency of 93-95% over the anode life of better than a year, a power efficiency of 56-57%, and a voltage efficiency of 60-61%. It will produce in 24 hrs., per square foot of floor space taken, 5 lb. of caustic soda and 4.43 lb. of chlorine. The caustic will run 120 grams per litre of sodium hydroxide, and the chlorine 95% or more. The cell itself is remarkably simple, whilst the ease of its assembling and replacement does not demand expensive labour in building or supervising while in operation.

compression chamber, the gas pressure is increased to 35 lb. per sq. in. gauge, or 50 lb. absolute, the acid continuing its cycle. Under this pressure the gas rises through double cooling coils kept at $-25^{\circ}\text{C}.$, and is liquefied. The liquid chlorine runs from the cooling coils by gravity through a trap to remove all non-condensable gases, then into an insulated steel vessel, the capacity of which is about 5000 lb. From this it is loaded either into storage tanks, 15-ton tank cars, or 150-lb. cylinders, by air under 100 lb. pressure, which is previously dried by passing through a series of towers containing strong sulphuric acid.

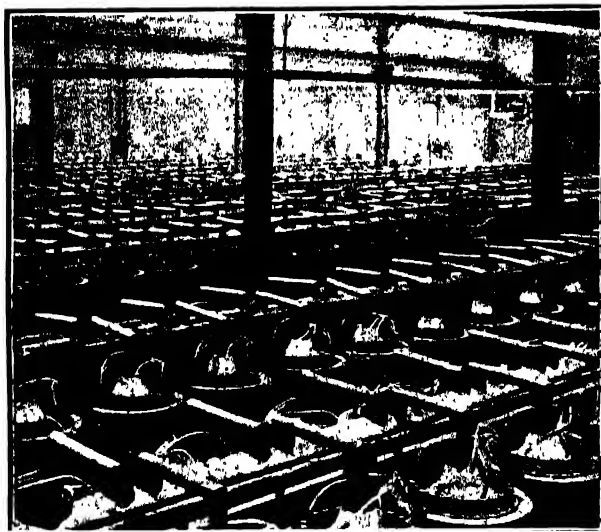
USES OF LIQUID CHLORINE

Chlorine, at ordinary temperature, is a greenish-yellow gas with a characteristic suffocating odour. It has an atomic weight of 35.45, and is about two and a half times as heavy as air. Liquid chlorine is of golden-yellow colour, and entirely free from the greenish tint possessed by the gas. It has a specific gravity of 1.469 at $0^{\circ}\text{C}.$, weighing approximately 90 lb. per cu. ft. Liquid chlorine boils at $-33.6^{\circ}\text{C}.$ and when confined

at a higher temperature will build up its own pressure until it ceases to boil. The tanks used for transporting this commodity thus carry a pressure of about 100 lb. per sq. in. at ordinary summer temperature (78° F.).

When liquid chlorine is cooled to below -102°C . it becomes an almost colourless solid, crystallising in the rhombic system.

Chlorine does not burn, but supports the combustion of some burning bodies. It reacts chemically with most metals, under favourable conditions, to produce chlorides. At high temperature its action is particularly rapid. It is a curious fact that practically no action will take place when chlorine is completely freed from aqueous vapour. If dry chlorine is allowed to enter a flask filled with "Dutch metal" (cheap imitation of gold leaf made from an alloy of copper and zinc) no action takes place, but on the introduction of the smallest trace of moisture the metal at once takes fire. This particular property is of great importance to the chlorine industry,



Part of the cell room

as once the gas is dried it can be conveniently handled in iron pipe, tanks and other apparatus.

As to the commercial uses of liquid chlorine, it is estimated that about 65% of the chlorine gas manufactured in the United States and Canada is consumed by the pulp and paper industry—that 22% is consumed in the textile industry; 10% in sanitation; and the remaining 3% in all other uses. We will try and cover some of the more important uses, touching briefly on those of less importance, or at least those using a small percentage of the total gas produced.

CHLORINE IN THE PAPER INDUSTRY

Wood pulp, regardless of the process by which it is made, requires bleaching before it can be used for the production of white or light-coloured papers. In the sulphite, or soda process, a portion of the lignin always remains in the pulp, and this lignin always carries coloured bodies of highly complex chemical composition. These coloured impurities cannot be removed by washing

or mechanical treatment, because they are united chemically with the fibre, and therefore require a chemical process for removal.

The bleaching process is essentially an oxidising reaction, and this is shown by the fact that many materials become bleached by simply exposing to the wind and sunshine. Chlorine, when brought in contact with water, releases the oxygen from the water. This nascent oxygen reacts with the hydrogen of the colouring matter to yield colourless compounds which produce the bleaching effect. In practice, calcium hypochlorite is used for this purpose, because solutions of comparatively high concentration may be obtained. It is the available oxygen, then, in the formula, $\text{Ca}(\text{OCl})_2$, which does the work.

In practice, the washed pulp from the digesters is treated with a solution of calcium hypochlorite in a modern bleaching machine, such as the Thorn, Fletcher, or Bellmer bleacher. The bleach solution is made by simply passing liquid chlorine—piped direct from a tank car—into a reaction tank containing milk of lime. These are usually vertical, cylindrical concrete tanks, having a capacity of about 1500 cu. ft. Circulation is maintained by either a mechanical paddle agitator or a centrifugal pump. This reaction will proceed at a rate approaching one ton of liquid chlorine per hour, without gas escaping at the surface of the liquid. Chlorination is allowed to continue until the lime has been practically used up, and the strength of the solution is about 35 grams of calcium hypochlorite per litre. The chlorinated solution is then pumped to a settling tank, in which the excess lime settles out, leaving the finished clear solution ready for the bleaching machine.

The old method of making bleach liquor, and the one still in use by many of the smaller mills, is to add bleaching powder (chlorinated lime) to water, agitate, and allow to settle. This gives exactly the same compound, but bleaching powder is messy stuff to handle, it deteriorates rapidly, and the sheet steel drums are bulky and difficult to dispose of. Liquid bleach made from liquid chlorine, on the other hand, is more economical, more efficient, due to more neutral solutions being obtained, and contains less sludge to handle.

About 7% of chlorine is required to bleach pulp. This varies more or less, depending upon the wood and the method of cooking the fibre.

In 1926, over 300 fifteen-ton liquid chlorine tank cars were in pulp mill service in the United States and Canada. The Canadian Salt Company owns and operates in Canada about one-fifth of these tank cars.

CHLORINE IN THE TEXTILE INDUSTRY

The theory of bleaching cotton and linen is quite similar to the bleaching of wood pulp—all being pure cellulose. The bleaching of these textiles involves two general steps in procedure: first, a removal of the fatty and waxy matters on the fibre, and, second, a destruction or removal of the colouring matter. If the waxy matters are not first removed by boiling in dilute alkali, they will tend to resist the action of the bleaching agents. Whilst other oxidising agents are sometimes used, the use of hypochlorite is favoured for bleaching because of cheapness, efficiency, and lack of injury to the fibre.

Either calcium hypochlorite or sodium hypochlorite serve the purpose, and are made by chlorinating milk of lime or caustic soda, as the case may be. Sodium hypochlorite is doubtless more desirable than calcium hypochlorite, because it is a more soluble salt. In using calcium hypochlorite lime salts are precipitated in the fibre, and if the "souring," or acid wash, which follows is not complete, a harsh fabric results. Sodium salts, on the other hand, are easily washed out, very little acid is required, and a soft feel is imparted to the fabric.

The soda bleach solution is conveniently made by dissolving a definite quantity of caustic soda in a tank and adding the weighed molecular quantity of liquid chlorine from a standard cylinder resting on a platform scale. The operation is very simple, and requires no chemical control.

We might say that liquid chlorine is far more desirable than chloride of lime for textile mills as it is clean, there is no dust, very little odour, no sludges to handle, and in the long run it is more economical.

Large quantities of sodium hypochlorite made in the above manner are used for bleaching in laundries and in the household under the name "Javelle Water." And while speaking of sodium hypochlorite, it may be mentioned that "Dakin-Carr" solution, the antiseptic used almost exclusively in the base hospitals during the late war, was a 1% solution of sodium hypochlorite. This solution is used to-day in practically all the important hospitals in the country. Its chief advantage over other antiseptics is the fact that it not only sterilises the wound but dissolves necrotic tissue as well. This results in very rapid healing. Sodium hypochlorite was also instrumental to a large degree in stamping out the spread of foot-and-mouth disease prevalent in England in 1923, and is commonly used on farms for general sterilisation.

(To be continued.)

INDUSTRIAL NOTES FROM CANADA

A large plant is being erected in Quebec for the manufacture of industrial alcohol. Molasses storage tanks of 3,600,000 gallons are completed. The plant will have a capacity of 9000 proof gallons daily.

Reports reaching Winnipeg indicate that oil has been struck for the first time in Manitoba, near Grandview, Manitoba. According to Mr. Walter T. Ross, oil operator, of Billings, Montana, the Number One well on the Balak lease is flowing 35 to 40 barrels per day. Partial tests indicate that the oil is paraffin base, with high gasoline content. Oil has been struck at the shallow depth of less than 1000 ft.

A fourth big oil well is reported in the Turner Valley field, southwest of Calgary. The McLeod No. 2 well is now producing between 5 and 6 million cb. ft. of wet gas. The well has not been connected to a separator yet, consequently the gasoline content is not definitely known, but is reported at 150 to 200 barrels per day. The other producing wells in this field are Royalite No. 4, Vulcan and Illinois-Alberta. The original wonder well, Royalite No. 4, has been producing 500 barrels of naphtha and 17,000,000 cb. ft. of gas per day for upwards of two years, and its flow shows no diminution.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING, JULY 4 to 8, 1927

RAILWAY FACILITIES

The Railway Companies of Great Britain (except the Metropolitan, the Metropolitan District, and London Electric Railway Companies) have agreed to issue tickets at the ordinary single fare and one-third for the double journey to persons travelling to Edinburgh to attend the meeting. Tickets will be available from Saturday, July 2, to Saturday, July 9.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

ANNUAL REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY—VOL. XI.

This volume of the Annual Reports (covering the year 1926) is now ready, and copies have been despatched to those who have subscribed for them.

The price of the volume is 7s. 6d. to members of the Society and 12s. 6d. to non-members. Fellows of the Chemical Society, who are not members of the Society of Chemical Industry, can purchase the book at the price of 10s.

Orders for copies, accompanied by the appropriate remittance, should be sent to the General Secretary of the Society.

CHEMICAL SOCIETY'S LIBRARY

Members of the Society of Chemical Industry are reminded that they are entitled to consult the Library of the Chemical Society, Burlington House, Piccadilly, W.1, and to borrow books therefrom.

The Library is open daily from 10 a.m. to 9 p.m. Saturdays from 10 a.m. to 5 p.m. The Library is closed on Bank Holidays, the day following, and on other such occasions as the Council may direct.

LIST OF MEMBERS ELECTED

March 11, 1927

- Archibald, Peter K., 12, Armadale Street, Glasgow. E. Junior Works Chemist.
- Bassett, H. Norman, "Redville," High Street, Swindon, Wilts. Assistant Analyst.
- Crossley, Dr. Moses L., c/o Calco Chemical Co. Library, Bound Brook, N.J., U.S.A. Chief Chemist.
- Duncan, John R. M., 9, Norse Road, Scotstoun, Glasgow. Chemist.
- Frank, Prof. Dr. Fritz, Lützowstr. 96, Berlin, W.35. Chemist.
- Fitzpatrick, Alfred S., Australia House, Strand, London, W.C.2. Research Chemist.
- Fuerst, George M., 17, Philpot Lane, London, E.C.3. Chemical Merchant.
- Fulford, Sydney B., 89, Hamilton Road, Brent, London, N.W.11. Research Chemist.
- Gee, Jack H., 9, Chichester Terrace, Brighton. Produce Merchant.
- Harrison, Sir Cecil R., K.B.E., Woodcote, Chislehurst, Kent. Chairman of Messrs. Harrison & Sons, Ltd.
- Hazeldon, John N., c/o Coal Oil Extraction Ltd., Aldwych House, Aldwych, London, W.C.2. Chemist.

Hubball, Wilfrid, "Dolwen," 49, Heaton Road, Withington, Manchester. Research Chemist.

MacEwan, James U., Galotta, Ontario, Canada. Metallurgist.

Spooner, Walter, c/o 86, Whiteley Street, North Road, Clayton, Manchester. Analytical Chemist.

Steuart, Daniel W., c/o Maypole Margarine Works, Ltd., Southall, Middlesex. Chemist.

Strong, Howard W., Dept. of Chem. Tech., Imperial College of Science, S. Kensington, London, S.W.7. Research Chemist.

Watson, Sidney G., c/o W. C. Holmes & Co., Ltd., Whitestone Iron Works, Huddersfield, W. Yorks. Chemical Engineer.

Wild, Leonard, 65, Balliol Road, Bootle, Liverpool. Chemist.

BIRMINGHAM AND MIDLAND SECTION

Mr. H. W. Rowell gave a lecture on "The commercial synthetic resins and their products," at the meeting on March 7.

The manufacture of synthetic resins, said Mr. Rowell, has become a chemical industry of such commercial importance that the volume of its demand for raw materials affects their market price. A resin may be prepared by heating under a reflux condenser one molecular equivalent of crystal carbolic acid with one molecular equivalent of 40% formaldehyde solution. After several hours the condensation is complete, and the mixture separates into an upper watery layer and a lower resinous layer. Acids, alkalis and salts which act as electrolytes, catalysts, or condensing agents may be added to the mixture. They considerably shorten the time of reaction, and may produce resins having different practical use or final properties. In practice, synthetic resins are made from synthetic phenol and synthetic formaldehyde, thus making the product truly synthetic. The "treacle" "primary" or "A" resin thus produced is separated from the watery layer and dried by heating under vacuum. It is a sticky viscous mass, either clear or translucent, soluble in alcohol and acetone, but not in benzene or petrol. If this "treacle" is further heated under controlled conditions it polymerises to the "resin" or "B" stage, when it has the appearance of common resin, melts to an extremely viscous mass at temperatures below 80° C., and is still soluble in alcohol and acetone. The "final," "baked," or "C" stage is produced by still further heating and polymerisation, when it becomes insoluble in alcohol and acetone, and does not soften when heated.

The "final" state of the various phenol-aldehyde resins may exhibit some difference in hardness, softening with heat or solvents, and other physical properties, but generally speaking they do not soften on heating, are not decomposed at temperatures lower than 350° C., are insoluble in all the usual organic solvents, acids, alkalis and chemical solutions, except concentrated nitric and sulphuric acids and caustic solutions. Strong caustic soda will dissolve them, and they may be re-precipitated on the addition of acid.

When cresols are used to replace phenol the resulting final product is generally softer and more flexible. Orthocresol alone combines more slowly with formaldehyde, and by incomplete combination produces this softness and flexibility. When mixed cresols are used

together with phenol the reaction is even more difficult to follow, but technical observation of the properties of the variety of resin-like bodies it is possible to make from phenol and formaldehyde leads to the conclusion that a number of reactions go on side by side.

Methods of producing flexible or elastic final products of phenol-aldehyde resin have been suggested which are based on the addition of substances which either dissolve or are dissolved in the hard baked final resin. No really flexible product has been produced commercially, because whilst these added substances produce flexibility, they reduce melting or softening point, reduce tensile strength, or otherwise damage the good properties of the resin.

Oil-soluble resins of the phenol-aldehyde type have been sought for varnish work, and large amounts of air-drying or "cold" lacquer and stove drying or "hot" lacquer are used in the light metal trades. Phenol-aldehyde resins are not suitable for metal lacquering, but are suitable for papier maché and similar work. One of the Albertol modifications is said to produce a good lacquer. A new phenol-urea-formaldehyde lacquer removes entirely the faults of the phenol-aldehyde type and seems to be a decided advance in protective lacquer work.

A solution of phenol-aldehyde resins in alcohol and acetone is largely used for treating taped or cotton-covered wires in electrical apparatus. A thiocarbamide resin is prepared from formaldehyde and thiocarbamide.

In his concluding remarks Mr. Rowell said the original search for synthetic varnish resins has resulted so far only in the modified phenol-aldehyde type called Albertols, the coumarone resins, and an insignificant supply of shellac substitutes of various composition and special application. The production of these resins, compared with the consumption of the natural resins, is quite small, and there is room for the discovery of something more satisfactory for varnish manufacture. Over 90 per cent. of the synthetic resin manufactured is of the phenol-aldehyde type, and new applications, modifications and increased output are frequently registered. Except for the light colour of the thiocarbamide resins, no competition is in sight. There is still a demand for a new synthetic material which has all the properties demanded by the electrical engineer, and also for a transparent, colourless, synthetic material which can replace plate glass.

LONDON SECTION

Dr. Bernard Dyer presided at the meeting on March 7, in the absence abroad of the Chairman, Mr. C. S. Garland.

Prof. W. E. S. Turner, Head of the Department of Glass Technology, Sheffield University, gave a lecture on "Recent progress in the glass industry," in which he dealt mainly with the economic aspect and touched briefly upon recent technical developments and present lines of progress. Giving figures of the distribution of glass factories throughout the world, he showed that Germany heads the list with 383, and the United States comes second with 310. Great Britain has 115 factories. Figures of employees in the glass industry in the various countries of the world showed that Germany again heads the list, with the United States second, and England and Wales third. In analysing the trend of imports and

exports of glass in relation to Great Britain, it was shown how, in 1850, we were distinctly an exporting country, whereas since then the ratio of exports to imports had declined, until to-day it was a very low figure, owing to the flooding of this country with cheap glass from the Continent. Thus the ratio for 1926, although slightly better than in the previous years, was still at a very low level. On the other hand, curves showed that the exports of Germany had been continually rising since 1870. The only satisfactory feature was that the exports of glass from this country had shown a tendency to go up. Curiously enough, the export of optical glass from Germany had not recovered its pre-war position, and was very much less in 1925 than in 1913. Amalgamations of firms had taken place in the optical glass trade in Germany, and to-day there was practically only one firm. In Great Britain there were three factories to-day producing optical glass. As regards chemical glassware, Great Britain held a rather high position in the list, being second to the United States, although manufacturing a much less quantity than the United States.

After referring to the influence of the war upon the glass industry, Prof. Turner mentioned that developments have been taking place in Canada, where there are now eight factories in operation; in Australia, where activity is being shown in the manufacture of bottles, and a big combine of manufacturers has taken place with a capital of over £2,000,000; in South Africa and in India, although very slowly in the latter case. The glass industry had also been established in South America, whilst, as a result of the war, considerable progress had been made in Japan, for window and sheet glass and particularly bottles. In 1925 Japan produced something like 250 million beer bottles.

The next very important influence had been the use of automatic machines in the glass industry, which had reduced the number of factories and employees, whilst at the same time increasing the output. These developments in automatic machines had called for better refractories, and a vast amount of work had been done in that direction, so that whereas at one time refractories for the glass industry did not last for more than 5 or 6 weeks, 10 or 11 months was now fairly good, whilst under certain conditions refractories had been known to stand up for three or four years. A development in America was the electric fusion of the blocks of the refractory material used in the furnaces instead of cementing them together with some heat-resisting cement. Whether this would be economic remained to be seen, but actual commercial production was about to begin.

Prof. Turner then dealt with the manufacture of electric lamp bulbs, and discussed various types of bottle-making machines. An illustration was also given of a glass tube drawing machine, capable of drawing 200 ft. per minute. It was shown how the manufacture of window glass has been largely mechanised.

Chemical glassware is not yet made by machine, although there are processes in America whereby flasks and beakers can be produced in this way. Considerable developments in chemical glass, however, are certain in this country, which is regarded as in an advantageous position because we have a wider choice of first-class chemical glassware manufactured here. This British

glass is very much superior to that which came from Germany. In regard to chemical glass and optical glass we had an advantage in this country of a tariff under the Safeguarding of Industries Act which had stimulated both industries. As regards optical glass, the development that had taken place was seen in the fact that, whereas Messrs. Chance Bros. only had 26 types before the war, they now have 112.

Finally, Prof. Turner referred to the facilities available in this country and elsewhere for training in glass technology, and concluded by emphasising the fact that the position of the British glass industry, both technically and commercially, has vastly improved from what it was in 1913.

An interesting discussion followed, in which Dr. Monier Williams, Dr. Cox, Mr. Collett, Mr. Gallimore, and Mr. Brewis took part. Mr. Redfern, of Messrs. John Lumb & Co., Castleford (Yorks), said that his firm had developed a bottle-making machine which he claimed to be the best in the world. At the moment they had in course of manufacture a bottle-making machine capable of producing 40 million bottles a year, which was to be sent to the largest firm in the East, viz., the Mitsubishi Shoji Kaisha, Ltd. This machine was of the suction type, and he claimed that this is the best type for producing first-class bottles. He maintained that it is a standing disgrace to this country that further efforts had not been made to produce a bottle-making machine here. In all the bottle-making factories in this country there were American machines.

Mr. Hancock said that only those intimately acquainted with the manufacture of glass could appreciate the enormous amount of information given by Prof. Turner, and the extraordinary amount of hard work that had been involved in getting the results he had mentioned. All this was due to scientific research, and particularly so in relation to refractories, for the production of high-quality glass was intimately bound up with the existence of a thoroughly satisfactory refractory material. We could go away encouraged by the statement of the best authority on glass in the country that the British glass industry is being developed on the best scientific lines, and is showing a considerable amount of development.

Prof. Turner, replying to a question raised by Dr. Monier Williams, said that the amount of boron in chemical glass had to be very carefully regulated. Otherwise it would do harm. The limit might be put at 5 per cent. or 6 per cent. Mr. Collett's reply to Dr. Cox stating that the skill of the operators in this country had not deteriorated was correct. At the same time, in some countries the workers had an instinct for glass manufacture which did not exist in others, and from that point of view, perhaps, our operators were not quite so skilful as the Belgian glass workers. They had an intuition for the work which was very wonderful. This also was preserved in Czechoslovakia and in Germany, but even in Germany he had been told that the skill of the workers had considerably deteriorated since the war, just as we had complained of deterioration of craftsmanship in this country. He did not think the showing of the mould marks on moulded and turned bottles was due to the refusal of the men to make the extra turn, as suggested by Mr. Brewis. It was due to

the fact that the methods adopted on the Continent for preventing the mould marks from showing were not adopted in this country. At the same time, bottles could be obtained here without showing the mould marks. As to the bottle-making machine referred to by Mr. Redfern, it certainly was a credit to him and his firm. He agreed with Mr. Redfern that it is a great pity that not only we in this country, but even also Germany, seemed to be looking to America to make good the deficiencies in the glass industry so far as mechanical devices are concerned. There was no real native development going on in Germany, and Mr. Redfern had furnished us with a striking example of what the Britisher ought to do. Replying to Mr. Gallimore, there was no difficulty, in respect of melting, in substituting barium carbonate for soda ash, and a considerable amount of work was done in Germany during the war because of the shortage of soda ash. The adoption of it, however, was not very widespread, and it was never added to the extent of more than a very few per cent. For a considerable time he believed that soda ash would be used for 90 to 95% of the glass manufactured on automatic machines, because of the fairly high rate of change of the viscosity which enabled the machine to manipulate the glass satisfactorily and get a satisfactory distribution of the glass in the article. He could not, off-hand, give Mr. Brewis the analysis of costs that he had asked for, but most of the large glass works now had their costing departments and worked out the items in very great detail. Similarly, with regard to chemical glass he had no means now of comparing the practice of Continental firms in supplying special shapes with what it was before the war. The conditions had changed in Germany considerably, but as wooden moulds were used in many cases in preference to metal moulds it should not be difficult for the user to provide his own mould when he wanted special shapes. The pear wood used was more easily available in this country than in some of the country districts on the Continent. As to the high cost of optical glass, it must be remembered that the glassmaker was lucky if he got 20% of his melt available in a form in which it could be used. It certainly seldom rose above 30%, and that naturally affected the price.

CALENDAR OF FORTHCOMING EVENTS

- Mar. 18. CHEMICAL ENGINEERING GROUP AND THE INSTITUTION OF CHEMICAL ENGINEERS.** Joint meeting with the Coventry Engineering Society, Coventry Technical Institute, at 7.45 p.m. "The importance of chemistry to the engineer," by Prof. J. W. Hinchley. At 3 p.m. a visit will be paid to the works of Messrs. Morris Motors, Ltd.
- Mar. 18. BIOCHEMICAL SOCIETY.** University College, Gower Street, W.C.1. (See CHEM AND IND., Mar. 11, p. 215.)
- Mar. 21. INSTITUTION OF THE RUBBER INDUSTRY, Sales Section.** Engineers' Club, Coventry Street, W.1. at 8 p.m. "What constitutes a good traveller," by F. W. Moore.
- Mar. 22. INSTITUTE OF METALS, Birmingham Local Section.** Engineers' Club, Waterloo Street, Birmingham, at 7 p.m. "Nickel-iron and related alloys," by W. T. Griffiths. (Arranged by the Co-ordinating Committee.)
- Mar. 22. ROYAL PHOTOGRAPHIC SOCIETY, 35, Russell Square, W.C.1, at 7 p.m. Scientific and Technical Group.** Annual General Meeting. "Flame and the photography of flame," by O. C. De C. Ellis.
- Mar. 22. SOCIETY OF CHEMICAL INDUSTRY, Birmingham and Midland Section.** University Buildings, Edmund Street, Birmingham, at 7.15 p.m. "The removal and recovery of phenols from ammonia sulphate still effluents," by D. W. Parkes.
- Mar. 22. INSTITUTION OF PETROLEUM TECHNOLOGISTS.** Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m. *Annual General Meeting.*
- Mar. 22. SOCIETY OF CHEMICAL INDUSTRY, South Wales Section.** Annual Meeting. Technical College, Cardiff, at 7 p.m. Address by W. J. Cooper.
- Mar. 22. MANCHESTER STEAM USERS' ASSOCIATION.** Annual General Meeting, 9, Mount Street, Albert Square, Manchester, at 3.45 p.m. At the conclusion of the meeting the members will be invited to visit the Museum, which contains many items illustrating the causes of boiler accidents.
- Mar. 24. SOCIETY OF CHEMICAL INDUSTRY, Edinburgh and East of Scotland Section.** Annual Sectional Meeting. The North British Station Hotel, Edinburgh, at 7.15 p.m. At 8 p.m., a meeting will be held jointly with the Edinburgh and East of Scotland Section of the Institute of Chemistry, when a paper on "Fire risks in industry" will be read by A. M. Cameron.
- Mar. 24. CHEMICAL SOCIETY.** Annual General Meeting, Burlington House, Piccadilly, W.1, at 4 p.m. Presidential Address on "Experiments on molecular complexity," by Prof. H. Brereton Baker. The Longstaff Medal for 1927 will be presented to Prof. R. Robinson, and the Harrison Memorial Prize for 1926 will be presented to Dr. C. R. Harrington. The Anniversary Dinner will be held the same evening, at 7 for 7.30 p.m., in the King Edward VIIth Rooms, Hotel Victoria, Northumberland Avenue, W.C.2. Among the distinguished guests present will be the Presidents of the French, German and Italian Chemical Societies.
- Mar. 25. CHEMICAL ENGINEERING GROUP.** Joint meeting with the Institution of Mechanical Engineers, Storey's Gate, S.W.1, at 5.15 p.m. "Lubrication," by Dr. W. R. Ormandy.
- Mar. 25. SOCIETY OF CHEMICAL INDUSTRY, Glasgow Section.** Messrs. Ferguson & Forrester's Restaurant, 36, Buchanan Street, Glasgow. *Annual Business Meeting*, at 6.30 p.m. Also a joint smoker with the Glasgow and West of Scotland Section of the Institute of Chemistry, at 7.30 p.m., to which the Ardeer Chemical Club, the Andersonian Chemical Society, and the Glasgow University Alchemists' Club have been invited as guests.
- Mar. 25. SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY, Newcastle Sections.** Jointly with the Newcastle Chemical Industry Club. Annual Dinner, at Messrs. Tilley's Restaurant, Blakett Street, Newcastle, at 7.30 p.m. Amongst those who have promised to attend are Sir George and Lady Renwick, Prof. Arthur Smithells, Dr. J. T. Dunn, and the President of the Society of Chemical Industry, Mr. F. H. Carr, C.B.E.
- Mar. 29. HULL CHEMICAL AND ENGINEERING SOCIETY,** Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m. "Works filtration," by R. B. Foster.

THE INSTITUTION OF CHEMICAL ENGINEERS

The first of the biannual conferences for the 1927 session was held at Burlington House on March 9 and 10, and at the Hotel Victoria on March 11.

Two papers were presented at the afternoon session on March 9, when Sir Alexander Gibb, vice-president of the Institution, occupied the chair. In the first of these papers, entitled "Lead as a constructional material in chemical engineering," Mr. S. J. Tungay reviewed the peculiar properties of lead, which enable it to be modelled in the cold, its low melting point whereby it can be readily cast or pieces joined by soldering or burning, as well as the ability to obtain it in a remarkably pure condition at an exceptionally reasonable first cost, whilst a high price could be obtained for old metal or scrap lead. The purity of the lead and its bearing on its ability to resist corrosion was considered, and methods were given for testing the quality of chemical lead. The author also considered other influences which affect the corrosion of this metal, such as mechanical strain, the velocity of flow of the corrosive fluid and its concentration, and the effect of impurities. The application of this metal as a protective coating to vessels in which reactions were carried on under pressures or vacua next received the attention of the author, who advocated the homogeneous lining and described the Zeitler method. The concluding portion of the paper dealt with hard leads, and gave the ranges of antimony which could be employed in hard leads for various forms of chemical plant.

This paper was followed by a paper on "The production of dissolved acetylene and its application to lead burning," by Mr. W. C. Freeman. Attention was drawn to the dangers attendant upon the compression of acetylene gas, which is unstable and liable to be detonated by shock when subjected to pressures of 30 lb. per sq. in. The storage of this gas in cylinders under high pressures is effected first by thoroughly purifying the gas, which is then admitted to a cylinder which is filled to one-fifth of its volume with a porous material, lapok, which is chemically inert to acetone and acetylene and has a low conductivity which prevents rapid changes in temperature. Acetone is used in the cylinder as a solvent for the gas, the filling being carried out in three stages as follows. The gas is admitted until a pressure of about 75 lb. per sq. in. is attained, and then the cylinder is disconnected and laid aside to allow the temperature to return to normal; when this has been accomplished more gas is added until the pressure reaches about 150 lb. per sq. in., and again the cylinder is laid aside to cool. During the third stage the pressure is brought up to 225 lb. per sq. in. The paper concluded with an illustration of the types of burners in use and a demonstration of lead burning. The discussion which followed centred round the corrosion of lead, although questions were asked relating to the purity of acetylene and the temperature of the oxyacetylene flame.

At the evening meeting the President of the Institution, Sir Frederic L. Nathan, occupied the chair, and two papers, (a) "The function of the Schmiedel box in the manufacture of sulphuric acid," by Dr. H. J. Bush and Mr. A. Grounds, and (b) "Recent developments in the Mills

Packard chamber plant," by Mr. W. G. Mills, were read.

The authors of the first paper, in introducing their subject, pointed out that they were not dealing with the Schmiedel process, but simply with the function of the box and its ability to treat successfully gases containing varied and rapidly fluctuating percentages of sulphur dioxide from plants used in metallurgical operations such as the blowing of copper matte. After describing the box itself and the arrangements of the plant at the Mitterberg works at Ausserfelden, Mr. Bush and Mr. Grounds discussed the theory of the process, and gave the results obtained by Dr. Schmiedel. The authors also explained that although these boxes were originally fitted with regulus metal rollers, the later boxes were now fitted with cast iron rollers, which were found to resist corrosion very well. Diagrams were shown illustrating how the Schmiedel box could be incorporated into existing chamber plants and the various acid rings which might be formed, all taken from existing sulphuric acid plants. Such boxes have also been used in the metallurgical industry in the desulphurising of base metal sulphides, where the gases obtained are cold and wet.

As it was the desire of the meeting that this paper on the Schmiedel box and the paper on the Mills Packard chamber plants should be discussed together, Mr. Mills was next asked to read his paper. Opening with a description of the original type of tower having a wall slope of 8 : 1, the author dealt with the developments of the cooling water system—firstly, with the object of curtailing the amount of water used; secondly, with providing a means of distribution which could be easily cleaned when they became blocked by the rapid growth of algæ; and thirdly, a form of gutter which, whilst being easily cleaned, would not become readily choked up. The author then considered the latest type of chamber, in which the slope of the outer wall is 13.74 to 1, and showed how the walls of this chamber were supported so that the cooling water could have a clear passage from top to bottom over almost the entire surface of the chamber. Slides were shown of plants having peculiar features in their construction, such as wood and ferro-concrete framing for the chambers, the provision of a covered passage round the battery when erected in an exposed position, and the paper also included tables giving the sizes of the towers and their water consumption, as well as observations made from plants whilst in operation. Nor was the corrosive effect on the lead of the gas in the chamber omitted, specimens of the lead obtained from chambers which had been in use for 13 years being submitted for inspection. The discussion chiefly related, in regard to the first paper, to the nitric acid consumption, the corrosion of the rollers, and the possibility of using the Schmiedel box as an absorber; and in regard to the second paper, to cooling effects of the water both on the vapours inside the chamber and as a means of preserving the lead.

When the conference resumed on Wednesday afternoon, the President, Sir Frederic L. Nathan, again occupied the chair, and a paper on "Rubber as a constructional material in chemical engineering" was read by Mr. B. D. Porritt.

At the beginning of his paper Mr. Porritt considered the chemical and physical properties of caoutchouc, and remarked on the importance of the resins, proteins and sugars, both from the point of view of conferring stability to the action of oxygen on the caoutchouc and in the vulcanising processes. The processes of milling, compounding and vulcanisation, and the effect of each process upon the material were next described, mention being made of the ability to vulcanise *in situ* at the temperature of boiling water by the use of modern accelerators. Comparative figures were given showing how the elongation and the maximum stress per unit area of properly vulcanised rubber compared with the elongation and maximum stress per unit area of unworked raw rubber. The next point to receive attention was the use of fillers, and a distinction was drawn between materials which do not enhance the properties of the rubber and those which, acting as "reinforcing ingredients," do. The term "grain" and its significance to the engineer were also dealt with. In the latter portion of the paper the author enumerated the many uses to which rubber can be applied in a chemical works, and pointed out its inability to resist such substances as chlorine, bromine, ozone and nitric acid, and the fact that it is slowly carbonised by concentrated sulphuric acid. Several important points were brought out in the subsequent discussion. Briefly, these points were: the desire to be able to fix the rubber lining *in situ*, and not have to send large pieces of plant to rubber works to have this done; the need for a satisfactory method of fixing rubber to metal; that, if possible, it was desirable to be able to obtain rubber having standard characteristics. Questions were also asked relating to ball mill linings, stress diagrams, and the presence of vapour as a rubber preservative in tropical countries.

After dinner the Vice-President, Sir Alexander Gibb, took the chair, and Prof. F. C. Lea gave a lecture on "The effect of temperature on some of the properties of metals with particular reference to the limiting creep and stress."

In view of the modern trend of carrying out reactions at high temperatures and under high pressures, this paper was singularly appropriate and valuable. After briefly describing the various machines upon which the work had been carried out, and the methods adopted for heating the specimens and measuring the strains produced by the applied loads, the author proceeded to discuss the results obtained. The first set of results showed that with increase of temperature above a certain value there was a rapid diminution in the ultimate strength of the specimen, the elastic limit, too, diminished with increase of temperature, whilst, although the elongation first tended to diminish, afterwards it rose rapidly as the temperature increased. By plotting extension against time, Prof. Lea found that with loads below a certain value extension went on until fracture ensued. This stress, termed the "limiting creep stress," is dependent upon temperature, and the author next proceeded to show curves giving the relationship between the "limiting creep stress" and ordinary stress and temperature. Repetition stresses were also considered, and diagrams illustrative of how the breaking stress varied with the temperature were shown. Briefly the results

point to materials being able to withstand repetition stresses much better than continuous stresses at high temperatures. The materials considered in this paper were mild steels of carbon constants varying between 0.14 and 0.75, and duralumin. A number of questions were raised in the ensuing discussion relating to the effect of the previous working on the specimen, the behaviour of metal chrome steels, etc.

On Friday the fifth annual corporate meeting of the Institution was held at the Hotel Victoria, and after the general business had been transacted the President, Sir Frederic Nathan, delivered his presidential address, entitled "Some industrial developments and the chemical engineer."

Beginning with beet sugar, the President outlined the present position of the industry in this country, and indicated the lines along which future developments were possible, reference also being made to the work that is being done on the De Vecchis process. Turning to the rapid development of the motor car, Sir Frederic Nathan showed that the production of power alcohol was bound to become an important industry, and although its development in this country might be somewhat limited on account of the lack of raw materials, yet something might be done in the treatment of waste material such as the cossettes after the sugar had been extracted, and from other sources. Another industry in which he showed that considerable developments could take place was one drawing its raw material from the sea, namely, the manufacture of fish oil, glue, isinglass, fish meal, etc. Turning to coal, a survey was given of the field for development existing in this essential industry, and the importance of the production of hydrogen at low cost was emphasised. The Electricity Bill and its bearing on chemical industry were next considered, and it was pointed out that in the future chemical works using large amounts of steam in their processes could produce and might be made to produce electricity as a by-product by using high-pressure steam for its production and the low-pressure steam afterwards for their steaming processes, thereby utilising their coal more effectively. The address throughout contained valuable data on the various points raised. The thanks of the meeting to Sir Frederic Nathan were moved by Sir Alexander Gibb, President-elect, and seconded by Mr. Rogers.

In the afternoon the Institution again met, under the chairmanship of Sir Frederic Nathan, to hear a paper on "The Cross cracking process and plant," by Mr. F. M. Rogers. After considering the merits of cracking in the vapour and liquid states and the considerations which influenced the selection of the Cross cracking process, Mr. Rogers described the plant itself. In the description prominence was given to the formation of the joints on the headers of the heaters, the making and erection of the reaction chamber, a vessel about 42 ft. long, 3 ft. 10 in. external diameter, with walls 4 in. thick forged in one piece; the regulating valve, "fraid" valve and anchorage for the "fraid" pipe, as well as the cooling coils at the top of the dephlegmating column, upon which the product is so dependent. The foundations of these plants were considered, since this weight of plant formed a heavy compact load on a site whose weight-supporting value was not more than 2 cwt. per sq. ft. Another

point to which attention had to be given was in the staying of the dephlegmating columns, which have to be maintained vertical, and being about 7 ft. 4 in. in diameter and 52 ft. 6 in. in height, offer a considerable surface to the wind. The paper also included a section on operation and control, in which were given figures relating to throughput and yields, operating pressures and temperatures, whilst in the last paragraphs the author dealt with the operating costs and the product of cracking. The Chairman, in opening the discussion, referred to the fact that one-third of the gasoline used in the United States of America was produced by cracking. Points such as the length of time that petrol made by a cracking process could be kept, the design and methods of maintaining the dephlegmators vertical, etc. were amongst those discussed.

The annual dinner was held at the Hotel Victoria on March 11, Sir Frederic Nathan, K.B.E., presiding. The principal guest was the Rt. Hon. Sir Herbert Samuel, and among those present were Sir Frank Heath, Sir Arthur Duckham, Dr. W. H. Eccles, F.R.S. (President, Institution of Electrical Engineers), Mr. F. Palmer (President, Institution of Civil Engineers), Mr. W. Reavell (President, Institution of Mechanical Engineers), Mr. F. H. Carr, C.B.E. (President, Society of Chemical Industry), Mr. W. J. U. Woolcock, C.B.E., Sir Joseph Petavel (National Physical Laboratory), Sir Thomas Holland, Dr. C. H. Lander, and many members and visitors and ladies.

Proposing "The Institution of Chemical Engineers," Sir Herbert Samuel said that, although only four years old, the Institution showed all the signs of healthy and vigorous growth, the membership being nearly 400. Institutions such as these, which grew up almost naturally in the professions of this country, were a sign of the genius of this nation—for it was nothing else—for organisation. We had to depend upon our efficiency in the presence of world competition with other nations because Great Britain had no advantages upon which to rely except the abundance and excellent quality of its coal. We had to rely on our brains and the initiative of the great professions, such as that of the chemical engineer. He had been, so to speak, sentenced to six months' hard labour when he was appointed Chairman of the Coal Commission, and the members of that Commission, after an exhaustive and exhausting inquiry, came to the conclusion that the future of the coal industry depended very largely upon the adoption of a successful economic process for the distillation of coal. Processes were known for the distillation of coal, and the whole problem was one of devising a plant which would make a process commercially and practically profitable. Speaking of the relation of the State to science, Sir Herbert said it was essential that those responsible for the Government should attach full value to science. That was more essential to-day than it had ever been before. The establishment of the Department of Scientific and Industrial Research was a step of immense national importance. Great Britain had splendid traditions in science, particularly in the science of chemistry, and it was our task to carry on this great past to a still greater future. The prosperity of the nation depended upon the success of its great industries; which, in turn,

were dependent on the degree of our industrial chemistry. That, in its turn, relied upon the ability and energy of the three partners, the pure scientist, the commercial chemist, and the chemical engineer.

Sir Frederic Nathan, replying to the toast, said the present is a time of progress, and the Institution of Chemical Engineers could fairly claim to have advanced in all directions during the past year. The membership had increased by 78, the third volume of Proceedings, containing many valuable papers, had been issued, the library had been enlarged, the sphere and influence of the Appointments Bureau had been extended, and in instituting the examination scheme it would be admitted the Council had taken a step of great importance in enhancing the position of the members in the scientific, technical and commercial world. He personally had always placed the training of the chemical engineer in the forefront of the objects of the Institution, and ever since the Institution was founded the Council had been endeavouring to create, by arranging suitable training and facilities for the examinations, a high standard of knowledge and intelligence for the chemical engineer. The need of fully qualified chemical engineers had been manifested both in this country and abroad, as was shown by the Report of the Appointments Bureau. Unfortunately the Cambridge University authorities had not yet seen their way to introduce special courses for chemical engineers, but he felt confident it was only a matter of time before that and other universities and technical colleges would follow the example of the University of London and the Imperial College of Science, and establish Chairs of Chemical Engineering. The results of the examination held by the Institution were disappointing, except in so far as they disclosed the great need that exists for educational facilities. It was to be hoped, now that definite information of the requirements of the Institution were known, that the educational authorities would assist the rising generation to acquire the knowledge necessary to enable it to become members of a profession essential to the well-being of the country.

Sir Alexander Gibb proposed "Kindred Institutions," and welcomed the Presidents of the other Institutions who were present. He related something of the history of our leading engineering institutions, and showed how each was formed at the very moment it was required. At the present time there were, he said, 84 engineering and technical institutions in this country, and he expressed the hope that the near future would see a drawing together of these bodies, all of which have certain interests in common.

Dr. W. H. Eccles, replying to the toast, claimed that the great improvement in the conditions under which the working classes of this country to-day were living was due in the main to the work of the engineering and scientific institutions. Notwithstanding this, the engineering and scientific societies were not allowed to take any part in the conduct of the affairs of the nation, and they had extremely little influence upon the policy of the Government. They were, moreover, scarcely heard at all in the counsels of those who dictated the circumstances and the legislation affecting even their own professions. It was for this reason that he welcomed the suggestion made by Sir A. Gibb that

the kindred institutions should come together in order to bring some influence to bear upon the affairs of the nation. "Cohesion and adhesion" should be the motto of the engineering and scientific institutions of the country if they were to take their part in national affairs.

Mr. F. H. Carr, C.B.E., who also replied, said that the chemical engineer is as essential to chemical industry as air is to breathe. The whole progress of the application of chemical science to industry depended on what the engineer could achieve. If we looked back 20 years the progress in chemical industry was astounding, but that such progress had reached its consummation nobody for a moment could believe.

Sir A. Duckham, proposing "Our Guests," said he wanted to impress upon them very strongly that the chemical engineer was the man of the future. The chemical engineer was the administrator of our industry, and it was administrators that were wanted in this country at the present time. In this connexion there was great need for trying to get education in this country suitable for the chemical engineer. We wanted fundamentals; we wanted the fundamental engineer and the fundamental chemist. We did not want the high spots of the chemist or the engineer, but men with a fundamental knowledge of these great arts. Afterwards they could specialise in the line they wished, but we wanted first of all, in our education, fundamentals. Hitherto we had lacked fundamentals in this country. In his own industry he had great difficulty in finding men with that fundamental knowledge and with administrative ability to back it up. For this reason he would like to see a closer touch, during the training of the student, between the university and industry and commerce. It behoved all connected with big undertakings to open their doors to students in the long vacations and at other times so that the students might come into the works and see the processes being worked. This would help these young men to become good servants to the industry in the future. On the other hand, he would very much like to see our technical men going into the universities and lecturing from time to time and setting some examination papers, and so take the commercial side into the universities. He had spoken at a good many public schools and at conferences of headmasters, and there was undoubtedly a great desire on their part that the boys should see something of the lives they would have to lead in industry after they leave the college. He personally would like to welcome to the works of the country the professor and the teacher. It was very important that the teacher should be kept in touch with modern business and technical methods in order to see what industry wanted, and the training that was necessary for those coming from the colleges into industry. There was also another point he wished to put. Great developments were before us. He was an optimist, and was not one of those who was ready to decry this country and say it was going down. We were going ahead in spite of the fearful conditions we had been suffering from. It was in this spirit that he tried to encourage all his young people to get on with the job and get through with it and conquer. A motto which he always used was "Every-

thing is possible," even teaching turtles to fly. That would not be a bad motto for the chemical engineer. In one case, a very difficult problem, it seemed impracticable to get a certain plant in a certain position, but last night as he was walking down his drive an idea had come to him all of a sudden; he could not say how. It was found possible, and the moral was never to give up trying. With Mr. Carr, he maintained there was no limit to development in the future. In coupling the name of Sir Joseph Petavel with the toast, Sir Arthur said it had been his privilege to see the work that was being done at Teddington. It was amazing, and more use should be made of the National Physical Laboratory. He was certain that industry in this country would support research which could not be done under better conditions or with better brains than at the National Physical Laboratory.

Sir Joseph Petavel replied.

Mr. W. J. U. Woolcock, C.B.E., proposed the "President" and recalled the time when he worked with Sir Frederic Nathan during the war, when he was never let down in the answers that were provided for him to be given to the House of Commons. Sir Frederic had been equally thorough in the work he had been doing for the Institution, the success of which had been very largely due to his efforts.

Sir Frederic Nathan, replying, said he had accepted the office of President with considerable misgivings, but realising that with the great help of the Council and honorary officers some measure of success had been attained, he gave up the office without any misgivings. He wished his successor, Sir Alexander Gibb, as pleasant a time as he himself had had.

EMPIRE MINING AND METALLURGICAL CONGRESS

The Canadian Institute of Mining and Metallurgy announces that 500 acceptances have been received from intending delegates to the Empire Mining and Metallurgical Congress, which will be held in Canada during August to October, 1927. Over 200 acceptances have been received from Great Britain, and a further 600 persons have indicated their interest in the Congress.

The Congress will provide a unique opportunity not only of studying the mining opportunities but also the mining possibilities of Canada. Canada possesses one of the greatest fields left in the world to-day, but only a small proportion has been prospected; yet the results are so important that development should be greatly accelerated. Capital is wanted for development, preferably from within the Empire. Sir Alfred Mond said, on his recent visit to Canada, that countries were being forced into great economic units. One of these units would be the countries of Central Europe, another the United States; but he believed that within the constituent countries making up the British Empire there lay the possibilities of another economic unit so great in extent that it would dwarf by comparison all others. In such a scheme Canada would be a very important factor, and one of its greatest contributions would be the diversified products of its mines.

OBITUARY

PROFESSOR E. H. RENNIE

Time irresistibly takes its terrible toll and the names left upon the roll of our old guard are now very few. The Australian mail just in brings me a copy of the Adelaide *Register* of January 10, giving an account of the sudden death of my old friend, Edward H. Rennie, Professor of Chemistry in Adelaide University since 1885. He seemed to be in good health but on Saturday, January 8, going into the garden, after drinking some water, he lay down—and just died. A few days previously I had received a long chatty letter from him, dated December 20. In this he speaks of having had a very strenuous year and feeling somewhat played out. During the first six months he had been acting Vice-Chancellor of the University, then came the University Jubilee and after this the meeting at Perth of the Australian Association for the Advancement of Science, of which he was President. Added to this, he had been anxious on account of the illness of his wife and daughter. He tells me of the journey across the arid region to Perth, lasting three days. At one part, he says, the railway ran in an undeviating straight line, nearly 400 miles, across flat desert, where nothing was growing over about 2 feet high, the horizon being unbroken by a single tree or elevation of any kind. People seldom realise how much of Australia is country of this order. Aborigines were seen here and there, almost in their primitive condition, except that they wore clothes.

Rennie was born on August 19, 1852, at Balmain, Sydney. He graduated at Sydney University, B.A. in 1870, and M.A. in 1876. He was five years a master in Sydney Grammar School, and then a year and a-half at Brisbane Grammar School, after which he came to England and took the London D.Sc. in 1881. He assisted C. R. Alder Wright at St. Mary's Hospital. His first communication to the Chemical Society was made with Alder Wright (1880). He then spent some time with me at the London Institution; the only record of our work is in the *Chemical News*. I was greatly attracted to him, and was hoping to secure him as my chief assistant at the Finsbury Technical College, at the opening, in 1883; to my regret a tempting offer came from his home, and he returned to Australia in 1882. Two years later he was appointed Professor of Chemistry in Adelaide University. I visited him in 1914, reaching Adelaide a week ahead of the Association in order to stay quietly with him. I then gained some idea of the man's devotion to his post and the great burden of work upon his shoulders. Rennie's self-sacrificing service to his University, both as teacher and administrator, cannot be over-rated. He was extraordinarily thorough, deliberate and exact in his outlook and work, a most painstaking teacher and very popular, owing to his quiet, tactful manner. In his leisure he was an assiduous follower of the art of Izaak Walton; in fact, noted as a sea fisherman. His scientific services to Australia are also to be ranked very high, though unfortunately, owing to the official calls upon him, he had but little spare time for original inquiry. He devoted himself particularly to the study of native materials. Perhaps his most interesting discovery was that of trihydroxymethylnaphthaquinone in *Drosera Whittakeri*.

Australia is remarkable for its numerous species of long trailing *Droseras*. Rennie and I spent a delightful day in the hills behind Adelaide, and nothing interested me more in my journey around the Continent than his digging up the *Drosera* tubers and showing me the beautiful glistening crystals of the hydroxyquinone present in the outer layers. Why or wherefore such a compound should so come to the surface in a plant is difficult to say.

We spent another day on the sea shore, tracking down *Lotus australis*, which I was anxious to compare with our *corniculatus*. We found it in quantity, highly cyanophoric, very like the plant growing at Ballantrae. I fancy *corniculatus* must have wandered to the Antipodes and there changed its name.

Australians are in no way sufficiently alive to the need of studying their natural organic products. The wonderful work on eucalyptus oils done by Smith and Baker of Sydney has not yet been appreciated. Recently (February 12) an advertisement was printed in *Nature* for a lecturer and demonstrator in organic chemistry at the University of Sydney, salary £350 per annum. Only by accident is a chemist good enough for such a post likely to be bought at so low a price, perhaps that of a dock labourer—only a week's pay of the comedian, Billy Merson. No one in Australia will rate a man very high who is paid such a salary. It were time that organic chemistry were put upon a higher footing, especially in so important a seat of higher learning as Sydney—so that it may have some chance of being mentioned along with the harbour.

Australia can ill-afford to lose a man of Rennie's calibre, and will do well to take warning and, if she find other such men to serve her, relieve them more of ordinary routine labours. It is always to be remembered that the higher work done by a competent professor is that which most tells upon the character of the best students.

H. E. ARMSTRONG

DR. ADOLPH LIEBMANN

We greatly regret to announce the death of Dr. Adolph Liebmann, one of the original members of this Society.

Dr. Liebmann was born in 1852 at Bacharach, on the Rhine, studied chemistry under Kekulé and Clausius, and took the Ph.D. degree at Bonn in the late 'seventies. He then became assistant to Kekulé, and published from the University of Bonn several researches in organic chemistry. In 1881 he came to England and entered the dyestuff factory of I. Levinstein & Co., at Manchester, as research chemist, where he remained for 2 or 3 years. During this early period he obtained his first experience of chemical patent law, being closely connected with the historical patent actions of the Badische v. Levinstein. About the year 1884 he established a consulting practice in Manchester in partnership with his friend, the late Dr. A. Studer, and for a number of years the firm of Liebmann and Studer was well known in connexion with dyeing and textile chemistry, particularly as specialists in Aniline Black dyeing and cotton mercerisation. He also established a wide reputation as a chemical patent expert, in which field he became still more active when he removed to London in the year 1909.

He was retained for a number of years by the Badische Aniline Company and acted for them in many patent actions, notably the historical Rhodamine 6G case and the sulphuric anhydride litigation with Nobels. He was also called as expert witness in the protracted litigation regarding the saccharin patents, in the "oil-hardening" action of Crosfields *v.* Levers, the Osram lamp cases, and the Sulphur Black litigation. In most of these patent actions he was closely associated with the late Sir James Dewar, and frequently also with Lord Moulton prior to his becoming a Judge. In conjunction with Sir James Dewar he carried out in the laboratory of the Royal Institution many investigations upon patented processes.

His consulting work also extended to the United States, to which country he made many and lengthy visits. The last of these occasions was in connexion with the important "ore-floatation" litigation, in which after a very protracted fight judgment was given for his clients.

Dr. Liebmann combined with great theoretical and practical knowledge a keen logical mind which rendered him almost as good a lawyer as a chemist. He was regarded in the Courts as one of the fairest and most conscientious of witnesses, and his evidence always inspired great confidence with the Judges. His genial and kindly disposition endeared him to all who knew him.

After the outbreak of war he led a very retired life, as, although very loyal to his adopted country, he was of a highly sensitive nature. He was consulted by Lord Moulton in 1914 regarding the establishment of a national dyestuff industry, a proposal he greatly favoured, but the advice which he gave to keep politics out and leave the development of the scheme in the hands of chemists was unhappily not followed.

For some months his health had been gradually failing, and he passed away quite painlessly at his home at Weybridge on February 15 last.

PERSONAL AND OTHER ITEMS

Sir Alfred Mond, Sir Harry McGowan, Mr. J. G. Nicholson, Lieut.-Col. G. P. Pollitt and Mr. T. W. Stuart have been appointed to the board of the United Alkali Co., Ltd.

The University of Manchester will confer the honorary degree of D.Sc. on Prof. R. Willstätter, lately professor of chemistry in Munich University, and on Dr. C. S. Myers, C.B.E., F.R.S., Director of the National Institute of Industrial Psychology, on Founder's Day, May 18.

At the June Convocation of Durham University it is proposed to confer the honorary degree of M.Sc. upon Mr. Hugh Dunford Smith, who is the Hon. Secretary of the Newcastle-upon-Tyne Section of the Society of Chemical Industry.

Mr. P. W. Clutterbuck, O.B.E., M.Sc., Ph.D., has been appointed assistant lecturer in physiological chemistry in the University of Manchester.

The late Dr. J. J. Acworth, founder of the Imperial Dry Plate Co., and formerly chemist to Ilford, Ltd., left £562,026, with net personalty £528,177.

The late Sir Edward Thomas Holden, J.B., head of E. T. Holden & Sons, Ltd., tanners and leather manufacturers, left £124,967, with net personalty £119,861.

Prof. D. Berthelot, a member of the Académie des Sciences, and the second son of the eminent chemist, Marcellin Berthelot, has died at the age of 62.

Dinner to Sir D. Milne Watson

A complimentary dinner was given on March 8 at the Savoy Hotel by the governing bodies of the several national organisations of the gas industry to Sir David Milne Watson, the governor of the Gas Light and Coke Company, and president of the National Gas Council of Great Britain and Ireland. Among those present were Prof. A. Smithells (in the chair), Mr. P. Ashley, Alderman Sir A. Ball, Mr. C. Bigham, Prof. J. W. Cobb, Mr. J. E. Cowen, Sir A. Duckham, Mr. J. H. Ellis, Sir Fortescue Flannery, Mr. R. W. Foot, Mr. W. L. Galbraith, Mr. F. W. Goodenough, Mr. T. Goulden, Brig.-Gen. H. B. Hartley, Mr. T. Hardie, Councillor W. J. Harvey, Mr. R. M. Holland-Martin, Mr. F. H. Jones, Alderman Sir W. Kay, Alderman J. H. Lloyd, Mr. J. W. Napier, Bailie J. B. Paterson, Mr. J. F. Ronca, Alderman J. H. Waddington, Mr. W. E. Whyte, Mr. J. Wilkinson, Mr. H. Woodall, Lieut.-Col. H. W. Woodall, and Mr. H. James Yates.

The Gas Industry in 1925

The Board of Trade has issued Part II of the return relating to all authorized gas undertakings in Great Britain for 1925 (price 10s. 6d.). The return deals with 782 undertakings with a total nominal capital of £171,987,989, an increase of £3,582,215 over the amount shown in the previous return. The receipts on revenue account, £66,042,643, show a decline of £667,347 from the previous year's total, but the expenditure, £56,908,648, shows a decrease of £978,979, and the gross profit has been increased by £311,632.

Colloid Chemistry of the Rubber Industry

The first course of the series of Gow Lectures on the Colloid Chemistry of the Rubber Industry will be given under the auspices of the University of London by Dr. E. A. Hauser, of Frankfurt-on-Main, at University College, London (Gower Street, W.C.1), during the first fortnight in May next. Full particulars of these lectures will be published later.

United Kingdom Iron and Steel Output

In February the output of pig iron in the United Kingdom amounted to 567,900 tons, as against 434,600 tons in January, 539,100 tons in April, 1926 (the month immediately preceding the strike), and 502,000 tons in February, 1926. The production includes 194,600 tons of hematite, 187,700 tons of basic, 142,900 tons of foundry, and 17,500 tons of forge pig iron. The number of furnaces in blast at the end of February was 162, an increase of 10 since the beginning of the month. At the end of April, 1926, 147 furnaces were in blast, and at the end of February, 1926, 146. The output of steel ingots and castings amounted to 819,100 tons, or an annual rate of 10,648,300 tons, allowing for the shorter month, compared with 730,700 tons in January, 661,000 tons in April, 1926, and 703,800 tons in February of that year. In the years 1913 and 1920 respectively the monthly

average production was of pig iron 855,000 tons and 669,500 tons, and of steel ingots and castings 638,600 tons and 755,600 tons.

Survey of the Sugar and Glucose and Spirit Distilling Trades in 1924

The following data are extracted from the "Preliminary Reports No. 3" of the Third Census of Production (1924) regarding the sugar and glucose trade:—During 1924 the total quantity of sugar refined was 19,785,000 cwt., valued at £44,454,000, as compared with 11,300,000 cwt. (£8,995,000) refined in 1907. Other products, including glucose, molasses and caramel, raised the total value of the products in 1924 to £53,174,000, as compared with £12,315,000. The substantial increase in the rate of Excise duty must be taken into account in comparing these values. Exports of refined sugar amounted to 1,447,000 cwt.; imports for home consumption amounted to 11,337,000 cwt. The molasses exported totalled only 591,000 cwt., as against the total import of 3,258,000 cwt. Of the refined sugar exported, nearly the whole, 1,008,000 cwt., was consigned to the Irish Free State, together with 21,000 cwt. of molasses and 34,000 cwt. of glucose. A further quantity of 2,558,000 cwt. of unrefined sugar was also imported either for use by manufacturers or for direct consumption. The net output of the industry, calculated as explained above, was £19,923,000, which represents a net output per person employed of £1578, compared with £506 in 1907. During 1924 the number of persons employed in the industry was 12,626, compared with 6501 in 1907, the greatest number employed at any time being 12,215. Thus the output of refined sugar in 1924 was 75% above that of 1907, though the increase of persons employed in the industry was 94% and the increase in horse-power of engines was 160%. The total capacity of the engines at the works of the firms engaged in the industry in 1924 was returned as 35,371 h.p., compared with 13,618 h.p. for the year 1907. The capacity of electric generators in the trade was 18,004 kw., against 4205 kw.

In 1924 about one-third less spirits were distilled in England and Wales than in 1907, while those distilled in Scotland had increased by about 12%. This leaves the 1924 return slightly below that of 1907 in quantity. In 1924 the plain spirits amounted to 34,191,000 gallons, compared with 36,057,000 gallons in 1907, the corresponding figures for methylated spirits being 1,733,000 gallons and 1,098,000 gallons respectively. The total value of the product, however, exclusive of duty, amounted to £7,125,000 in 1924, as against £3,417,000 in 1907. Imports of spirits in 1924 amounted to 3,306,000 gallons, and exports totalled 8,373,000 gallons, including 172,000 gallons exported to the Irish Free State. During the year 24,000 cwt. of yeast were exported, against 193,000 cwt. of yeast imported. The net output of the distilleries was £2,575,000, and the net output per person employed was £557, against £236 in 1907. The total horse-power employed was 12,685, compared with 10,529, and the electrical generating capacity was 5041 kw., against 503 kw.

The returns from factories engaged in compounding, rectifying and methylating spirits showed a total product for this trade valued at £6,597,000, as compared with £4,027,000 in 1907. Only 952 persons were employed,

but the net output amounted to £1,000,000, and the net output per person employed totalled £932, against £354 in 1907. The production included 5,468,000 proof gallons of methylated spirit (£499,000) against 5,675,000 gallons (£270,000) in 1907; and 2,118,000 gallons of British and Irish spirits (£5,987,000), against 5,903,000 gallons (£3,685,000). These figures do not include spirit methylated by firms for their own use in the manufacture of varnish, etc. The horse-power employed was 360 (412).

Synthetic Oils in Germany

The Leunawerke, near Halle, which form part of the I.G., is to begin, states the *Manchester Guardian*, the production of "synthetic oils" from lignite in April. At first the output will be small, but will be increased in response to the demand of the market.

Non-metallic Mineral Products in Canada in 1925

According to a statement issued by the Dominion Bureau of Statistics at Ottawa, production from the 35 plants in Canada classified under the Miscellaneous Non-Metallic Mineral Products Industry amounted in value to \$7,978,183 as compared with an output value of \$6,991,904 in 1924. This industry includes 13 establishments manufacturing artificial abrasives or abrasive products, 2 plants making graphite electrodes, 6 concerns producing gypsum products, 11 mica-trimming shops, and 1 plant making foundry supplies.

Production of artificial abrasives such as crude carborundum, aloxite, firesand and fused alumina during 1925 was valued at \$5,186,802, and the output of abrasive products, and other commodities, including ferrosilicon, was sold for \$722,516, making a total production value for the industry of \$5,909,318, as compared with a corresponding figure of \$5,628,653 in 1924. Capital employed in the industry amounted to \$6,160,392, employees numbered 598 persons, payments in salaries and wages totalled \$853,458, and raw materials cost \$2,006,618. Four plants in Ontario and one in Quebec made artificial abrasives, while eight establishments in Ontario manufactured grinding-wheels, sand-paper and similar products.

Gypsum products made in this industry amounted in value to \$1,001,509. Eight plants were in operation, capital employed totalled \$640,486, employees numbered 213, and materials cost \$348,046. Wall-coating gypsum board and gypsum blocks were made in three different plants in this industry and the output was valued at \$864,483; in addition, hardwall plaster and some wall-board was made in plants which also quarry the gypsum and are therefore included in the mineral production group. Plaster castings and ornamental plaster works made up the bulk of the remainder of the output in this industry.

Errata

We regret that in the notice of the "Annual Reports, 1926," which appeared in our last issue, the section on "Drying oils, varnishes and driers" was wrongly attributed to Mr. A. A. Drummond. This section was contributed by Mr. S. S. Woolf, Mr. Drummond being the author of the section on "Resins and solvents."

In the issue of March 4, p. 182, col. ii, the word "rhodium" on line 15 should read "sodium."

PARLIAMENTARY NEWS

British Industries Fair

In reply to Colonel Day and Mr. Lunn, Sir Burton Chadwick said that 74,162 buyers, of whom 1581 came from overseas, visited the London section of the Fair. This latter figure did not include a considerable number of United Kingdom agents of overseas firms who were buying on foreign account. The figures showed an increase of 25% on those for last year. In addition, the general public visited the Fair to the number of about 25,000 in London and 10,000 in Birmingham. The exhibitors in all sections of the Fair have expressed themselves as more than satisfied with the actual and anticipated results, although no official figures are available as to the business done. — Mar. 7

Disinfectants (Tests)

Answering Lieut.-Col. Fremantle, Mr. Guinness said he was not aware that the test for disinfectants which the Ministry of Agriculture had adopted for use under the Diseases of Animals Acts was in any sense unreliable. It was adopted after full consideration and scientific advice as being a test conducted under conditions which resembled as closely as possible the actual conditions under which the disinfectants prescribed by the Ministry were used in practice. The test had been prescribed on the advice of the Government chemist. Mar. 7.

Imports of Oil and Motor Spirit

Sir P. Cunliffe-Lister informed Mr. G. Hall that the imports of crude petroleum in the years 1910, 1925 and 1926 respectively were 187,318 gallons, 569,082 169 gallons, and 538,239,606 gallons. Total imports of refined petroleum for the same years respectively were as follows: 345,282,518 gallons, 1,044,219,196 gallons, and 1,374,696,350 gallons — Mar. 8

Safeguarding of Industries Act (Chemical Products)

Replying to Major Crawford, Sir P. Cunliffe-Lister said that before an article could be exempted from duty under Section 10 (5) of the Finance Act, 1926, the Board must be satisfied not only that the article was not being made in His Majesty's Dominions, but also that there was no reasonable probability that it would be so made within a reasonable period. With regard to the lactic acid B.P. mentioned, applicants were given the name of a manufacturer who proposed to produce it in the near future and was setting up the necessary plant for the purpose. Mar. 8.

Sir Burton Chadwick informed Mr. Fenby that an Order under Section 10 (5) of the Finance Act, 1926, exempting phenacetin, phenazone, oxalic acid, hydroquinone and certain other products from duty was made by the Treasury on March 7. — Mar. 9.

Sale of Food and Drugs Bill

This Bill was read for the third time and passed. — Mar. 11

COMPANY NEWS

BRUNNER, MOND & CO., LTD.

A dividend has been declared on the ordinary shares for the three months ended December 31, 1926, at the rate of 17½% per annum, making 7½%, less tax, for the

nine months, equivalent to 10% for the year. The sum of £10,964 has been carried forward. This dividend constitutes the final payment to shareholders under the old company, which was recently merged into the Imperial Chemical Industries.

UNITED ALKALI CO., LTD.

The net profit for 1926 amounted to £195,765 (against £391,085 for 1925), plus £103,709 brought forward. A dividend has been recommended on the ordinary shares at 10% per annum (same), leaving £11,708 to be carried forward. The report states that the company suffered severely by the general strike and the coal stoppage, resulting in loss of employment and revenue to its works in this country, a much greater proportion than usual of the profits being provided from its works abroad, the dividend from the North American Company being £149,132. Referring to the formation of Imperial Chemical Industries, Ltd., the report states that all the shareholders, except about 4%, agreed to exchange their shares for those of the combine. This is considered highly satisfactory. Five new directors have been appointed—Sir Alfred Mond, Sir Harry McGowan, Mr. J. G. Nicholson, Lieut.-Col. G. P. Pollitt, and Mr. T. W. Stuart. The first four have long been directors of other of the Imperial Chemical Industries constituent companies, and their election will promote a consolidation of policy and interest. Mr. Stuart was a prominent member of the staff during the whole life of the company until recently, when he retired.

HADFIELDS, LTD.

A dividend has been announced for 1926 on the ordinary shares at the rate of 2½%, less tax, compared with 3% for 1925.

COURTAULDS, LTD.

The fourteenth ordinary general meeting of the ordinary shareholders was held on March 8, Mr. Samuel Courtauld (chairman) presiding. The year 1926 had been a very difficult one for the company, various events, of which the coal strike was by far the most damaging, combining to reverse a promising start and bring about a serious falling off in the year's business. The weaving department showed considerable strength under the trial. Sales fell away in the autumn, but not so seriously as might have been expected, due to a bold policy of manufacturing for stock. But towards the end of the year stock grew too heavy, and although sales were beginning to improve, the output was still being restricted. The consumption of artificial silk in England and the greater part of Europe had also been adversely affected by a change in fashion, which, at the moment, did not favour highly lustrous materials. Under these handicaps, and in spite of some restrictions of production, it was not surprising that the company had accumulated large stocks of yarn. Since the end of the year the volume of business had been steadily growing, and this fact, coupled with some evidence of more stability in the world-price of artificial silk, enabled the directors to think they were past the worst. The Wolverhampton factory was practically completed during the summer, but the state of business did not warrant

starting more of the plant than was necessary for the building up of the organisation. Here there was a very large power of production which could be brought in at any moment. The factory at Cornwall, Ontario, had been running at full capacity since the summer, and was selling its output. Both the factory belonging to Glanzstoff-Courtaulds at Cologne and the one at Calais were well advanced, and would be in a position to start before many months. Referring to the agreement made with the Snia Viscosa Company with the object of promoting technical and commercial collaboration (cf. CHEM. AND IND., Feb. 4, 1927, p. 110), the chairman said this agreement represented the furthest steps—apart from the company's American interests—which it had yet taken in the way of international commitments and alliances, and if markets to-day were feeling more confidence in the stability of artificial silk prices, he thought it might be partly due to the knowledge of the arrangement. The year 1926 was also a disappointing one for the industry in America, but the American Viscose Corporation reported that sales were now improving and stocks falling. As regards the immediate outlook, there were two reasons why an improvement should be shown. One was the general feeling that prices were not going to be lower at present. Buyers did not want lower prices to-day; what was wanted was stability. The other reason was that the disturbances caused by the reductions in prices made last year, varying from 15% to 25%, were beginning to subside, and the new price-level was opening a wider field to the use of artificial silk, and the expected stimulus to consumption was at last beginning to be felt. The price of first-grade viscose silk to-day was only about 15% to 20% of that of natural silk; it was 25% cheaper than worsted yarn of similar counts, and only about 33% higher than mercerised cotton. It was interesting to note that whilst the prices of these other yarns stood at anything from 30% to 90% above pre-war level, viscose silk was actually offered to-day at a lower price than in 1914. Whilst the chairman did not expect further substantial economies to be effected in working costs, he believed that new methods would be concerned chiefly with improvements in quality. Substantial progress had already been made in this direction. In reply to a shareholder, the chairman said the company was not linked up with the Nuera Company in any way. The only connexion it had with it was in investigating a new process under an option in which the Nuera Company had a minor share. The company was continually following up fresh discoveries, inventions and developments, and it was much too soon to say whether this particular piece of experimental work would be a success or not. A final dividend was declared on the ordinary shares of 3s. 3d. per share, free of income tax, making 4s. 6d. or 22½% for the year. [For the accounts, see CHEMISTRY AND INDUSTRY, Feb. 25, 1927, p. 175.]

HENRY BESSEMER AND CO., LTD.

A net loss is shown for 1926 of £27,667, making with the debit balance brought in, £64,286. This is arrived at after making provision for depreciation at the usual rate, and after writing off losses incurred in realisation of the remainder of the surplus stocks purchased prior to 1925. A profit of £1,307 was made in 1925.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali.—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime.—£7 10s. per ton, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate.—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Sulphammoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton. contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
Arsenic, Sulphide, Yellow.—2s. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 2d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£7—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—1s. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 6d. per lb. Crude 60's, 1s. 8d.—1s. 9½d. per gal.
 Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 1d. per gal. Pale, 95%, 1s. 10d.—2s. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 2½d.—1s. 3½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 2d.—2s. 5d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 11½d. to 2s. 3d. per gal. Firm. Pure, 2s. 3d.—2s. 5½d. per gal.
 *Xylol.—2s. 3d.—3s. per gal. Pure, 4s. per gal.
 Creosote.—Cresylic 20/24%—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9½d.—1s. 0½d. per gal., according to quality. Solvent 90/160, 1s. 8d.—2s. 1d. per gal. Solvent 95/160, 1s. 9d.—1s. 10d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—87s. 6d.—105s. per ton, f.o.b. according to district. 79s.—79s. 6d. per ton March/April shipment.
 Pyridine.—90/140.—9s. 6d.—13s. per gal. Nominal. 90/180.—7s. 6d. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—8d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Brisk.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 4d.—1s. 4½d. per lb. Less 5%. Very firm.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 6d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 1½d. per lb. Less 5%. Very firm market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—11s. 3d.—11s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—8s. 9d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.
 Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d.—2s. 6d. per lb. Potassium.—1s. 11d.—2s. 1d. per lb. Sodium.—2s. 2d.—2d. 4d. per lb. All spot.

Calcium Lactate.—1s. 4d.—1s. 5d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7d. per lb., according to quantity.

Cresote Carbonate.—6s. per lb.

Ether meth.—1s. 1d.—1s. 11d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—6s. 6d.—7s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perochloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £33 per ton net.

Magnesium Oxide.—Light Commercial £37 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.

Mercurials.—Red oxide, 6s. 11d.—7s. 1d. per lb., Levig, 6s. 7d. per lb.; Corrosive sublimate, Lump, 5s. 2d.—5s. 4d. per lb., Powder, 4s. 9d. per lb.; White precip., Lump, 5s. 2d.—5s. 6d. per lb., Powder, 5s. 7d. per lb., extra fine, 5s. 7d.—5s. 8d. per lb.; Calomel, 5s. 9d.—5s. 11d. per lb.; Yellow Oxide, 6s. 4d.—6s. 5d. per lb.; Persulph B.P.C., 5s. 7d.—5s. 8d. per lb.; Sulph. nig., 5s. 4d.—5s. 5d. per lb.

Methyl Salicylate.—1s. 8d. per lb.

Methyl Sulphonol.—15s.—15s. 3d. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. 9d.—4s. per lb.

Phenazone.—5s. 9d.—6s. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 94s. per cwt., less 2½% for ton lots. Very firm market.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Rosocin.—4s. per lb. spot.

Saccharin.—55s. per lb.

Salol.—3s.—3s. 3d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—77s. 6d.—82s. 6d. per cwt. net, according to quantity.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal 1s. 10d.—1s. 11d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonol.—10s.—10s. 3d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 1d. per lb.

Thymol, Puriss.—11s. 6d.—12s. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (ex Anethole).—10s. 3d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.

Cinnamic Aldehyde.—Natural, 17s. 6d. per lb.

Coumarin.—10s. 9d. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—9s. 6d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—3s. per lb.

Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb. Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Shui Oil) 12s. per lb.—(ex Bois de Rose) 16s. per lb. Linalyl Acetate.—(ex Shui Oil) 14s. 6d. per lb.—(ex Bois de Rose) 18s. per lb.

Methyl Anthranilate.—9s. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—36s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—11s. per lb.

Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 3d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—11s. 3d. per lb.

Camphor.—63s. 6d. per cwt. Cananga, Java, 22s. 6d. per lb. Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 20s. 9d. per lb. Lemon.—10s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Bulgarian, 70s. per oz., Anatolian, 30s. per oz. Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 20s. per lb. Japanese, 8s. 6d. per lb. Firm. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than May 7th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Mar. 24th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Alexander and Baer. Fine-grinding mills. 5703. Mar. 1.

Anode Rubber Co., Ltd. (Klein and Szegvari). Apparatus for producing liquid dispersions. 5769. Mar. 1. Process of producing aqueous dispersions of organic substances. 6092. Mar. 4.

Anode Rubber Co., Ltd. (Klein, Szegvari, Gotlieb, and Wilson). Apparatus for preventing separation of constituents of liquid dispersed systems. 6037. Mar. 3.

Bourdais. Dispersion of solids or liquids. 5678. Mar. 1.

- Crowe. Ball mills. 5767-8. Mar. 1.
 Fusion Corp., and Hollins. Extraction of dust etc. from gases. 6237. Mar. 5.
 Industrial Associates, Inc. Spray drying. 6126. Mar. 4. (U.S., 18.6.26.)
 Jackson (American Encaustic Tiling Co.). Tunnel kilns. 5617. Feb. 28.
 Jackson (Bennett, Inc.). Production of dispersions. 5596. Feb. 28.
 Johnson (I.-G. Farbenind.). Apparatus for carrying out chemical etc. processes. 5967-8. Mar. 3.
 Meyerhofer. Effecting conversions of solids etc. 5865. Mar. 2. (Ger., 13.4.26.)
 Moseley. Emulsions and dispersions. 6206. Mar. 5.
 Smith. Mixing-machines. 5716. Mar. 1.

I. - Complete Specifications

- 23,722 (1925). Wade (Philips' Glöcilampenfabr.). Continuously separating a gaseous mixture. (266,396.)
 30,645 (1925). Evans. Drying-cylinders. (266,481.)
 31,399 (1925). Radiation, Ltd., Brayshaw, and Brayshaw. Furnaces. (266,487.)
 7418 (1926). L'Air Liquide. Separating constituents of gaseous mixtures. (263,732.)
 21,269 (1926). Powley & Sons, Ltd., and Powley. ing apparatus. (266,615.)
 28,755 (1926). Hoffmann. See II.
 *903 (1927). Amundsen. Production of cold. (266,683.)
 *5015 (1927). Vernay. Extracting solid matters in suspension in a liquid. (266,719.)
 *5102 (1927). Chem. Fabr. Pott & Co. Producing solvents and emulsifying-agents. (266,746.)
 *5412 (1927). Silica Gel Corp. Refrigeration. (266,747.)

II. Applications

- Chem. Fabr. in Billwader, and Kuhlwein. Obtaining high-grade products from raw coal etc. 6209. Mar. 5.
 Cuvier. Fuel-economising product. 5615. Feb. 28.
 Gardner. Manufacture of carbon. 6238. Mar. 5.
 Goskar. Distillation of carbonaceous materials. 5751. Mar. 1.
 Inray (Allgem. Ges. f. Chem. Ind.). Treatment of hydrocarbons. 5857. Mar. 2.
 Johnson (I.-G. Farbenind.). Working with hydrocarbons at high temperatures. 5966. Mar. 3.
 La Ribosière. Treating mineral oil hydrocarbon material. 5870. Mar. 2.
 Pope. Apparatus for low-temperature carbonisation. 6005. Mar. 3.
 Semet Solvay Co. By-product coke ovens. 5567. Feb. 28. (U.S., 22.3.26.)
 Soc. Internat. des Proc. Poudhomme-Houdry. Apparatus for desulphurisation of gases. 6086. Mar. 4. (Fr., 4.3.26.)

II. - Complete Specifications

- 9860 (1926). Schicht A.-G. Manufacture of highly viscous lubricating-oils. (250,947.)
 11,074 (1926). I.-G. Farbenind. Manufacture of motor fuel. (251,969.)
 15,040 (1926). Still. Distillation of solid fuel in coke ovens. (266,584.)
 15,396 (1926). Humphreys & Glasgow, Ltd. (Brady). Purification of gas. (266,586.)
 28,755 (1926). Hoffmann. Apparatus for distilling or drying coal etc. (261,740.)
 2313 (1927). Chavanne. Gasification of solid fuels. (266,656.)
 *30,124-5 (1926). Chem. Werke Carbon Ges. Highly-active carbon. (266,673-4.)
 *32,715 (1926). Humphreys & Glasgow, Ltd. Apparatus for carburetting water-gas. (266,680.)

*32,716 (1926). Humphreys & Glasgow, Ltd. Apparatus for making gas. (266,681.)

*5165 (1927). Wiberg. Reducing to carbon monoxide the carbonic acid content in gases. (266,729.)

IV.—Applications

- British Dyestuffs Corp., Gibson, and Payman. Producing wax-like polychloronaphthalenes. 6159. Mar. 4.
 Carpmael (Bayer & Co.). Azo dyestuffs. 5889. Mar. 2.
 Comp. Nat. de Mat. Col. et Manuf. de Prod. Chim. du Nord. Manufacture of dyestuffs etc. 5749. Mar. 1. (Fr., 5.3.26.)

IV. - Complete Specifications

- 25,713 (1925). Cassella & Co., Ransford, and Carpmael. Vat dyestuffs. (266,404.)
 2286 (1926). I.-G. Farbenind. Manufacture of alanes of the anthraquinone series. (246,840.)
 4850 (1926). Chemical Works (Sandoz), and Böniger. Manufacture of diazotisable azo-dyestuffs. (266,533.)
 5594 (1926). Carpmael (Chem. Fabr. vorm. Schering). Manufacture of halogen substituted oxindol-3-acetic acids and homologues thereof. (266,539.)
 10,158 (1926). Brit. Dyestuffs Corp., Saunders, and Goodwin. Azo dyes. (266,561.)

V.—Applications

- Hagiwara. Manufacture of artificial silk etc. 5700. Mar. 1.
 Jackson (Bennett, Inc.). Production of waterproof paper etc. 5618. Feb. 28.
 Micklethwaite. Production of artificial silk yarns. 6182. Mar. 5.

V. - Complete Specifications

- 29,539 (1925). Bruckhoff. Degreasing raw wool etc. (266,436.)
 29,549 (1925). Boger. Softening, spinning, and twisting artificial silk. (266,438.)

VI. Application

- Gorrie. Machine for dyeing etc. 5806. Mar. 2.

VI -- Complete Specification

- 28,427 (1926). Clavel. Weighting silk. (266,640.)

VII. - Applications

- Bachmann. Production of active silicic acid. 5571. Feb. 28. (Austria, 18.3.26.)
 I.-G. Farbenind., and Staib. Converting oxides into anhydrous fused chlorides. 6220. Mar. 5.
 Kasser, Lederer, and Stanczak. Precipitating metal hydroxides. 5610. Feb. 28. (Czecho-Slovakia, 9.3.26.)
 Nishigawa. Manufacture of ammonium sulphate. 5747. Mar. 1.
 Pease. Manufacture of potassium phosphate etc. 5552. Feb. 28.

VII.—Complete Specifications

- 21,315 (1925). Kleinmann, and Buttnerwerke A.-G. Treatment of natural aluminium hydroxides. (266,225.)
 23,727 (1925). Skoglund. Manufacturing sulphuric acid. (266,397.)
 29,548 (1925). Wohlers. Apparatus for making anhydrous metallic chlorides. (266,437.)
 18,879 (1926). Colum. Production of double salts of calcium halides with calcium lactate. (266,607.)
 *1601 (1927). Soc. Chim. Usines du Rhône. Treating acetic acid. (266,684.)
 *3009 (1927). Norsk Hydro-Elektrisk Kvaestofakt. Purification of gases for production of ammonia. (266,689.)
 *5251 (1927). I.-G. Farbenind. Treatment of crude nitrate of soda (caliche). (266,735.)
 *5378 (1927). I.-G. Farbenind. Treatment of crude nitrate of soda. (266,744.)

VIII.—Applications

Dartmoor China Clay Co., Ltd., and Parker. Bleaching clay etc. 5607. Feb. 28.

Hartford-Empire Co. Refractory body. 5566. Feb. 28. (U.S., 1,3,26.) Glass furnaces. 5588. Feb. 28. (U.S., 24,6,26.)

Jackson (American Encaustic Tiling Co.). Manufacture of ceramic ware. 5595. Feb. 28. 5617. See I.

VIII.—Complete Specifications

32,808 (1925). Kreidl. Production of white opacifying-media for glasses and enamels. (245,757.)

3157 (1926). Case. Porous compounds from gypsum. 266,524.)

21,335 (1926). Loessin. Manufacturing ceramic materials etc. (259,236.)

*5566 (1927). Hartford-Empire Co. Refractory body. (266,751.)

X Applications

Dawson. Alloy. 5960. Mar. 3.

Dicker (Wiarda & Co.). Treatment of manganese ores. 5745. Mar. 1.

Garnud and Sollis. Aluminium alloy. 6010. Mar. 3.

Lacell. Production of magnesium. 6027. Mar. 3. (Fr., 63,3,26.)

Mond (Metallbank und Metallurgische Ges.). Apparatus for entering ores etc. 5560. Feb. 28.

Rogers (Remy-Stahlwerke, Stahlschmidt & Co. Ges.). Treating refined steel. 5583. Feb. 28.

X Complete Specifications

21,509 (1925). Croese. Manufacture of metals and alloys in the electric furnace. (266,658.)

29,026 (1925). Fiodin and Gustafsson. Producing iron and other metal and alloys. (243,353.)

19,647 (1926). Goldschmidt A.-G. Utilising scrap metal. (257,905.)

3707 (1927). Goldschmidt A.-G. Bearing metal alloy. (266,696.)

5035 (1927). Selz. Aluminium alloys. (266,720.)

XI Application

Dupire. Electrolytic apparatus. 6107. Mar. 4. (Fr., 63,3,26.)

XI Complete Specifications

21,509 (1925). Croese. See X.

33,011 (1925). Fullers United Electric Works, Ltd., and White. Electric accumulators. (266,497.)

11,554 (1926). Gill. Electric batteries. (266,565.)

XII Complete Specification

29,526 (1925). Nestfield and Goodricke. Manufacture of soap. (266,435.)

XIII Application

Schmidding. Preparation of lacquers from tung oil. 5629. Feb. 28.

XIII.—Complete Specifications

21,195 (1925). Pollak. Manufacture of condensation products of urea or its derivatives and formaldehyde. (248,904.)

10,533 (1925). Frenkel and Brust. Manufacture of priming material. (266,401.)

11,055 (1926). Bakelite Ges. Purification of condensation products produced from phenols and aldehydes. (247,956.)

5586 (1927). I.-G. Farbenind. Manufacture of condensation products of urea and formaldehyde. (266,752.)

XIV.—Application

Medgyes. Preparation for dusting rubber. 6093. Mar. 4. (Hungary, 25,9,26.)

XIV.—Complete Specifications

27,092 (1925). Schidrowitz, and Vultex, Ltd. Manufacture of rubber. (266,418.)

29,433 (1925). Barrett Co. Rubber-compounding material. (243,384.)

*5178 (1927). Soc. Itall. Pirelli. Vulcanisation of rubber. (266,732.)

XV.—Application

Reekin. Leather preservative. 6228. Mar. 5.

XV.—Complete Specifications

22,532 (1926). Kemmler. Manufacture of chamois and like leather. (266,622.)

*3802 (1927). I.-G. Farbenind. Manufacture of tanning agents. (266,697.)

XVI.—Application

Jackson. Production of fertilisers. 5793. Mar. 2.

XVI.—Complete Specification

*3702 (1927). Chem. Fabr. vorm. Schering. Diminishing loss of carbohydrates in plants when stored. (266,695.)

XIX.—Applications

Bolton, Read, and Pulvo, Ltd. Preservation of eggs. 6246. Mar. 5.

Schwartauer Honigwerke und Zuckerraffinerie. Production of pectin solutions. 5711. Mar. 1. (Ger., 1,2,27.)

XX.—Applications

Carmphael (Bayer & Co.). Manufacture of pharmaceutical products. 5750. Mar. 1. Manufacture of aminoquinolines. 6167. Mar. 4.

Ellis (Chem. Works formerly Sandoz). Preparation of soluble derivatives of meta-aminobenzoic acid esters. 6160. Mar. 4.

I.-G. Farbenind. Production of condensation products of urea etc. 5586. Feb. 28. (Ger., 27,2,26.) Production of side-chain bearing aromatic compounds etc. 5965. Mar. 3. (Ger., 3,3,26.)

Riedel A.-G. Manufacture of hydro-aromatic dicarboxylic acids. 5555. Feb. 28. (Ger., 22,6,26.)

XX.—Complete Specifications

16,919 (1925). Dehn (Chem.-Pharm. A.-G. Bad Homburg). Manufacture of quinine solutions. (266,209.)

21,195 (1925). Pollak. See XIII.

26,083 (1925). Johnson (Badische Anilin & Soda Fabrik). Manufacture of organic compounds containing oxygen. (266,405.)

26,593 (1925). Johnson (Badische Anilin & Soda Fabrik). Manufacture of methanol and other oxygenated organic compounds. (266,410.)

26,786—7 (1925). Fernbach, Yull, and Rowntree & Co., Ltd. Production of citric acid. (266,414—5.)

2286 (1926). I.-G. Farbenind. See IV.

*5155 (1927). Chem. Fabr. vorm. Schering. Manufacture of compounds suitable for combating vagotomy. (266,727.)

*5586 (1927). I.-G. Farbenind. See XIII.

XXI.—Complete Specification

30,116 (1925). Lage. Production of photographic plates, films, etc. for indirect three-colour photography. (266,468.)

XXII.—Application

Mexco, Ltd., and Scott. Explosives. 6032. Mar. 3.

XXII.—Complete Specification

24,308 (1926). Jamotte. Antiseptic and disinfectant. (259,233.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*British India*: Soap (233). *Canada*: Microscopes (B.X. 3299); Steel, rubber (C.X. 2226). *Chile*:

Refined camphor (261); Asbestos, emery, chemical products, hydrochloric and sulphuric acids, alcohol, ferrocyanide of potassium, disinfectant, disinfecting apparatus, lubricating and illuminating oils, paint, varnish, iron and steel, metal, glass, galvanised and black tubes, copper tubing (C.X. 2206). *Denmark*: Small refrigerators, air compressors (240). *Germany*: Refrigerating machinery (242). *Holland*: Leather (243). *Poland*: Chemicals, raw and dressed hides (246). *Rumania*: Porcelain insulators (B.X. 3314), Zinc plates, tin, lead (A.X. 4383). *Spain*: Skins (249). *Sweden*: Resin (251). *Switzerland*: Skins (252). *Uruguay*: Fuel oil (B.X. 3319). *Yugoslavia*: Photographic dry plates, printing paper (245).

Safeguarding of Industries Act

The Board of Trade give notice that representations have been made to them under Section 10 (5) of the Finance Act, 1926, regarding ammonium perchlorate and potassium guaiaccol sulphamate.

Section 10 (5) of the Finance Act, 1926, is as follows:—
“The Treasury may by order exempt from the duty imposed by section one of the Safeguarding of Industries Act, 1921, as amended by this Act, for such period as may be specified in the order, any article in respect of which the Board of Trade are satisfied on a representation made by a consumer of that article that the article is not made in any part of His Majesty's Dominions in quantities which are substantial having regard to the consumption of that article for the time being in the United Kingdom, and that there is no reasonable probability that the article will within a reasonable period be made in His Majesty's Dominions in such substantial quantities.”

Any person desiring to communicate with the Board of Trade with respect to the above-mentioned applications should do so by letter addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, within two months from the date of this notice.

The Board of Trade also give notice that the Treasury, by Order dated March 7, 1927, have exempted, under the foregoing provision of the Finance Act, 1926, for a period of twelve months from the date of the Order, the following articles from the duty imposed by Section 1 of the Safeguarding of Industries Act, 1921, as amended by the Finance Act, 1926:—

R acetone; acetone (fermentation); acetone, synthetic; acid oxalic; amidopyrin (pyramidon, dimethyl-amido-antipyrine); barbitone (veronal, malonal, malourea, acid diethyl barbituric, diethyl malonylurea, hypnogen, deba); furfural; guaiaccol carbonate (duotal); methyl sulphonal (diethyl sulphonemethylethylmethane, trional); phenacetin (acetparaphenetidine); phenazone (antipyrine, phenyldimethylpyrazolone, analgesin, anodyne, dimethyl oxychinizin); piperazine (diethylene-diamine, dispermin); pyramidon veronal; salol (phenyl salicylate); sulphonal.

News from Advertisements

A chemist is required to organise and control a Food Research Department of an old-established firm.

Three positions, as chief chemist, works manager, and

production manager, respectively, are available with a large English viscose silk works.

Certain copies of this JOURNAL and also of the “Annual Reports” are wanted.

PUBLICATIONS RECEIVED

REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY. Issued by the Society of Chemical Industry. Vol. XI.—1926. Pp. 742. London: Society of Chemical Industry, 1927.

CHEMICAL REVIEWS. Vol. III. February, 1927. No. 4. Contributions by G. Hevesy, P. V. Wells, G. Scotchard, M. Heidelberger, and C. E. Bills. Published quarterly for the American Chemical Society. Pp. 332—445. Baltimore: The Williams & Wilkins Co.; London: Baillière, Tindall & Cox, 1927. Price 23s. 6d. post free per annum.

GAS AND GASES. By R. M. Caven, D.Sc. Pp. viii + 256. London: Williams & Norgate, Ltd., 1926. Price 2s. net.

THE STUDY OF WAR FOR STATESMEN AND CITIZENS. Edited by Major-General Sir George Aston, K.C.B., with introductory address by the Rt. Hon. Viscount Grey of Fallodon, K.G. Pp. viii + 205. London: Longmans, Green & Co., Ltd., 1927. Price 10s. 6d. net.

THE OIL AND COLOUR CHEMISTS' HANDBOOK. Translated from Wolf-Schlick Taschenbuch für die Farben- und Lackindustrie, by W. H. Hilton-Brown. Pp. 176. London: The Trade Papers Publishing Co., Ltd., 1927. Price 10s. 6d.

Gmelin's HANDBUCH DER ANORGANISCHEN CHEMIE. 8th completely new and revised edition. Published by the Deutschen Chemischen Gesellschaft. Edited by R. J. Meyer and collaborators. System No. 19. Wismut, und Radioaktive Isotope. Pp. xxii + 229. Berlin: Verlag Chemie, G.m.b.H., 1927. Price 33 m.

DIE TECHNISCHE HERSTELLUNG KONZENTRIERTER ESSIGSÄURE. By Dr. H. Suida. Pp. 13. Reprint from the Oesterreichische Chemiker-Zeitung, 1927, Nr. 1. Vienna: Ferdinand Brück & Söhne.

LOW-TEMPERATURE CARBONISATION. VERTICAL RETORTS AT H.M. FUEL RESEARCH STATION. By C. H. Lander, D.Sc., M.Inst.C.E., and J. Fraser Shaw, Eng. Capt. R.N. (ret.). Pp. iv + 7. H.M. Stationery Office, 1927. Price 6d. net.

VAN NOSTRAND'S CHEMICAL ANNUAL. A HAND-BOOK OF USEFUL DATA. Edited by John C. Olsen, A.M., Ph.D., D.Sc., assisted by T. R. Le Compte, B.A., M.Sc., Ph.D. Sixth issue, 1926, thoroughly revised and enlarged. Pp. xv + 882. London: Chapman & Hall, Ltd., 1927. Price 21s. net.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF MINES. Washington: Government Printing Office, 1926: Accidents due to Explosives in Metal Mines of the South-west, as shown by Records in Arizona. By E. D. Gardner. Technical Paper 400. Pp. 29. Price 5 c. Coking of Oil Shales. By W. L. Finley and A. D. Bauer. Technical Paper 398. Pp. 11. Price 5 c. Diamond Drilling, with special Reference to Oil-field Prospecting and Development. By F. A. Edson. Pp. viii + 170. Bulletin 243. Price 35 c. Occurrence, Distribution, and Significance of Alkali Cyanides in the Iron Blast Furnace. By S. P. Kinney and E. W. Guernsey. Pp. iv + 37. Technical Paper 390. Price 10 c. Strength of Ore and Top Rock in the Red Iron-ore Mines of the Birmingham District, Ala. By W. R. Crane. Pp. 24. Technical Paper 379. Price 10 c.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Management Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW
SERIES

LONDON, MARCH 25, 1927

No. 12

EDITORIAL

Scientific and Industrial Research

THE Report of the Committee for Scientific and Industrial Research for the year 1925-6 has just been issued, and it is, as usual, full of interesting information and sage reflections. All those who claim to be interested in chemistry or the chemical industry in general should read this document: in the brief space available for editorial comment on it only two or three points can be mentioned. Many others deserve attention, and we trust that they will remain in our mind. In considering pure scientific research the committee finds no sign of decay in this country; in every branch of natural science we can point to men of international reputation occupying positions which allow them full scope for their talents. Nor does there appear to be any chance that a young man of talent, however lowly his origin or restricted his means, will fail to find the opening in the world of pure science that his talents deserve. The committee has done much to assist students, and has, during the last seven years, granted allowances to about 700 students, of whom nearly 400 were students of chemistry. This appears to us to be a fair measure of the extent to which chemistry is now recognised as essential to our industrial efficiency and progress. The committee, however, reports that some modification may become necessary: it appears that at present far too many men are encouraged to specialise in chemistry, very large numbers of applications are received whenever a post for chemical research is advertised: on the other hand, the demand for men who combine a study of chemistry with a study of other subjects, such as agriculture, biochemistry or botany, outstrips the supply. The committee has done a little to differentiate between the various branches of scientific research, and in this report the following significant sentence occurs:—"But in any future scheme, however administered, we feel sure that more differentiation ought to be made in the interests not only of pure science and of industry, but of the men themselves."

In considering the state of industrial research the report states: "Everyone who is anxious to promote industrial research in this country is confronted by the fundamental difficulty that public opinion is not yet fully aroused to its necessity. To justify this statement--if it requires justification--one need only compare the quality of the articles in the daily newspapers which deal with financial, literary and administrative questions with those which deal with scientific matters." These observations are true and melancholy; the fault may be shared in due proportions by the newspaper editors, the general public, and, so far as chemistry is concerned, by the whole body politic of chemists. It would not be difficult, so far as chemistry is concerned, to remedy this state of things. Certainly the chemistry of most of our daily newspapers is far below the proper standard.

The Bureau of Abstracts

A few years ago there came into being a committee to supervise the preparation in this country of abstracts of the new work in pure and applied chemistry. In such a journal as this we need not dilate on the usefulness of abstracts. Wisdom that is hid and treasure that is hoarded up, what profit is in them both? As we, to our great joy, have no part in the preparation of the abstracts we are free from any bias or prejudice concerning them. We consider, on the other hand, that we are quite competent to express our opinion of them and, in our view, having regard to the nature of abstracts and the purpose thereof, the abstracts prepared by the Bureau deserve the very highest praise. Very few new facts or new guesses at facts escape the close net spread for their capture; few purely ephemeral notes find their way into the two familiar records of chemical activity. The names of those who organise this huge task and of those who participate in the work are well known to us all; perhaps some of our readers do not realise how great a debt of gratitude they owe to the chairman of the Bureau, Prof. J. C. Philip. He has worked hard at

he has often been delayed and sometimes disappointed, but never dismayed or disheartened. He has been not only patient and long-sighted, but he has a natural gift of quiet determination which has been of great value to him and to his colleagues. The rapid progress in the preparation of the British abstracts has been partly due to his tact and good judgment, but still more to the fixity of his mind, which has overcome many obstacles, and has never been turned aside from that course which he found to be the best and most sensible. Such a man is usually a very good chairman: rumour has it that Prof. Philip has been an excellent chairman of the Bureau. We do not know that rumour is to be greatly relied upon: in this case the uncertain opinion of rumour is confirmed by the unanimous judgment of British chemists that the abstracts issued by the Bureau, which he founded and has hitherto guided, are such that we should be very proud of them.

Electrical Power from Tropical Seas

It would be a doubtful compliment to Georges Claude to style him the Jules Verne of chemical engineering, for he has proved too conclusively and too frequently that he is no mere dreamer, but a seriously practical engineer. We confess that, remembering our own experiences with a catalytic gas process conducted at a mere 60-lb. pressure, we smiled rather quizzically and prematurely when we first read we think in an early post war issue of *Comptes Rendus* of Claude's proposal to work a synthetic ammonia process at a thousand atmospheres pressure. Before many moons, however, we had cause metaphorically to kick ourselves, for a small scale unit was soon operating successfully, to be followed with astonishing rapidity by full-size synthetic ammonia plants. We now learn from a survey of the world's fixed nitrogen position made by the Fixed Nitrogen Laboratory of the United States that thirteen Claude plants were operating in 1925, producing *in toto* 54,250 tons of fixed nitrogen. Four plants are in France, two in Italy, two in Spain, and one in Belgium, Poland, America, Japan and Czechoslovakia. Several of these plants are being enlarged, that at Bethune probably now having an annual capacity of nearly 20,000 tons of ammonia. It is, therefore, with profound interest that we read of the latest proposal of Georges Claude to win power from tropical seas. Between the surface water and the deep sea water of tropical oceans there exists a considerable difference in temperature. The cold currents from the polar seas maintain the deeps at a low temperature, whilst the surface water is continually heated by the sun. It is theoretically possible, as even our limited acquaintance with thermodynamics tells us, to utilise this temperature difference for the generation, or rather transformation, of energy. We shall not attempt to discourse learnedly on Carnot heat diagrams, sources of heat and "sinks," but shall content ourselves with describing an experiment carried out by MM. Claude and Boucherot before the French Académie. If warm water at a temperature of 30° C. is caused to boil under vacuum, steam at low pressure is obtained. If this steam is drawn off by the vacuum obtained by con-

densation through the agency of cold water, a turbine may be supplied with driving force and electricity generated. The French savants estimated that 400,000 kw. of electrical energy could be generated by the employment of 1000 cubic metres of tropical sea water per second. It requires but a simple calculation to show us that the theoretical production of power in these circumstances must be very low in efficiency, and we shall await with interest the practical details of the process. The heat difference is there spread over unlimited amounts of water so that low theoretical efficiencies may not matter from the economic point of view. The fundamental idea in one form or another is not new, but several attempts to apply it practically have met with failure. The reputation which Georges Claude has already won makes us hesitate to be sceptical, and it may not be long before we have to repent and blot out a present recollection that many treasure hunts in tropical seas have ended in disaster.

The Beethoven Centenary

Beethoven died on March 26, 1827. The shadow of his genius is cast, irrespective of time and space, over all nations and professions, and our homage to his great talent is as sincere as that of our music masters, even though, as chemists, we cannot so thoroughly comprehend its sway. Our highbrow musical friends may smile a little, and think that our professed love for Enterpe is really nothing more than a mild flirtation, but we shall continue to believe, perhaps egotistically, that we can appreciate Beethoven. Man cannot live by bread alone, and the chemist must realise that to live within the narrow confines of his own profession is unprofitable, unsoeable and, in the end, uninspiring. Beethoven may have been a musical genius and naught else. Our Irvines, Armstrongs, Perkins and Popes may be great chemists and naught else, although we number amongst our friends many great chemists who are no mean musicians and artists, but if the average chemist is to take his true place in the world he must do the things and love the things which his fellow voyagers on the ship of life consider essential to culture. "The man that hath no music in himself is fit for treason, stratagems and spoils." The works of Beethoven, of Shakespeare, are an international heritage, and so no less are the discoveries of the world's great chemists. The inspiration which the memory of Beethoven engenders may well help to heal the sores of war amongst chemists. Britain may be justly proud of her chemists and Germany of hers, but it is the common duty of the sons of all nations to build up and embellish the science of chemistry. We cannot afford to live in a splendid isolation in the world of to-day. The most recent instance of this truism within our own sphere is given in a paper by Perkin and Robinson in the *Journal of the Chemical Society*. The synthesis of harmaline presents a very notable stage—we imagine the authors will not make it a climax—in the work on the harmala alkaloids which has been proceeding over the past twenty years, but Perkin and Robinson do not refrain from paying a gracious compliment to the work of Otto Fischer. Beethoven died on March 26, 1827. Centenaries have, indeed, more than a sentimental value.

rate has been only 5, a reduction of 96%. This remarkable reduction could hardly be accounted for in any other way than by the purification of its water supply.

A properly chlorinated water, then, is a sterile water. Yet only about 0.2 part per million is required to accomplish it, which is equivalent in cost to only 1 cent per person per year.

To-day it is common practice to chlorinate sewage effluents that are discharged into rivers and lakes. This is done to some extent at both Montreal and Toronto, and Cleveland, for instance, has two enormous chlorinating plants treating the sewage of the city prior to its discharge into Lake Erie to protect the bathers at the city beaches. At Detroit the waters of the bathing beaches have been chlorinated by means of a motor-boat carrying and distributing liquid chlorine from cylinders. At the present time over 1000 swimming pools in North America are sterilised with liquid chlorine.

It has been made compulsory that certain trade wastes be chlorinated before discharging into trunk sewer lines. This applies particularly to abattoirs and

CHLORINE TREATMENT OF CONDENSING WATER

The maintenance of a high vacuum in a modern power house is of great importance because a variation of one inch affects steam consumption and, therefore, the fuel bill, to the extent of about 6%. A good vacuum can be maintained only if the water-side cooling surfaces of the condenser tubes are kept perfectly clean. When the cooling water is drawn from the river, lake or sea it is frequently found that a glutinous, clinging mud adheres so firmly that it can only be removed by mechanical means—steam and compressed air being of no use. This trouble is often due to some micro-organisms of the alga or amoeba type. It has been found that one part or less of liquid chlorine per million parts of water will maintain a perfectly clean condenser at a saving of about 50% of the labour alone for cleaning by mechanical means.

In the case of sea water, mussels and limpets grow luxuriously in these places due to comfortable temperatures and because a beneficent engineer is constantly pumping food to them. This food consists of micro-organisms in the water, but if these are killed with chlorine at the inlet, the mussels will starve to death and the tube will be kept smooth and clean.

METALLURGY

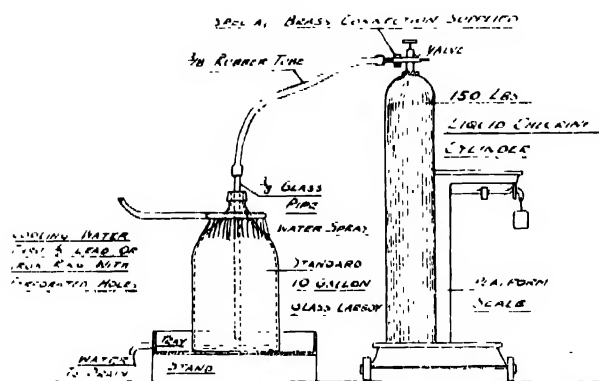
In metallurgy, it is used in the chlorination of ores, more especially for the separation of gold and silver from other base metals, for the separation of cobalt from nickel, and for the recovery of tin from scrap by the detinning process. The last process is becoming rapidly of greater importance due to the increased production of tin plate containers and the high cost of tin. Dry chlorine will combine with tin to form anhydrous tin tetrachloride, whilst the iron on which the tin is plated will remain unaffected. There are various patented processes for carrying out this reaction, and it is quite economical, as it turns an apparently waste material into a valuable compound which finds a ready market in the silk industry.

FLOUR MILLS

Flour, in the freshly-milled condition, is slightly yellow in colour and contains gluten which is not sufficiently pliable and elastic to give it the best baking qualities. When this flour is stored, the intensity of acidity is increased which results in the gluten becoming elastic. As this intensity of acidity increases the flour becomes correspondingly whiter through elements in the atmosphere decolorizing the yellow colouring matter known as carotin.

The storing or ageing of flour is not economically feasible. It means large buildings and close control to ensure that the ageing does not progress too far.

All the large flour mills and many of the small ones now mature their flour by exposing it to chlorine or some compound of chlorine in specially-designed apparatus. The function of the chlorine is to accelerate Nature's process, and accomplishes its results by both increasing the pH value and oxidising the carotin. This system requires little attention, and only ordinary labour is required.



Formula: 17 lbs caustic soda (76%) 12 lbs liquid chlorine, 10 galls. water.

Manufacture of liquid bleach "sodium hypochlorite" on a small scale using liquid chlorine and caustic soda

tanneries, for which as high as 250 parts per million, for example, are sometimes required to destroy anthrax.

A few years ago the daily papers were full of the "oyster typhoid epidemic," which the U.S. Public Health Service attributed to eating oysters from an area which was polluted with sewage. So to-day we have "chlorinated oysters," and certain States have devised regulations to make this compulsory.

Many creameries and other bottling works use chlorine for sterilising bottles, and statistics show that it is far more efficient than steam in removing the last traces of bacterial infection from the bottles. In bottle sterilisation the chlorine is applied in the final rinse water.

Chlorine gas is a splendid deodoriser in that it combines with most noxious gases to produce sweet, or at least pleasant-smelling compounds. Thus, the organic sulphur compounds which are responsible for the odours around kraft pulp mills, and odours emanating from municipal incinerator plants etc. may be effectively disposed of by simply allowing a small amount of chlorine to pass up the stack with the gases or products of combustion.

PETROLEUM INDUSTRY

In the petroleum industry gasoline and kerosene, as obtained from the stills, contain small amounts of constituents which impart an objectionable odour and so must be removed before the product can be sold. These impurities have been identified principally as mercaptans. For many years a caustic-soda solution of bicharge has been used to accomplish this removal, but in recent years chlorine in the form of calcium or sodium hypochlorite has been introduced for the same purpose. In this case the mercaptans are oxidised to sulphides ($R-SH$ to $R-S$).

Aluminum chloride, made usually by the action of chlorine on bauxite, is used in one process for cracking oils.

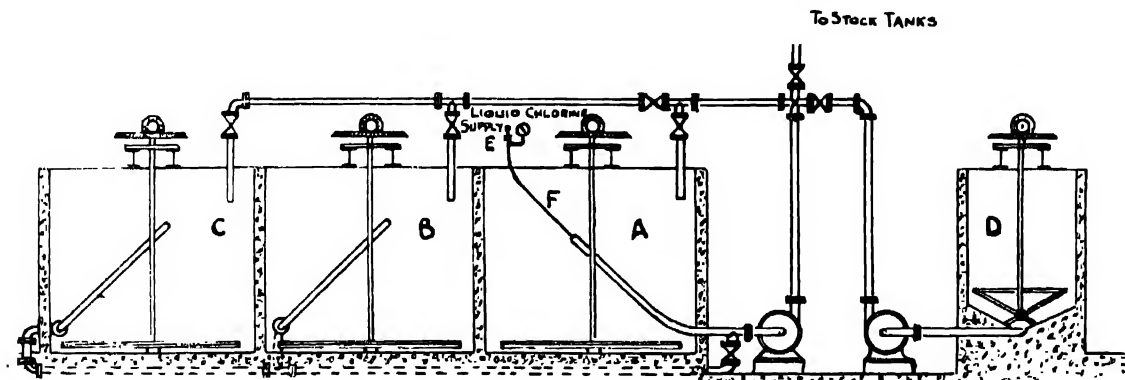
Ethylene glycol, which is being introduced as an anti-freeze for automobile cooling systems, is made from ethylene C_2H_4 , one of the hydrocarbons found in refinery gas. The ethylene is first converted to ethylene dichloride, which is proving to be one of our most useful solvents, in some ways superior to both chloroform and carbon tetrachloride. When ethylene dichloride is hydrolysed we obtain ethylene glycol.

the presence of water. Temperature also plays an important part. The metallic chlorides serve important functions in industry and are indispensable as catalysts in some important organic syntheses.

Organic Chlorides. In organic chemistry chlorine may be used in elemental form to produce: (1) Addition products; (2) Substitution products; (3) Oxidation products; and (4) It may be used in combination with other elements to produce anhydrides and effect condensations. For these we find a large number of chlorine compounds in use, such as $AlCl_3$, $SbCl_5$ and $SnCl_2$.

A typical series of additional compounds is the acetylene derivatives. The products obtained by substitution are probably of greater importance and interest than those falling under other headings. Among important examples, we may cite monochlorobenzene, used as a dye intermediate; *p*-dichlorobenzene, used to combat peach tree borer; monochloroacetic acid, benzyl and benzal chlorides and their oxidation products, benzaldehyde and benzoic acid.

Organic chlorination is carried out at widely different temperatures, and the catalysts differ essentially in



The Canadian Salt Company's absorption system

Chloro derivatives are also now produced by direct chlorination. We thus have methyl and methylene chlorides, chloroform and carbon tetrachloride, and recently some derivatives of ethane have appeared on the market.

SYNTHETIC HYDROCHLORIC ACID

Synthetic hydrochloric acid may be manufactured by burning hydrogen in an atmosphere of chlorine, and at our Sandwich Plant we have installed a plant capable of producing 15 tons of 22° Baumé acid per day. This plant burners and absorption system, is made entirely of fused silica. Inasmuch as the chlorine and by-product hydrogen used are pure, the resulting acid is water white and of C.P. grade. The chief outlets for this acid are for metal cleaning in the steel mills, leather and textile industries, manufacture of sugar from starch, inorganic preparations, etc.

OTHER USES

Metallic Chlorides.—It need only be said that all the common metals or their ores react directly with chlorine under favourable conditions to yield chlorides. Some metals, such as tin and aluminium for example, must be dry whereas others, such as iron and zinc, require

nature. Plant construction suitable for one is fatal to another, and the presence or absence of light also plays an important part.

Many very useful compounds are made in this way.

CHLORINE IN NATIONAL DEFENCE

Major-General Fries, of the United States Army, recently stated that there is no chemical which is more indispensable to the Chemical Warfare Service than liquid chlorine, and his statement is more or less borne out by the fact that the United States Government, at the close of the world war, had increased their chlorine plant at Edgewood Arsenal, Maryland, from 50 to 100 tons daily capacity. Even this was not sufficient to meet the demands of the service, and civilian plants were called upon to make up the deficiency.

Chlorine, however, as an individual gas, was effective only in the early days of the war. We all recall the awful casualties inflicted upon the Canadian troops in the initial gas attack north of Ypres in April, 1915. Chlorine alone was used in this instance, but it was soon found that gas masks, using activated carbon, furnished almost complete protection from chlorine when chlorine was used alone.

This led to the use of other gases, each having a specific purpose, and at the close of the war we had some 44 different chemicals, 31 of which had chlorine as a base, or as an essential constituent.

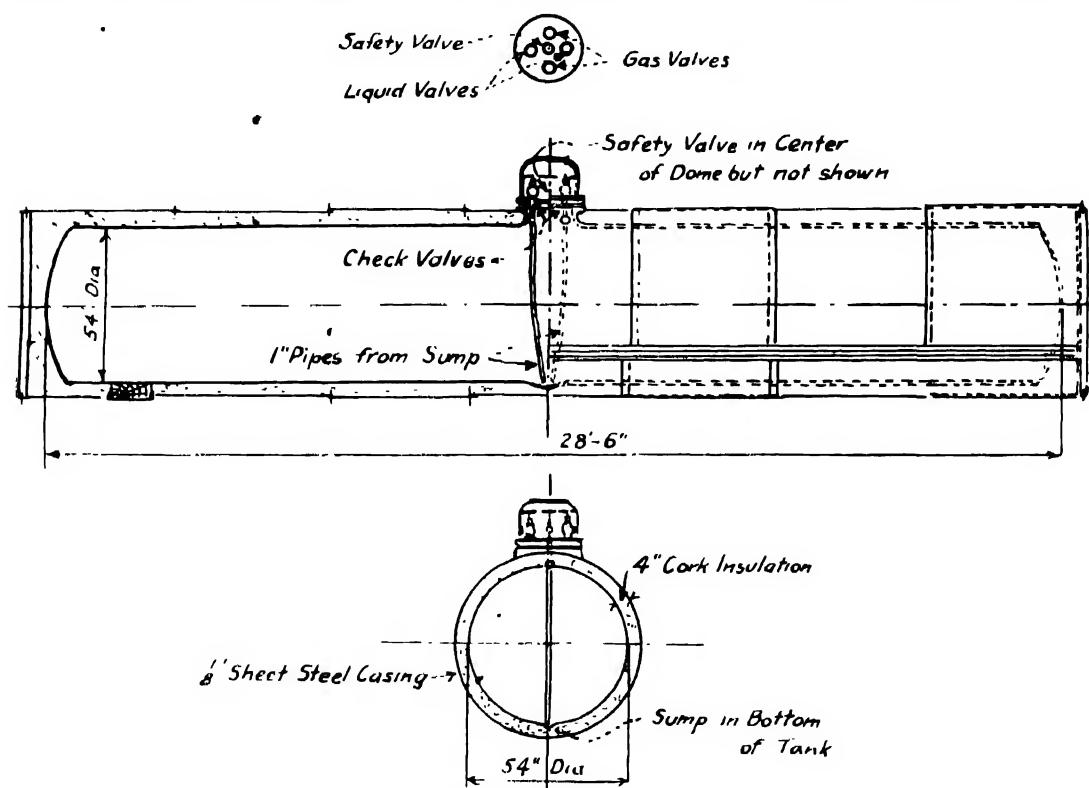
Among the more important gases used were :-

Chloropierin (trichloronitromethane)	vomiting gas.
Blue Cross (diphenylchlorarsine)	sneezing gas.
Phosgene (carbonyl chloride)	lethal gas.
Mustard gas (ethylchlorosulphide)	blistering gas.
Lewisite (an arsenic-chlorine compound)	penetrating gas.
Chloroacetophenon	tear gas.

In addition to these various gases, we also have

of war gases containing chlorine remained practically free from the ravages of the epidemic. This, coupled with the fact that in 1918 approximately 40% of the two and a half million men in the U.S. Army entered hospital with influenza, resulted in numerous tests being made, particularly by the Army Medical Corps, which showed that chlorine in concentrations of 0.015 mg. per litre (1 part in 133,000) had a distinctive curative value in common colds, influenza, whooping cough, and other diseases in which the infecting organisms were located on the surface of the mucous membranes of the respiratory passages.

Over 8000 patients have been treated by the medical officers of the U.S. Army. Accurate records have been



Section of standard Class V. tank car for liquid chlorine

chemicals for producing the smoke screen, namely, the tetrachlorides of tin, silicon, titanium and carbon.

One method for making picric acid during the late war was to first produce chlorobenzene, nitrate it, then replace the chlorine by hydroxyl, by treatment with alkali.

We hear a great deal about chemical warfare being inhuman, but the actual statistics do not bear this out. It is a question whether it is not just as sportsmanlike to fight with chemicals as it is to fight with machine guns. In any event chemical warfare is here to stay, and the various nations will continue and are continuing, development along this line.

THE USE OF CHLORINE IN PREVENTIVE MEDICINE

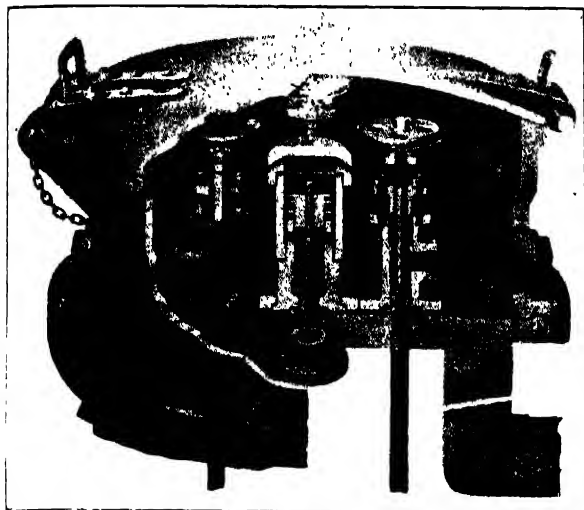
It was observed during the "flu" epidemic in 1918 that employees of plants engaged in the manufacture

kept of 1312 cases, 51.8% were reported cured, 38.3% improved, and 9.9% reported not improved.

These startling results caused many clinics to spring up in the larger cities where a number of patients could be treated at one time in chambers or rooms specially constructed for the purpose. The patient is supposed to remain in this chamber for about one hour, during which time the correct concentration of chlorine and air are maintained by means of a fan and special chlorine control apparatus. A physician is in charge, and the patient may read, rest, or converse while undergoing treatment.

Many excellent physicians have used chlorine without much success, while others are most enthusiastic over results obtained. Much depends upon how it is handled, and there is considerable evidence that the treatment has been abused in the hands of inexperienced laymen.

Medical Life, of New York City, announced, through its editor, that replies received, in answer to a questionnaire on the value of chlorine as a cure for colds and other respiratory ailments, have established



Dome and fittings for Class V tank cars

the value of the treatment beyond all question. This questionnaire was sent to practically all of the leading nose and throat specialists in the U.S. using chlorine.

From the standpoint of preventive medicine, then, it is believed chlorine has a great field of usefulness.

If time permitted, one could mention many other commercial uses for liquid chlorine: for example, chlorine is now being used in Japan in the refining of sugar; it is used for bleaching shellac; for the manufacture of pure cellulose for artificial silk; and in the De Vans process for the manufacture of pulp from esparto grass and straw. Chlorinated fish oil has also appeared as a substitute for linseed oil in some applications.

From the foregoing it is evident that chlorine is essential to present conditions of life. It is fortunately widely distributed in combined form, and by reason of electrical developments, readily produced in elemental condition. We have seen how it is employed to maintain health and to prevent the spread of sickness. We are further enabled by way of chlorine to proceed to the manufacture of paper, artificial silk and of dyes, and so produce those products which lend to our pleasure and comfort in life. It is also possible to produce through chlorine other products leading to agony and death. Chlorine, like everything else, is capable of "Use and Abuse." Abuse must be controlled: use must be extended.

INDUSTRIAL NOTES FROM CANADA

The International Nickel Co. of Canada, Ltd., has now completed a \$750,000 addition to its refinery at Port Colborne, Ontario. The purpose of the addition is to produce electrolytic nickel of high quality, 99.9% pure. It is expected that about 6000 tons of the company's annual production will be of this grade.

THE CONTACT PROCESS FOR SULPHURIC ACID*

By W. H. DE BLOIS†

By the contact process we understand that process for the manufacture of sulphuric acid by which sulphur dioxide gas produced by the burning of sulphur, sulphur bearing ores, or as a by-product in the treatment of sulphide ores, is made to combine with the oxygen of the air to form sulphur trioxide, which then only requires the addition of water to form sulphuric acid. The contact process is one of the outstanding achievements in chemical engineering. From the standpoint of the difficulties involved and the time absorbed in their solution, it probably stands alone in the field of technical chemistry. In fact, the manufacture of sulphuric acid from the earliest days has been surrounded with problems which have interested the ablest chemists.

THE CHAMBER SYSTEM

Although this paper has particularly to deal with the contact process, it may not be amiss to refer briefly to the chamber system, which was, and still is, a most important factor in the industry.

The development of the lead chambers began in England towards the end of the eighteenth century in response to the increased demand for sulphuric acid which followed then, as it does now, the general industrial progress of the country. England was in the first stages of that remarkable commercial evolution which was destined to make such progress in the following century. Sulphuric acid had hitherto been made in small quantities and in an intermittent fashion by burning a mixture of sulphur and nitrate of soda in the horizontal neck of a glass retort set in a sand bath, with a little water in the bottom. One can easily imagine the difficulties these early pioneers experienced as the sulphur was ignited and a small proportion of the sulphur dioxide combined with oxygen under the influence of the nitrogen acids, finally condensing on the sides of the glass vessel, which probably cracked as the reaction continued, the day's labour being lost. One can also understand the price that was asked and evidently obtained for the product, some \$1000 per ton, a figure which would make the modern sales executive turn green with envy and long for the good old days.

Probably the breakage of the vessels first led to the construction of a small lead chamber, and soon afterwards to a continuous system of operating whereby the sulphur dioxide gas was fed continually into the chambers with the necessary amount of nitrogen oxides and water in the form of steam or spray. Towers for recovering the oxides of nitrogen at the end of the chambers soon followed, and it may not be amiss to mention that these oxides in effect perform the same function as platinum or other catalyst in the contact process, for in both the sulphur dioxide is encouraged to combine with oxygen from the air to form the trioxide, a reaction which otherwise would not proceed at all or at an extremely slow rate. The nitrogen oxides are nearly all recovered

* Read before a joint meeting of the Montreal Section of the Society of Chemical Industry and the Canadian Institute of Mining and Metallurgy at Montreal, January 17, 1927.

† The Mond Nickel Co., Ltd., Coniston, Ont.

and used over again in the chamber process, while the platinum in the contact process apparently remains unaltered over many years, if conditions are properly maintained.

The chamber process would, in all probability, have remained unchallenged had it not been for one principal objection, viz., the fact that the maximum strength of the acid produced does not exceed 80%, and any further concentration must be at the expense of fuel in some form and at considerably increased cost. In the early days this was not a serious objection, but as the demand grew from industries such as oil refining, explosives and others, for a stronger acid, the problem became more acute. Even then matters might have remained as they were had it not been for an entirely new demand for fuming sulphuric acid—or, as it is known in the trade, oleum. This is a solution of SO_3 in 100% H_2SO_4 , and could not be made by any modification of the chamber process. Fuming acid had been made for many years, and the limited demand supplied by a single firm in Bohemia, which decomposed by heat a ferric sulphate leached out from pyritic slates, the resulting sulphur trioxide being led into and absorbed in sulphuric acid until the desired strength was obtained. The product was, naturally, very impure, and probably almost black in colour. This, then, was the state of affairs in the fourth quarter of the last century, the period which marks the early development of the contact process, and leads up to its introduction on a large scale in the opening years of the present century.

THE CONTACT REACTION

Although the so-called contact reaction was observed by Davy and others, the first record of its possible use for the manufacture of sulphuric acid is in a patent taken out by one Peregrine Phillips, a vinegar manufacturer of Bristol, in 1831. Whether Phillips used his spare time while waiting for the fermenting process to proceed, or whether the then mysterious agency which caused the formation of vinegar started a train of thought which led to experiments with platinum as a contact substance, is not stated, but the fact remains that he describes with almost prophetic insight the fundamental features of the contact process. He proposed to draw sulphurous acid gas and air in proper proportions through porcelain tubes heated to a strong yellow heat and containing platina in a finely divided state. He affirms that sulphuric acid gas will be instantly formed, and proposes to absorb this gas in water in a tower packed with pebbles. Having taken out this patent, Phillips disappears from the scene, and no other record appears of his activities or of whether he actually tried out his patent on a commercial scale. It is interesting to speculate as to the type of man this Peregrine Phillips was, and we are at liberty to give full scope to our imagination, for we are not burdened by a biography or particulars of any kind beyond the fact that he was a manufacturer of vinegar and took out a patent covering the manufacture of sulphuric acid by the contact process. That he was an Englishman may at once be admitted, and, therefore, furnishes another argument for those who claim that more scientific discoveries originate in England than is usually

realised. It is further probable that he was not a University man, for technical courses in those days were practically non-existent, and the ordinary college course would hardly incline a man to take up the work of vinegar manufacture. Is it not more likely that he was a practical man with a natural scientific bent, who used his spare time in experimenting along various lines, and who, if the truth were known, had probably worked out some kinks in the fermentation of vinegar which would have surprised his contemporaries? We now know that some of his statements were erroneous—that strong yellow heat is too high for proper working of the reaction, and that, further, it is impossible to absorb sulphur trioxide completely in water. To this practical man, however, belongs the credit of making the original scientific discovery, and of realising its possible commercial importance.

From the time of Phillips's patent up until about 1875 little progress can be recorded. Several sporadic attempts were made to replace the chamber process, but with little success. The importance of eliminating impurities from the gas had not been realised, the laws of gas reactions were but imperfectly understood, and last but not least, the real incentive was lacking—namely the existence of an urgent demand for fuming acid. This last reason was removed by the synthetic production of alizarine about 1870, followed by other colouring matters, all of which required oleum or fuming acid for their preparation. The natural result followed. The Bohemian manufacturer, using the distillation method mentioned, advanced the price until it became almost prohibitive. Here was the real incentive, and it is not surprising that almost immediately several chemists and manufacturers started to experiment with the object of developing the contact process on a commercial scale.

Just at this time a curious incident occurred which had a remarkable, although temporary, effect on the progress of the work. Clemens Winkler, a professor in the Freiberg School of Mines, published a paper in which he reviewed the work hitherto done, described certain experiments, which he had carried out, all of which led him to the conclusion that the cause of previous failures could be attributed to the presence of diluting gases, such as oxygen and nitrogen. He stated that it was necessary to have sulphur dioxide and oxygen present in the theoretical proportions, and to accomplish this proposed to decompose sulphuric acid by heat into sulphur dioxide, oxygen and water, and absorb the water, thus leaving the sulphur dioxide and oxygen in the proper proportions. These were then led over heated platinised asbestos to recombine as sulphur trioxide, which was absorbed in sulphuric acid to produce oleum.

Such experimental results could now be proved faulty without further test by simply referring to the law of mass action, but this law was, at that time, imperfectly understood, and the reputation of Winkler was such that his conclusions were accepted without criticism, and no one seemed to take the trouble to repeat his experiments, which were opposed to all experience, and were soon found by Winkler himself to be fallacious. In spite of this, however, several factories sprang up

to exploit the process, and actually succeeded in making oleum on a commercial scale, although the difficulties were enormous, as anyone can appreciate who attempts to decompose such a corrosive substance as sulphuric acid in vessels constructed of any of the ordinary materials. The life of these plants was comparatively short and the cost correspondingly high.

This was the situation until about the year 1900. Winkler's results had been accepted as final for over twenty years, although there is evidence which seems to show that he had long before abandoned them himself, and was devoting his attention to the use of pyrites burner gas.

In 1901, Dr. Knietseh, of the Badische Co., in Germany, delivered his famous lecture, describing in part the work done by that company. They had long before perceived the errors in Winkler's work, and had devoted themselves to the problem of utilising pyrites burner gases with a large excess of oxygen and nitrogen, and had so well succeeded that they were able to announce that the contact process was ready to take its place, not only for the manufacture of oleum, but also as a competitor of the chamber process in the production of ordinary concentrated acid.

Notwithstanding its many defects, and in some instances what almost appear to be intentional omissions, this paper is still one of the most important written on the subject. It deals with the action of various catalysts under varying conditions of temperature and rate of flow, gives a great deal of information as to the physical properties of oleum and sulphur trioxide, and, most important of all, deals with the problems involved in the purification of the burner gas so that the danger of injuring the catalytic material is removed.

The first experiments with burner gas seemed almost without hope. After a time the contact mass lost its activity in spite of cooling, washing and filtering through various media. It was then discovered that the impurities, especially arsenic, were carried along in the form of a fine mist or fog which was very difficult to remove. To this day this mist is the major problem in the purification of burner gases, and it is not too much to say that the problem has not been entirely solved. The experiments were continued, and, finally, after some ten or fifteen years of labour, involving, naturally, very heavy expenditure, the process was placed on a commercial scale, and the production on a larger tonnage basis commenced. As is usual in such cases, other firms were working along similar lines, and the years from 1900 onward witnessed a very rapid development, not only in Germany, but also in the United States, Canada, and England.

THE CATALYST

This, then, is a brief summary of the development of the process up to the time of its comparatively rapid growth. To deal more particularly with the details, it may be as well to take up the catalyst itself first, which is, after all, the heart of the system. The usual definition of a catalyst is a substance which, without appearing among the products of a reaction, alters its velocity. This velocity of reaction is the first and

an important point to keep in mind, for it directly affects the design of any particular plant. If by altering the quantity of the catalyst, or by changing its physical condition, or by any other means it can be made more active, then the quantity of gas which can be converted in a given time will be increased and an additional output obtained with no added investment. It is quite easy to understand, therefore, why a great deal of work and expense has been, and still is, spent on this problem.

At ordinary temperatures and pressures sulphur dioxide and oxygen are entirely without action on one another. A slight combination does apparently take place with increase in temperature, but this is due to the action of the surrounding solid substances. It is a curious fact that practically all solid substances which remain solid at the temperature of reaction will cause some conversion of sulphur dioxide into trioxide. Porcelain and silica, for example, will convert a considerable percentage at a temperature of 600° C., and between these comparatively inactive substances and platinum there would be a continuous gradation of various metals, salts, etc. Up to the present, platinum is the one substance which has proved most suitable.

THE REACTION

A second point to bear in mind is that a reaction between gases does not as a rule proceed until all the original materials are used up, for the opposite reaction immediately starts and a condition of equilibrium is reached, depending in this case principally on the temperature. No matter what the catalyst, this same equilibrium will be reached at a given temperature and with the same original proportion of sulphur dioxide and oxygen. It is important to know, therefore, the most favourable temperature range and to regulate conditions so that this range will be approached as closely as possible.

A third point is the rise in temperature due to the reaction $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$. This feature is of interest, as it provides heat, which can be used to raise the temperature of the incoming gas to a point where the reaction will commence. The most favourable initial temperature is from 350°-400° C. The rise in temperature due to the reaction, of course, depends on the content of sulphur dioxide in the gas, and at 7% is about 180° C. The percentage conversion drops rapidly as the temperature rises above this favourable point, or, in other words, the equilibrium just referred to is disturbed and the reverse reaction becomes increasingly active. This exothermic reaction furnishes a means by heat exchange, not only of raising the temperature of the gas, but at the same time of dissipating the heat which would otherwise hold the temperature too high for the best conversion.

Strange as it may seem, for several years some of the plants operating did not avail themselves of this simple and effective plan, with the result that the expenditure for fuel was excessive and the best conversion results were not obtained.

CATALYST POISONING

The poisoning of catalysts constitutes one of the outstanding difficulties, and is the major influence in

the design of the plant, for it would be fatal if, after careful design and erection, it was found that impurities which affected the activity of the catalyst were carried into the contact apparatus.

First among these poisons is arsenic. Just why this should act as a poison to platinum as well as to human beings has never been satisfactorily explained, but the fact remains that a comparatively small amount of arsenic will seriously reduce the activity of the contact mass, and if continued for any length of time will cause it practically to cease converting. Should this happen, nothing remains but to shut down and replace the catalyst with a fresh mass, hoping in the meantime that the cause has been removed. The source of the arsenic is in the original ore if pyrites is used, but even sulphur itself contains a minute quantity. It is apparently carried along with the sulphuric acid mist formed by the slight conversion to sulphur trioxide taking place in the burners themselves, the sulphur trioxide combining with water vapour present in the air. The problem is, therefore, to remove this mist as completely as possible.

The next most important poison is chlorine, probably in the form of hydrogen chloride. This is fortunately a temporary poison, and if the source of the trouble is found and removed, the catalyst will regain its activity by a short period of intensive heating. Several other substances are included in the list of poisons, such as antimony, iodine, etc., but as they very seldom occur, are of slight importance. The activity of the catalyst may also be reduced by otherwise inactive substances, which, escaping the purifying apparatus, may deposit in the contact mass and by reducing the area exposed to the gas, affect the conversion. In spite of all precautions in the way of filtering, some fine dust is almost sure to work through in the course of years and, finally, by reducing the area or by increasing the resistance, thus using additional power, render it advisable to renew the mass.

If not occupied with such prosaic details as usually occur in every-day plant operation, one would possibly pause and consider just what was being accomplished by the apparently innocent mass of platinum. I have in mind one converter unit containing about 400 oz. of platinum, or a quantity that could be packed in a suit case, which operated continuously for some 15 years, converting in that time over 100,000 tons of SO_2 to SO_3 and finally renewed, not because its activity had decreased seriously, but for the other reason mentioned above, namely, that the resistance to the gas had increased, due to the accumulation of foreign matter, to such a point that the power required to force the gas through was excessive.

I have already mentioned that platinum at present has no serious rival as a catalyst. Ferric oxide has been, and still is, used in the Mannheim process, but the disadvantage lies in its much lower activity and consequently lower conversion with any reasonable velocity of the gas. Its only advantage is its cheapness which, however, disappears over a period of years. In the Mannheim process the ferric oxide converts about 40% and the balance has to be carried out with platinum.

CATALYST CARRIERS

Mention has already been made of the importance of exposing as large a surface as possible to the reacting gases. This brings up the subject of catalyst carriers or the material used to hold the platinum. Of the many substances proposed and tried, only two are at present in common use, magnesium sulphate and asbestos. The advantages of the former are that the platinum can easily be recovered in case of poisoning, and it requires less elaborate support in the apparatus. The monohydrate is used and calcined twice, the last time after mixing with water to render it less friable. It is then crushed and sized to about $\frac{1}{2}$ in., when it is ready for platimising.

Asbestos has the advantage of the maximum exposed surface. This can readily be appreciated, when its nature is considered. The long fibrous variety is necessary, and as this is by no means common a high price has to be paid. A preliminary treatment with hydrochloric acid is given, and after platimising the asbestos is run through a carding machine in order to tease out the fibres and thus increase the available surface.

The platinum itself is usually purchased in the form of sponge. It is dissolved in aqua regia, evaporated to dryness, taken up with water and a suitable reducing agent added. The total volume is then carefully divided into equal parts, and equal weights of asbestos immersed in the solutions. After drying and carding, the mass is distributed evenly over the supporting plates in the contact vessels and is ready for use. In the preliminary heating given before the gas is introduced into the system the platinum chloride is reduced to platinum black.

THE CONTACT VESSELS

As to the form which the contact vessels themselves take, this has been the subject of many patents. The problem consists of three major parts: first, to provide supports for the contact mass which will expose the maximum area to the gas stream and be strong enough to resist the warping action of the heat; second to provide means of removing the heat of reaction, for the conversion drops very rapidly above 500°C. , and this temperature or much higher is quickly reached with a gas containing, say, 7% SO_2 ; and, third, to provide apparatus to recover the heat of reaction and apply it to the incoming SO_2 gas, thus raising the temperature to the proper point for reaction.

The second and third parts are usually treated as one problem, one of the simplest methods being to divide the catalyst into two portions and pack into separate vessels. The gas, after passing through the first, where the temperature rises to, say, 550° and possibly 800° , conversion takes place, is passed through a tubular heat exchanger where it gives up a considerable portion of its heat to the incoming gas and enters the second vessel at a temperature of from 375° — 400° , and the remainder of the gas is converted. This gas then passes through another heat exchanger and thence to the absorbers. Operating in this way it is possible to run without any fuel at all, and we have the interesting spectacle of a self-contained unit operating with its own heat of reaction.

PURIFICATION OF THE SULPHUR DIOXIDE

We now come to what is in many ways the most important part of the process, the purification of the sulphur dioxide. Reference has already been made to the poisoning of the catalyst, and it is obvious that all possible objectionable material must be eliminated before the gas is allowed to enter the contact ovens.

So long as the contact process was confined to laboratory experiments or used as it was in the early days to recombine sulphur dioxide and oxygen produced by the decomposition of sulphuric acid, no injurious effect on the catalyst was noticed, and it was only when experiments were extended to the use of pyrites gas that the trouble commenced. A long and tedious investigation resulted in the conclusions, first that some substances interfered with catalytic action even when present in minute amounts, and second that these impurities were carried through with the white mist of sulphuric acid formed in the burners. The removal of this mist, therefore, was the major problem, and one which had to be solved if the process were to be a success. Ordinary washing with water or dilute sulphuric acid was not sufficient as the mist was not completely absorbed by either, and recourse was finally had to careful filtration, which, when efficient was found to completely remove the mist. As to the physical condition of this mist, it might be best compared to a fog, and the particles are probably of almost colloidal dimensions. Once the mist was eliminated the activity of the catalyst remained unaltered over a long period and the problem considered was at least partially solved.

The first stage in the purification is to cool the gas and eliminate the dust carried over from the burners. The successful application of the Cottrell electrostatic apparatus has been made, but the more common method is to combine the two operations in a scrubbing tower, circulating weak sulphuric acid. The tower is equipped with coolers and pumps, and may be packed with quartz, or, in the case of a dusty gas, may have no packing at all. The gas entering at, say, 500° would be cooled to 100° or less, and is then ready for filtration. The materials usually employed for this purpose are coke or quartz, the former being perhaps the most efficient. As it must be finely ground, the area has to be correspondingly great. The gas issuing from the filter is then passed through drying towers to remove the water vapour. Strong sulphuric acid is used as any moisture passing this point would condense in the latter part of the system, and form a troublesome mist with sulphur trioxide. The drying completes the purification of the gas, which is then ready for the catalyst.

ABSORPTION OF SULPHUR TRIOXIDE

Contrary to what might be supposed, complete absorption of sulphur trioxide by water to form sulphuric acid is practically impossible, and it was found that this could only be accomplished by 97-99% acid. If water or acid of much lower strength is used, an acid mist is formed which resists almost any attempt to absorb, whilst if the acid is allowed to become stronger, there will be a similar escape of sulphur trioxide without, however, the formation of the mist. This fact is of

fundamental importance, and was made the subject of a patent in the early days of the process. No matter what strength of acid may be used in other parts of the process, the final absorption must be with acid of the concentration given. Providing the strength and temperature are within the limits and the drying of the gas has been efficiently performed, the absorption of the trioxide is rapid and complete, and there should be no visible sign from the exit of the absorption apparatus that the plant is running. But if anything goes wrong with the circulation or the strength of the acid, then there is liable to be a beautiful stream of trioxide which, combining with moisture in the atmosphere, will soon call forth vigorous protests from anyone working in the vicinity. Special precautions are usually taken to give the alarm in case of mishap to the acid pumps, and the strength of the acid is kept within the prescribed limits by an interesting piece of apparatus sometimes called the electro-titrimer. This consists of two platinum electrodes immersed in a stream of the absorbing acid, the conductivity being measured by means of a Wheatstone bridge connexion and a telephone. The conductivity of sulphuric acid changes rapidly at high strengths, and this method gives instant and accurate results, so that the operator can easily regulate the stream of water used for diluting.

Of course, the fact that the strength has to be maintained within narrow limits means that a large stream of acid must be circulated. This may run as high as 100 gallons per minute, the pumps employed being usually of the centrifugal type driven directly by electric motors.

As the strength of the absorbing acid is 98-99%, this is naturally the strength of the product which is drawn off in a constant stream. As the usual strength of commercial acid is 93.2% the additional dilution is carried out in an auxiliary vessel, and the resulting product pumped to storage tanks for shipment as required.

THE PRODUCTION OF OLEUM

For the production of fuming sulphuric acid or oleum additional absorption apparatus is necessary. Depending on whether the major portion of the output is required in this form or as ordinary strength, the oleum towers may form part of the main absorption system or they may be placed in a separate location and part of the trioxide by-passed. The absorption is usually carried on in two stages, the first tower concentrating to, say, 20% free SO_3 and the second to 35% or even 40%. As in the main absorption system, heat is produced and means of cooling the circulating acid must be provided. Oleum is largely used in the explosive industry, and its advantage is, of course, the available SO_3 in the free state which can combine with the water of reaction produced in nitrating operations. 40% oleum, for example, contains 60% H_2SO_4 and 40% SO_3 . The latter can, therefore, combine with water in the ratio of $4\frac{1}{2}$ to 1 until all the SO_3 is used up and the strength of the solution is still 100%. This helps to preserve what explosive men call the water balance in their operations, and thus avoid expense in concentrating weak solutions.

During the war, of course, the consumption of oleum increased enormously as it is used in the manufacture of practically all high explosives. A somewhat serious

situation developed in England in the early months of the war, due to a shortage of sulphuric acid, and we were called on in Canada to assist as far as possible. The problem of transporting any considerable quantity of fuming acid overseas was no easy one. The first attempts almost ended in disaster. The oleum was filled in steel drums containing about half a ton, and stowed in the hold of the ship. A small leak in one of the upper tiers percolated down through the lower rows, absorbing moisture as it went, until it reached a strength where it attacked iron, and the natural result followed. More leaks occurred, and finally there was a solution in the bottom of the ship of a strength that vigorously attacked the plates. This boat was beached before the voyage had proceeded far.

The method finally adopted was to stow the drums between layers of fine coal so that any leak was absorbed and prevented from penetrating the rows beneath. In this way several thousand tons of oleum were safely conveyed across until the situation was met in England by the erection of new plants or the extension of old.

THE PLANT

Mention has been made of the various materials used in the construction of an acid plant. As long as the burner gas is above the condensing point of sulphuric acid, iron or steel can be used. Below 300° C., however, it is necessary to use lead until the gas is dried, when iron can again be used. In the absorption system cast iron has almost perfect resistance to acid of 98–100% at the temperature employed, while wrought iron or steel is rapidly attacked. For oleum the reverse is true, and steel is the material used. For shipping, steel tank cars are used for all strengths above 70% as the action at the ordinary temperatures is negligible. Of late, various alloys have been coming into use for pump impellers, valves, etc., which are exposed to exceptional wear. An alloy of 62% nickel, 21% copper, with smaller quantities of other metals, for example, possesses remarkable acid-resisting qualities, and can be used for all strengths from 20% sulphuric acid up to 40% oleum.

The handling of the large volume of gas is an interesting problem, principally one of mechanical engineering. For a plant of, say, 75 tons H_2SO_4 per day and a gas of 7% SO_2 it is necessary to move about 6200 cu. ft. per minute at 15° C. Positive pressure blowers of the Roots type are commonly used, and are installed in parts of the system where they will have only dried and purified gas to deal with.

Assuming a total resistance of 100 m. water column through the entire system, the power required will be 130 h.p., with the usual allowance for blower and motor efficiency. If power costs are high, then it is important so to design the plant that the resistance will be at a minimum after balancing the investment against the saving in power.

THE INDUSTRY IN CANADA

The sulphuric acid industry in Canada dates back some fifty years. Raw materials used were either sulphur or sulphur bearing ores, and with the exhaustion of the latter within reasonable distance, more dependence was

placed on elemental sulphur. It can easily be seen that this material, hauled principally by rail from Texas, hardly forms a cheap source of sulphur dioxide, and it was this fact that first drew attention to the sulphur gases going to waste in the Sudbury district, in the process of smelting nickel ores. For over 25 years gases containing in the aggregate several million tons of sulphur have been discharged into the atmosphere to be forever lost. The utilisation of these gases has been frequently discussed, and it may be at once admitted that the problem is not an easy one; in fact, it is extremely complicated. Apart from sulphuric acid there is the possibility of recovering the sulphur either in the elemental form or as liquid sulphur dioxide, either of which could easily be disposed of to the paper mills if the cost could compete with imported brimstone. Just here the difficulty lies. While it is quite possible to reduce sulphur dioxide to elemental sulphur by various methods, there is, up to the present, none that can be operated at a sufficiently low cost. Liquefaction of sulphur dioxide is entirely practicable by the usual method of dissolving in water, heating the solution to expel the dioxide as 100% gas, which is then easily compressed and liquefied and can be shipped in tank cars. Here again the element of cost intrudes, and the principal item is the fuel used to drive off the gas. However, it may be said that the conversion into liquid sulphur dioxide is the more promising of the two.

The manufacture of sulphuric acid is on a different basis. With a gas of reasonable concentration, and provided the plant was designed to deal with the peculiar conditions existing, then there seemed to be no obstacle in the way that could not be met by good engineering and business judgment. It was soon decided that the contact process was the proper one to use, for practically all the Canadian consumption is in the form of concentrated acid, and the success of the enterprise depended on the fact that there would be no cost for raw material, which is entirely logical, for the gases had hitherto gone to waste. With the chamber system there would, of course, be the nitrogen oxides as well as fuel used for concentrating. It would hardly be fair to state that the question of utilising these gases for the manufacture of sulphuric acid had not been discussed before, but it is a fact that the subject was usually dismissed with a shrug, and the remark that Sudbury was too far away from the consuming centres, and perhaps with the thought, unexpressed may be, that the climate was prohibitive. It was soon found, however, that Sudbury was not within the Arctic Circle, that it was almost due west and about 130 miles from Montreal, and 250 miles from Toronto. We found, further, that the freight rates were well within the economic range, after allowing for a raw material costing nothing, and that sulphuric acid could be delivered to the principal consuming points at a figure considerably below the cost of production then existing. With this basis to work on, an extended investigation was undertaken at the smelter of the Mond Nickel Co., the thoroughness of which may be judged from the fact that over 2000 gas analyses were made to prove the suitability of the gases for the contact process, for it must be understood that the direct conversion of smelter gases by this process had not

hitherto been attempted, and that these gases have quite different characteristics from ordinary pyrites or burner gas. The first condition imposed was that the manufacture of acid must not interfere with the normal smelting operations, for, of course, the output of nickel matte, which is the main operation, could not be allowed to suffer. This condition was constantly kept in mind, and has been successfully met.

The smelting of nickel ores is conducted in two stages. The crude ore containing 4–5% nickel plus copper and 17–20% sulphur, after some preliminary treatment, is first charged to the blast furnaces with coke and limestone and smelted to a matte running from 15–20% nickel plus copper. This matte is bessemerized in basic converters to about 80% nickel plus copper, which is the product shipped to the refineries. No fuel is necessary in the converters as the sulphur and iron provide all the required heat. It was found that the blast furnaces could not discharge a gas of sufficient strength for the manufacture of acid without radical changes in design, so that attention was concentrated on the converters. Nickel smelting differs from copper, which it otherwise resembles, in that the bessemerizing process cannot be carried to metallic nickel without serious loss in the slag, among other drawbacks. This is due to the fact that the oxide and sulphide of nickel do not react in the same way as the oxide and sulphide of copper. From the point of view of acid manufacture this was a very important fact, for it meant that, as there was always an excess of sulphur in the molten matte in the converter, the strength of the sulphur dioxide gas was always at a maximum. As the oxidising efficiency of a converter is almost 100%, the gas emerging is practically nothing but sulphur dioxide and nitrogen, the former averaging about 14% by volume. To remove the gas it is necessary to provide hoods and flues leading to chimneys, and as the hoods cannot be connected tightly to the converter, some air is drawn in around the hoods which serves to dilute the gas. It was at this point that the gas is taken through a separate flue to the acid plant, for, of course, we are at present only using a small percentage of the total volume. The design of the plant followed in general principles that already described, with changes suggested by the results of the investigation and to adapt it to local conditions. The gas is scrubbed and cooled with acid in a mechanical scrubber which gives an intimate contact between the two, passes through a filter filled with fine coke, is dried with strong acid, and then led to the contact vessels containing the catalyst, in this case asbestos impregnated with platinum. Incidentally, it is interesting to note that the platinum used came from the Mond Nickel Company's mines, having been recovered in the refining process. The heat exchange system is used, and the heat recovered from the reaction is almost sufficient to pre-heat the incoming gas to the required temperature. The SO_3 is then passed to the absorption towers, packed with flat pebbles, through which acid of about 99% is circulated by means of centrifugal pumps. A portion of the gas is by-passed to the oleum towers, where fuming acid up to 40% free SO_3 is made by circulating in exactly the same manner as the absorption towers. The centrifugal pumps used for all except the scrubbing towers

are of chilled iron with impellers made from a nickel-chromium alloy. This alloy has remarkable acid-resisting properties, and is used for all strengths from 20% to fuming acid and at temperature up to 225° F. without appreciable signs of wear. The final product is an exceptionally high-grade acid free from all impurities, except a trace of iron, and is almost water white.

The quantity of sulphur dioxide escaping in the Sudbury district is many times greater than the available market for sulphuric acid in Canada. Altogether, some 500 tons of sulphur are discharged per day in the air as sulphur dioxide, or the equivalent of 1500 tons of sulphuric acid. The present consumption in Canada is about 200 tons per day, so we are still a long way from utilising the total sulphur for this purpose.

A start, however, has been made in the construction of the Comston acid plant, which assures Canadian consumers of a source of this important material at a cost which is already below that prevailing in the United States, and which should encourage its extended use. It is hardly necessary to emphasise the importance and advantages to Canada of a cheap source of sulphuric acid, controlled within the Empire. Of the 75,000 tons at present consumed, oil refining and sulphate of ammonia account for the largest part, over 50%. Explosives and the pickling of steel are close thirds, followed by industries such as tanning, textile and dye works, and others too numerous to mention. Even the humble storage battery is making itself felt, and is using a rapidly increasing tonnage. As Canada grows, so will the increased consumption in all of these lines lead to further use of sulphuric acid and to the extension of the plant which we have been describing, which is the first attempt to utilise the sulphur in the Sudbury ores, thus creating a new and important natural resource.

THE BUREAU OF CHEMICAL ABSTRACTS

More than three years have passed since the Councils of the Chemical Society and the Society of Chemical Industry agreed to make a combined effort in the co-ordination of abstracts, and entrusted the Bureau with the task of exploring the situation. The present moment, when the first joint index covering abstracts in both pure and applied chemistry is about to appear, seems appropriate for taking stock of the developments which have followed the establishment of the Bureau.

The opinion has been frequently expressed that the ultimate aim should be not merely the unification of the abstracts published by the two British societies, but the issue of *one* abstracts publication in the English language. This wider collaboration had been the subject of conference with American chemists on previous occasions, but at an early stage in the Bureau's activities the suggestion was made to the American Chemical Society that the question should be examined afresh. Those most closely associated with "Chemical Abstracts," however, after giving the suggestion their sympathetic consideration, felt unable to proceed further in the matter, and a reasoned statement, setting forth the American point of view, was communicated to the Bureau.

In these circumstances the Bureau settled down to

the more limited problem of unifying the abstracts published separately by the Chemical Society and the Society of Chemical Industry. The basic facts of the situation to be tackled three years ago were the different formats employed, the overlap in the preparation and production of abstracts, estimated at about 10 per cent., and differences in type, method of presentation, and indexing. A further fact, which turned out to have an important bearing on the degree of unification attainable, was that while the Chemical Society had already dissociated its abstracts from its Journal, the abstracts in applied chemistry were closely linked to the weekly publication of CHEMISTRY AND INDUSTRY.

It looked at one time as if the efforts to find some agreed line of advance towards unification were to end in failure, and about eighteen months of negotiation between the Bureau and the two societies were necessary to secure the measure of co-ordination now adopted. The essential points in the proposals finally accepted were (a) that both sets of abstracts should be printed in double column, quarto size, in the type hitherto used by the Chemical Society; (b) that the existing overlap should be eliminated; and (c) that a joint index covering both sets of abstracts should be produced. The first year of publication on the new basis has now been completed, the initiation of the changes being marked by the adoption of the title "British Chemical Abstracts" to cover both sections.

Outwardly, the most notable feature of the new arrangements has been the change in the format of the "A" abstracts, and it must be recognised that this has meant a big concession on the part of the Chemical Society. On both practical and sentimental grounds one dislikes an alteration in the accustomed size of periodicals, and it is natural that the adoption of the larger format has been unwelcome to many regular readers of the "A" abstracts. A reasonable faith, however, in the desirability of the ends to be attained reconciles one to the less attractive aspects of a forward movement.

As to the abstracts in applied chemistry it will probably be admitted by everyone that the adoption of the type and set-up previously used by the Chemical Society has led to an enormous improvement in appearance and legibility. Any increase in expenditure which this change has involved has been well worth while.

Along with the more obvious alterations to which reference has been made, various changes of a minor character have been introduced, such as the continuous pagination of the "A" section, the saving of space between successive abstracts in both sections, a more economical form of the "A" monthly author index, and the publication of the "B" abstracts in a complete block fortnightly, instead of in weekly instalments.

An essential feature of the Bureau's co-ordinating work is the joint index, covering both sections of the abstracts, and due to appear very shortly. This has proved a big undertaking, involving the preparation and sorting of about 50,000 index cards, and the task has been rendered exceptionally difficult this year because of differences in the systems of indexing

hitherto used. By next year these difficulties will have been surmounted, and a model for future indexes will be available.

During 1926 the Bureau published 11,053 abstracts of papers, and 4220 abstracts of patents. Although, on financial grounds, the Bureau cannot emulate the comprehensive sweep of the American net, every effort is made, by a systematic review of the available sources of information, to ensure that all novel matter of real chemical interest finds a place in "British Chemical Abstracts." In respect to the trustworthiness of its abstracts, the promptness of their appearance, and their legibility, the Bureau believes that it has achieved a high standard, in maintaining which the Editor is supported by a group of Assistant Editors, each an expert in a particular branch.

Apart from minor improvements which may be introduced from time to time, it seems as if the Bureau had secured the maximum extent of unification possible in existing circumstances. The ideal of a single abstracts publication, issued independently of the Journals of the two Societies, cannot be realised so long as the close association of the "B" section with CHEMISTRY AND INDUSTRY is considered vital. The work which the Bureau has already accomplished does, however, represent a notable co-ordination of chemical effort, and a few years' experience of this joint enterprise may prepare the way for a still further advance.

JAMES C. PHILIP

CANADIAN PULP AND PAPER INDUSTRY

The Lake St. John Power & Paper Co., Ltd., has commenced the construction of its mill at Mistassini, Lake St. John district, Quebec, and it is expected to be operating before the end of the year. The development contemplates an output of 220 tons newsprint daily, with arrangements for subsequent increase to 400 tons. The company holds, under lease from the Quebec Government, limits covering 1000 square miles of splendid timber lands situated on the Mistassini and Aux Rats rivers, and estimated to contain 6 million cords of pulpwood. The company will obtain, for the present, power from the Duke-Price Power Co., Ltd.

The largest pulp and paper mill in the world will be erected on the Campbell river, on the north-east coast of Vancouver Island, B.C. The ultimate capacity will be 1000 tons newsprint daily. The motive power will be obtained from the Campbell river falls. The site of the mill will be at Duncan Bay or Menzies Bay. The cost of construction will be in the vicinity of \$50,000,000, but the first unit, which will be immediately constructed, will have a capacity of 200 tons, and additions will be made until the full capacity of 1000 tons has been reached. The promoters are the Crown Willamette Paper Co., of San Francisco. This company dominates a number of large pulp and paper concerns in California and other north-western states, and is one of the wealthiest organisations in the industry. The company last year took over the large mills of the Pacific Mills, Ltd., at Ocean Falls, B.C., and are operating them. The company has obtained a lease of large limits, with plentiful supply of pulp wood.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICE

Annual Meeting, Edinburgh, 1927

PROGRAMME

MONDAY, July 4.

8-10 p.m. The North British Station Hotel—Informal Reception by the Chairman and Committee of the Edinburgh and East of Scotland Section, followed by Conversation.

TUESDAY, July 5.

9.30 a.m. Committee Room, University Union—Council Meeting.

10 a.m. Debating Hall, University Union—Welcome by the Lord Provost of the City of Edinburgh; Welcome on behalf of Edinburgh University by the Vice-Chancellor.

Annual General Meeting of the Society of Chemical Industry (for Members only).

Presentation of the Society's Medal to Lieut.-Col. G. P. Pollitt, D.S.O.

11 a.m. Debating Hall, University Union—Address by the President—Francis H. Carr, C.B.E. A panoramic photograph will be taken after the President's Address.

1.15 p.m. North British Station Hotel—Luncheon by invitation of the Edinburgh and East of Scotland Section. Representatives of the Edinburgh Town Council, and of the Universities of Edinburgh, St. Andrews, and Aberdeen will be present.

3.30 p.m. Garden party

8.30-1 a.m. Palais de Danse—Reception by the President, and Dance.

WEDNESDAY, July 6.

10 a.m. Medical Chemistry Classroom, Medical Buildings, The University.

Joint Meeting with the Biochemical Society—Subject of discussion: "The Physiological and Industrial Aspects of the Chemistry of Carbohydrates."

10 a.m. Midwifery Classroom, Medical Buildings, The University.

Meeting of the Chemical Engineering Group—Subject of discussion: "Paper."

2.15 p.m. Visit to University Chemical Laboratories, King's Buildings, Edinburgh.

4 p.m. Reception by invitation of the University Court in the Upper Library Hall, Old University Buildings.

7.15 for 7.30 p.m. North British Station Hotel—Annual Dinner of the Society.

THURSDAY, July 7.

10 a.m. Medical Chemistry Classroom, Medical Buildings, The University.

Address by the Society's Medallist—Lieut.-Col. G. P. Pollitt, D.S.O., on the "Development of the Synthetic Ammonia and Nitrogen Industry in Great Britain."

11 a.m. (Same room). Paper (to be arranged).

12 noon. (Same room). Paper by Prof. J. Read, University of St. Andrews.

10 a.m. Midwifery Classroom, Medical Buildings, The University.

Meeting of Fuel Section of the Society—Subject of discussion: "Coal Cleaning."

Afternoon—Meeting of the Fuel Section continued. Visit to the paper mills of Messrs. James Brown & Co., Ltd., Penicuik.

Visit to Castle Mills, Edinburgh, the works of The North British Rubber Co., Ltd.

8 p.m. City Chambers, Edinburgh—Reception by the Lord Provost and Magistrates of the City of Edinburgh.

FRIDAY, July 8.

Excursions.

(1) Whole day excursion to Melrose, Abbotsford, Dryburgh, and Peebles.

(2) Afternoon excursion to Forth Bridge and Incheolm.

Conducted tours of Old Edinburgh will be arranged on Thursday and Friday.

HEADQUARTERS IN EDINBURGH

The Office of the Society during the meetings will be in the North British Station Hotel, Princes Street, Edinburgh.

Members may have their letters sent to them, c/o The Society of Chemical Industry, at the office address given above.

RAILWAY FACILITIES

The Railway Companies of Great Britain (except the Metropolitan, the Metropolitan District, and London Electric Railway Companies) have agreed to issue tickets at the ordinary single fare and one-third for the double journey to persons travelling to Edinburgh to attend the meeting. Tickets will be available from Saturday, July 2, to Saturday, July 9.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

ACCOMMODATION

No single bedrooms are now available in the North British Station Hotel—the Headquarters of the Society—and only a few double rooms (with two beds) are still available.

Single room accommodation for both men and women is still available in the University Hostels. Immediate application for such should be made to the Hon. Secretary of the Section—Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

A list of other hotels was published in *CHEMISTRY AND INDUSTRY* for February 4, 1927, p. 105.

It is hoped that a lounge and writing room adjoining the office in the North British Station Hotel will be reserved for the use of members during the week of the meetings.

The women students' common room in the Medical Department of the University will also be reserved as a reading and writing room for the use of members.

BEILBY MEMORIAL AWARDS

From the interest derived from the invested capital of the Sir George Beilby Memorial Fund, at intervals to be determined by the administrators, representing the Institute of Chemistry, the Society of Chemical Industry, and the Institute of Metals, awards will be made to British investigators in science to mark appreciation of records of distinguished original work, preference being given to investigations relating to the special interests of Sir George Beilby, including problems connected with fuel economy, chemical engineering, and metallurgy.

Awards will not be made on the result of any competition, but in recognition of continuous work of exceptional merit, bearing evidence of distinct advancement in knowledge and practice.

The administrators of the fund are the Presidents, Honorary Treasurers and Secretaries of the three participating institutions.

AMERICAN SECTION

The February meeting was held on February 11, 1927, in Rumford Hall of the Chemists' Club, as a joint meeting with the New York Section of the American Electrochemical Society and American Section of the Société de Chimie Industrielle. The meeting began at 8 p.m., with Dr. Allen Rogers in the chair.

The principal speaker of the evening was Prof. Edward Bartow, of the University of Iowa, who dealt with the subject of "Sewage and trade wastes." Prof. Bartow described the activated sludge process and illustrated his remarks with slides of various large-scale sewage disposal plants. He then spoke of the treatment of waste from corn products plants and summarised the tremendous reductions made in the population equivalent of the waste by more careful manufacturing operations. The paper will be published in full at a later date.

Following the remarks of Prof. Bartow, Prof. D. D. Jackson discussed the methods of treatment used by New York City of distribution in the surrounding water. This capacity is largely taken up at the present time so that in the not distant future other means must be used.

Mr. E. B. Besselièvre described a proposed activated sludge plant for New York City, and outlined the legislation regarding sewage and trade waste in other States. Mr. William R. Copeland followed with a discussion of conditions in Connecticut and the problems involved by State lines. Discussion by members and guests followed.

Seventy-five members and guests attended the dinner in the club dining room preceding the meeting, and about 150 attended the meeting.

NEWCASTLE SECTION

Mr. Alfred Rudge presided over the meeting held in Armstrong College on March 2.

The Saville Shaw Medal was presented by the Chairman to Mr. T. G. Pearson, a student of Armstrong College, for research work upon the subject of "The action of sulphuretted hydrogen upon mono-hydrated ferric oxide." This medal is presented annually to the student of chemistry or metallurgy who has performed

research work of especial merit. Mr. Pearson is a native of South Shields, where he attended the High School, and is now reading for an Honours degree in Chemistry. After the presentation of the medal, Mr. Pearson read a paper by himself and Dr. P. L. Robinson upon the above work.

In the discussion which followed, Dr. G. Weyman remarked that the authors had tackled a difficult subject in dealing with the sulphides of iron. He himself had put his foot into this problem some years ago and had not, he was afraid, got it out yet.

Dr. W. B. Davidson expressed great appreciation of the paper, and suggested that the work should be extended to other temperatures. He looked forward to seeing the paper in print, as he thought it constituted a distinct advance in our knowledge of a reaction of great industrial importance, which was at present very little understood.

Prof. H. V. A. Briscoe supported the remarks of Dr. Davidson, and explained to the members present that this paper was the result of a new departure in the methods of practical instruction at Armstrong College, whereby the better students were afforded opportunities of engaging in research work as a part of their regular instruction in inorganic chemistry for the bachelor degree. The problems were specially chosen to afford a similar training in practical work to that ordinarily given.

The second paper was given by Mr. G. M. Nave, B.Sc., upon "Apparent specific gravity and porosity: A comparison of various methods."

SOUTH WALES SECTION

A joint meeting of the South Wales Sections of the Society of Chemical Industry and the Institute of Chemistry was held at the Technical College, Swansea, on March 16, when a paper was read by Mr. E. A. Tyler, M.A., F.I.C., entitled "Further notes on pure chemicals." The chair was taken by Mr. C. M. W. Grieb.

The paper was illustrated by means of lantern slides setting forth comparative results obtained on British and foreign analytical reagents, chiefly potassium compounds. The continued improvement in quality of the reagents of certain British firms was in evidence, but sometimes wide variability of purity was found. The lecturer stated that this fault was not peculiar to British products. At the same time he regretted that products had been examined which fell far below A.R. standards, although obtained under this designation. Attempts made to improve both the delicacy and accuracy of methods of detection of impurities were outlined, especially in relation to the occurrence of nitrates and chlorides. Dealing with chlorides, an account of a promising method of detection and estimation, founded on physico-chemical principles, was given in some detail, and the results obtained showed that the method might become valuable. However, many more compounds remained to be examined before any claim for its general utility could be advanced.

An interesting discussion followed, in which Dr. Coates, Messrs. Grieb, Green, Godsell, and Dunn took part. After Mr. Tyler had replied, a very cordial vote of thanks was accorded him for his interesting and valuable paper.

CALENDAR OF FORTHCOMING EVENTS

- Mar. 25. **CHEMICAL ENGINEERING GROUP.** *Joint meeting with the Institution of Mechanical Engineers.* Storey's Gate, S.W.1, at 5.15 p.m. "Lubrication," by Dr. W. R. Ormandy.
- Mar. 25. **SOCIETY OF CHEMICAL INDUSTRY, Glasgow Section.** Messrs. Ferguson & Forrester's Restaurant, 36, Buchanan Street, Glasgow. *Annual Business Meeting*, at 6.30 p.m. Also a joint smoker with the Glasgow and West of Scotland Section of the Institute of Chemistry, at 7.30 p.m.
- Mar. 25. **SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY, Newcastle Sections.** Jointly with the Newcastle Chemical Industry Club. *Annual Dinner*, at Messrs. Tilley's Restaurant, Blakett Street, Newcastle, at 7.30 p.m. Amongst those who have promised to attend are Sir George and Lady Renwick, Prof. Arthur Smithells, Dr. J. T. Dunn, and the President of the Society of Chemical Industry, Mr. F. H. Carr, C.B.E.
- Mar. 29. **ROYAL MICROSCOPICAL SOCIETY.** Conference at 30 & 31. Liverpool University.
- Mar. 29. **HULL CHEMICAL AND ENGINEERING SOCIETY.** Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m. "Works filtration," by R. B. Foster.
- Mar. 30. **OIL AND COLOUR CHEMISTS' ASSOCIATION.** Ninth Annual Dinner, Hotel Cecil, Strand, W.C.2
- Mar. 30. **INSTITUTE OF CHEMISTRY, Belfast and District Section.** Royal Belfast Academical Institution, at 7.30 p.m. "Some experiments on the nutrition of poultry," by Prof. G. Scott Robertson.
- Mar. 30. **FARADAY SOCIETY.** Second (Experimental) Report on Atmospheric Corrosion, by Dr. W. H. J. Vernon, will be read and discussed in the Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 3 p.m.
- Mar. 30. **SOCIETY OF CHEMICAL INDUSTRY, Nottingham Section.** The Annual Meeting, University College, Nottingham, at 7 p.m. At 7.30 p.m. a public meeting will follow, when a paper on "Accessory agents in biochemical and physiological reactions," will be read by Prof. A. R. Ling.
- Mar. 31. **SOCIETY OF CHEMICAL INDUSTRY.** *Joint meeting of the Manchester Section and the Chemical Engineering Group, together with the North-Western Section of the Institution of Mechanical Engineers.* in Manchester, for a further discussion of the paper on "Lubrication," by Dr. W. R. Ormandy.
- Apr. 1. **SOCIETY OF CHEMICAL INDUSTRY.** *Joint meeting of the Chemical Engineering Group and the Institution of Mechanical Engineers,* to be held at Storey's Gate, St. James's Park, S.W.1, at 6 p.m. "Lubricating oils—laboratory tests in relation to practical results," by A. G. Marshall and C. H. Barton.
- Apr. 1. **SOCIETY OF CHEMICAL INDUSTRY, Manchester Section.** Annual General Meeting, 16, St. Mary's Parsonage, Manchester, at 7 p.m. "The work of the National Physical Laboratory," by Dr. W. Rosenhain.
- Apr. 4. **SOCIETY OF CHEMICAL INDUSTRY, London Section.** *Joint meeting with the Fuel Section.* Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. "The international conference on bituminous coals at Pittsburgh," by Dr. R. Lessing.
- Apr. 5. **SOCIETY OF CHEMICAL INDUSTRY, Birmingham and Midland Section.** University Buildings, Edmund Street, Birmingham, at 7.15 p.m. "Ultra violet light," by A. A. King.

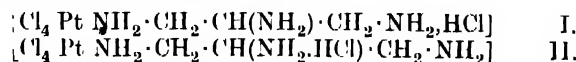
CHEMICAL SOCIETY

The President, Prof. H. Brereton Baker, C.B.E., F.R.S., before proceeding with the ordinary business of the meeting held on March 17, referred with deep regret to the death of the immediate Past President, Dr. A. W. Crossley, C.M.G., C.B.E., F.R.S., Fellows meanwhile standing. It was also announced that the Council had proposed Prof. Dr. Richard Willstätter for election as an Honorary Fellow.

Dr. F. G. Mann described—

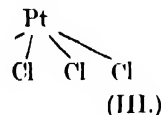
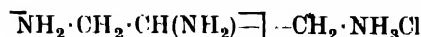
Tetrachloro - (triaminopropane γ - monohydrochloride) - platinum, a new type of optically active complex salt.

In tetrachloro- (triaminopropane monohydrochloride)-platinum, (J., 1926, 129, 2681), the platinum is co-ordinated to four chlorine atoms and to two of the three amino-groups of the triaminopropane molecule, the third amino-group being thus free for normal salt formation with acids. Hence, although the complex itself is neutral and non-ionic, the compound in aqueous solution furnishes one chlorine ion. Such a compound might exist in two isomeric forms, the platinum being co-ordinated either to the $\alpha\beta$ -diamino groups (I) or to the $\alpha\gamma$ -diamino-groups (II).



In the former compound, asymmetry is induced in the central carbon atom of the triaminopropane molecule by the disposition of the co-ordination linkings, since this atom thus becomes linked to an aminomethyl group ($\dots \text{NH}_2 \cdot \text{CH}_2 -$) on one side and to a methylene ammonium radical ($-\text{CH}_2 \text{NH}_3 -$) on the other side. This compound should therefore be capable of resolution into optically active forms, whilst the isomeric compound (II) should not be so resolvable.

Fractional recrystallisation of the camphorsulphonates has given the optically pure *l*-base-*d*-sulphonate and *d*-base-*l*-sulphonate, which in turn have furnished the *l*- and *d*-monohydrochlorides having $[M]_{5461}^{15^\circ} -502^\circ$ and $+501^\circ$ respectively. The compound is therefore the γ -monohydrochloride having the constitution (III), the metal being co-ordinated through the $\alpha\beta$ -diamino-groups. This is the first recorded case of a carbon atom owing its asymmetry to the operation of auxiliary valencies.



Dr. N. V. Sidgwick remarked that the formation of a 5-membered ring when either a 5- or a 6-membered ring was possible demonstrated the greater stability of the former when double linkings are absent.

In reply to Dr. J. Kenyon, Dr. Mann said that the asymmetry of the central carbon atom was actually realised in aqueous solution, the addition of water, followed by ionisation and loss of asymmetry, being

prevented by co-ordinating the $\alpha\beta$ -diamino-groups with platinum.

Dr. A. B. P. Page discussed :

The Activation of Wood Charcoal by Progressive Oxidation, in relation to Bulk Density and Iodine Adsorption.

THE difficulty of preparing charcoal with definite adsorptive properties has always prevented a satisfactory study of the change of activation with conditions of heat treatment. In this work, great care was taken to make a large quantity of wood charcoal of uniform quality. This standard charcoal was oxidised under accurately controlled conditions of temperature, time of treatment, and composition and rate of passage of the mixture of oxygen and nitrogen used in the oxidation. The bulk density of the treated charcoal was determined, and its capacity for removing iodine from solution in benzene. Adsorption isotherms were obtained for each charcoal and the Freundlich constants evaluated. At most temperatures the bulk density falls off smoothly with increasing oxidation. The variation of the two Freundlich constants is reciprocal. The exponent decreases and then increases rapidly with increasing oxidation, subsequently showing a much slower decrease. It is suggested that the rapid changes correspond with a change in the effective number of attracting centres per unit of charcoal surface, whilst the slow change corresponds with the increase of surface per gram of charcoal, indicated also by the bulk density curves.

The President asked why an ashless charcoal had not been selected for the experiments. The author had burned off the surface layer, getting nearer to the ash, producing a thinner layer of carbon which might be expected to show increased activity. With ashless charcoal, however, other workers might hope to obtain comparable results.

Prof. J. C. Philip said that he was originally responsible for the choice of birch charcoal in Dr. Page's work, and admitted the desirability of carrying out similar experiments with sugar charcoal. This was now in hand, but even sugar charcoal would probably present difficulties from the point of view of reproducibility of results.

Dr. S. Sugden discussed :—

The Parachor and Chemical Constitution. Part V. Evidence for the Existence of Singlet Linkings in Phosphorus and Antimony Pentachlorides.

THE parachors of phosphorus and antimony pentachlorides are lower than the sum of the atomic constants by 26 units. Since the additive nature of the parachor has been verified for a large number of substances, this is taken to mean that the pentachlorides possess a type of linking which has not been met with in the compounds previously studied.

From a discussion of electron valency formulae and the effect of the number of electrons in a linking on the structural constants for unsaturated linkings, it is concluded that these compounds contain two singlet linkings, each consisting of one electron held in common by two atoms.

The electronic theory of valency is extended to include linkings composed of an odd number of shared electrons,

and is applied to the formulation of higher halides, co-ordination compounds, and "molecular" compounds for which, hitherto, it has not been possible to write electronic formulae without violating the octet rule.

Prof. T. M. Lowry said that the magnitude of the deficiency was identical for phosphorus pentachloride and oxychloride; the explanation that the fifth valency is an electrovalency instead of a covalency was equally valid in both cases. The new data were therefore in harmony with the polar formula $[\text{PCl}_4]^+ \text{Cl}^-$. Dr. Sugden's arguments were invalidated by the fact that, although he had made an allowance for the increment for $\cdot\cdot\cdot$ to \cdot (assumed to be the same as for $\cdot\cdot\cdot$ to \cdot and \cdot to $\cdot\cdot\cdot$) in deducing a value for the single-electron linking, he had ignored it in calculating a value for the polar formula. The parachors therefore afforded no evidence for the existence of single-electron linkings, although this might, perhaps, be justified on other grounds.

Dr. N. V. Sidgwick said that the author had obviously discovered a method of great value in investigating molecular structure. However, to accept his latest interpretation would necessitate abandoning the idea of correlation between the structure of a linking and its behaviour. Singlet linkings should be weaker than doublets, and the only certain singlet linkings are known to be weak. The remarkable stability of SF_6 , however, does not accord with the view that four of the fluorine atoms are attached by singlet linkings.

Prof. C. K. Ingold considered that the author's physical evidence for the existence of pairs of singlets in phosphorus and antimony pentachlorides was very strong; the behaviour of these compounds as substituting agents provided chemical justification for the view. This was true also of iodine trichloride, the aryl iodide dichlorides, and probably the polyhalide ions. Sulphuryl chloride functioned in a dual capacity as a substituting agent, and its structure admitted of a distribution of charges between the oxygen and chlorine atoms. Prof. Ingold criticised the author's formula for nitric oxide, and referred to the tendency of the singlet linkings to arise in pairs, possibly deriving their stability from some form of mutual association.

Dr. Sugden replied that, although the anomaly found for the pentachlorides equals the difference between the constants for a non-polar and a semi-polar double linking, it did not follow that the effect could be ascribed in both cases to the substitution of a polar linking for a covalency. The semi-polar double linking, which consists of a covalency and a polar valency, has a constant of 1.6 in a large number of substances; since the effect of a covalency is zero, the effect of a polar valency should also be 1.6 unless the additive relation breaks down. The small effect of a polar linking on the parachor is demonstrated by measurements on the hydrogen halides. It was difficult to believe that the pentachlorides contain an electrovalency whereas the hydrogen halides do not. In the cobaltamine series the electrons responsible for the Bohr magnetons probably reside in the M -level; in the suggested formulae, as in the old ones, there are many more electrons in this level than the observed number of magnetons. The analogy with the structure

of the inert gases could not be very strongly stressed for an energy level well within the atom. Reactivity depends not only on the type of linking, but also on the type of atoms linked and the nature of the second molecule. The stability of carbon tetrachloride, involving only an ordinary chemical single linking, was almost as great a puzzle as that of sulphur hexafluoride.

BIOCHEMICAL SOCIETY

The annual general meeting was held in the Department of Physiology and Biochemistry, University College, Gower Street, W.C.1, on March 18.

The following communications were read:

"Carbohydrate metabolism of the brains of normal and diabetic animals," by B. Holmes and E. Holmes.—The authors briefly discuss the evidence which has led them to the conclusion that the brain contains no reserve of lactic acid precursor, and therefore depends entirely on the blood sugar for its supply of such precursor. Under anaerobic conditions the brain rapidly forms lactic acid from added glucose, under aerobic conditions the tissue readily compasses the disappearance of lactic acid. They quote figures to show that the amount of lactic acid in the brain immediately after death runs parallel with the level of the blood sugar at the moment of killing, in conditions both of extreme hypoglycaemia, and of hyperglycaemia. They describe experiments on depancreatized and on normal cats, showing that after pancreatectomy, lactic acid formation, both from the sugar of the blood in the living animal, and by the excised tissue *in vitro* (from added glucose), takes place as in the normal animal. Further, under aerobic conditions, the excised tissue still brings about the removal of lactic acid.

"Phosphagen," by P. Eggleton and M. G. Eggleton.—The substance phosphagen which is present in striated muscle, and which disappears therefrom in rapid fatigue, has been isolated from the skeletal muscles of the rabbit. Its barium salt has many of the properties of a hexose monophosphate, and is soluble even in 30% alcohol. It is always accompanied by another hexosemonophosphoric acid the barium salt of which is slightly less soluble in alcohol. The latter does not show the instability in acid which is characteristic of phosphagen. The purest sample of phosphagen obtained so far contains 7.95% of phosphorus and 40.4% of BaO, but its copper-reducing power (Folin technique) is very low even after hydrolysis. Phosphagen has been found in the skeletal muscle of the guinea pig and the tortoise. There appears to be a correlation between the "synthetic" ability of a muscle under the influence of fluoride, and its phosphagen content, since unstriated muscle, which contains little or no phosphagen, fails to show any "synthetic" ability.

"The phosphorus of caseinogen," by C. Rimington and H. D. Kay.—A phosphorus-containing peptone has been isolated from tryptic digests of caseinogen in a yield representing 50% of the organic phosphorus. It possesses the formula $C_{37}H_{73}N_9P_3O_{33}$, forms well-defined copper, silver and barium salts, is strongly laevorotatory with $[\alpha]_{D}^{20} = -77.16$, and behaves on titration and in formation of its salts as a 9-basic acid. This substance, which has been named phosphopeptone, is readily

soluble in water giving solutions which react acid to litmus. It cannot be crystallised, but passes with ease into the form of a transparent vitresoid mass. Two of the three atoms of phosphorus which it contains are detached as phosphoric acid by bone phosphatase: the remaining atom is, however, removed by kidney phosphatase. In this respect phosphopeptone resembles exactly tryptic digests of caseinogen in which also bone phosphatase will hydrolyse only two-thirds of the organic phosphorus, and appears, therefore, to be a representative fraction. The ratio total nitrogen/amino nitrogen in phosphopeptone is 9/1, and after acid hydrolysis becomes unity. From the hydrolysis products hydroxyglutamic acid has been isolated in a yield corresponding to two molecules per molecule of peptone. Other hydroxyamino acids are present, and among them most probably serine. The phosphorus in caseinogen is held in ester linkage. Phosphopeptone is very slowly attacked by pancreatic juice, both peptide and phosphorus linkages being opened up. The phosphorus is removed as phosphoric acid by 1% sodium hydroxide at 37°.

"The dual nature of vitamin B," by M. H. Roscoe.—The identity of the anti-neuritic vitamin, necessary for the cure of polyneuritis in pigeons, with the water-soluble vitamin B, needed for growth in rats, has been much discussed, and differences pointed out in their quantitative distribution, stability in the presence of heat, and solubility in alcohol, etc. Goldberger describes a pellagra-preventive factor, which is present in watery solutions of autoclaved (anti-neuritic free) yeast, and which is necessary to rats, both for growth and for the prevention of a pellagra-like condition. In the experiments undertaken Peters' 50% alcohol yeast extract, though curing neuritic symptoms in rats, neither enabled them to grow nor prevented the onset of a pathological condition of the skin (the pellagra-like condition of Goldberger). This was cured, however, by yeast autoclaved for 5 hrs. at 120° C., and growth was restored. The autoclaved yeast had no effect on the neuritic symptoms, and in the absence of the extract did not allow growth. Wheat germ has also been tested. Its anti-neuritic content was similar, but the "pellagra-preventive" content was much lower than that of yeast. The water-soluble vitamin B necessary for the growth of rats can thus be divided into an anti-neuritic factor and a "pellagra-preventive" factor. Both are necessary for growth.

"Some sterol colour reactions in their relation to vitamin A," by O. Rosenheim.—An attempt was made to throw light on the nature of the chromogen concerned in the blue colour reaction of cod-liver oil with $AsCl_3$ (or $SbCl_3$), which is considered as specific for vitamin A. It was found that treatment of cholesterol with benzoyl peroxide in chloroform solution produced a chromogenic substance which gave with the same reagents a blue colour, apparently identical with that produced with cod-liver oil. Although the resemblance of the two chromogens is striking in several respects, their identity is excluded by the fact that the artificial chromogen is destroyed immediately when added to any oil. Cholic acid also gives rise to a similar colour reaction when heated with benzoyl peroxide in chloroform solution.

This reaction again demonstrates the near relationship of the bile acids to cholesterol, which has been definitely established by the work of Windaus. The similarity of these colour reactions to the one of the chromogen of cod-liver oil suggests that there exists a similarity between the carbon-ring system of the sterol molecule and that of the unknown chromogen, and lends support to the view that oxidative changes in the sterol molecule may be concerned in the vitamin A formation. In view of the near relationship which has recently been shown to exist between ergosterol and vitamin D, the possible relation of vitamin A to the oxidation products of ergosterol is being investigated.

The following communications were also read:

"Observations on the sulphhydryl-disulphide system," by R. K. Cannan and B. C. J. G. Knight. "Estimation of adrenaline," by L. C. Baker and G. F. Marrian. "Observations on the adrenals of rats with relation to vitamin B," by L. C. Baker, G. F. Marrian and J. C. Drummond. "The relation of vitamin B deficiency to inanition in the pigeon," by S. Kon and J. C. Drummond. "The relation of certain dietary factors in yeast to growth on diets rich in protein," by A. Hassan and J. C. Drummond.

ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY

The 11th meeting was held on February 23, under the chairmanship of Mr. MacNaughtan, and Mr. T. Johnston read a paper on "The electrodeposition of iron." Mr. Johnston exhibited a comprehensive range of electrolytic iron in the various stages of manufacture of iron articles such as cores etc., used in electrical engineering, "built up" engineering parts and examples of deposits obtained in works practice.

Mr. D. J. MacNaughtan, introducing the speaker, said that iron deposition was rather an uncommon plating process, as it could hardly be used for decorative purposes. Nevertheless, its importance was indicated by the latest production figures, which showed that it was being produced at the rate of 200 tons a month in Germany and America and 60 tons per month in France.

Mr. Johnston prefaced his paper with a résumé of the history of iron deposition, and showed that progressive improvements had brought up the employable current density from 2 to as high as 240 amps. per sq. ft. There were many difficulties met with in the process, owing to the chemical and electrochemical peculiarities of iron. The depositing solutions commonly used were based on the simple sulphate and chloride solutions, or mixtures of these, three characteristic baths being the chloride solution, the sulphate solution, and the sulphate-chloride solution. In all cases it was best to use fairly high temperatures, and comparatively high current densities can be employed. Iron baths were very sensitive to slight variations in conditions, one of the most important factors being the degree of acidity.

The purity of electrolytic iron may reach 99.96-99.99%. Hydrogen, which is occluded in large quantities, is difficult to eliminate, but it is possible to effect this by suitable heat treatment. The metal is then highly ductile, and is particularly suitable for cold

working, stamping, etc. Among the most interesting applications were the "steel-facing" of printing blocks, "building up" worn and undersized parts, production of finely divided magnetic material, manufacture of tubes, sheets and strip, preparation of "pure" iron for research, and so on.

In the subsequent discussion Mr. E. A. Ollard stated that iron used for filling up blow-holes etc. had the advantage over nickel for this purpose in regard to the colour of the metal. The adhesion of the iron on steel and cast iron was good.

Mr. Lovelock said he used a cold solution for "building up" as wax was used as a stopper, and a saturated solution of ferrous ammonium sulphate at a p_H of 5.5. A bath was built round the part, and one-sixteenth of an inch could be deposited satisfactorily. Iron was preferred to nickel, not only on account of colour, but because it machined well. Mr. A. W. Hothersall said that p_H determinations could be made colorimetrically on filtered samples, though chloride solutions were apt to cloud. There was so little colour that rapid determinations could also be made with the Capillator. Another advantage that iron possessed over nickel was that it could be case-hardened, and heat treatment generally improved the properties of the deposit.

Mr. S. Wernick said that the deposition of iron was different from the plating of most common metals owing to the instability of the bath, due to oxidation. For the same reason, it had been found difficult to assign a definite value for the equilibrium potential of iron. It was not clear how the calcium chloride in the ferrous chloride-calcium bath acted, since common salt had been substituted with good results. Having regard to the importance of acidity, it was surprising that a buffer was not used. Probably the bath would become more stable as means to maintain a correct p_H were evolved.

SIR JESSE BOOT FOUNDATION LECTURE

Prof. F. S. Kipping, F.R.S., delivered the fifth annual Sir Jesse Boot lecture at University College, Nottingham, on March 11, on "Motor fuels: Present and future."

After a preliminary outline of the principles of combustion relative to hydrocarbons, Prof. Kipping dealt in turn with the three most important motor fuels, viz., alcohol, benzene (benzole), and petrol.

Alcohol is mainly produced from materials rich in starch or sugar, by fermentation processes. The world's annual production is said to be 450,000,000 galls., but of this only about 80,000,000 galls. is available for industrial purposes. Of this a large proportion is required in the making of ether, tinctures, perfumes, dyes, essences, etc., and very little is left for use as a motor fuel. Alcohol from starch could no doubt be obtained in much larger quantities than at present. Any vegetable product containing starch could be used. Although alcohol is too expensive to use alone as a motor fuel, it can be used mixed with petrol and (or) benzole. A 50-50 mixture of petrol and alcohol is sold in this country, and such a mixture (to which benzole is sometimes added) is used as an aviation spirit. The advantages claimed for such a spirit are: longer engine life, lower

maintenance costs, and although the calorific value of alcohol is less than that of petrol, more power is available because a higher compression ratio is possible.

Prof. Kipping then described the production of benzene from coal tar. Benzene is an important motor fuel, but cannot be used alone, though even if it could it would be too expensive. If the whole of the home consumption of coal, 180,000,000 tons per annum, were given over to motorists only 90,000,000 galls. of benzene would be available less than one-quarter of the amount of motor fuel required to-day.

The principal source of motor fuel to-day is petroleum or rock oil, which is a thick yellow or brown liquid, consisting of a mixture of an unknown number of hydrocarbons. The crude petroleum is fractionated and the various fractions re-fractionated. Some crudes give a motor fuel fraction which is about 50% of the whole, whilst others give none.

Prof. Kipping next dealt briefly with some of the processes which have been devised to increase and maintain our supplies of petrol.

About 40% of the crude petroleum is finally obtained as gas oil, which is not volatile enough for lamp oil nor thick enough for a lubricant. If this gas oil is "cracked," a spirit is obtained, which although different from "straight run" petrol, is a motor fuel as good or better than the straight run petrol. In this way the yield of motor fuel from the crude petrol is nearly doubled. In America nearly 40% of the petrol consumption is cracked spirit. Another small addition to motor fuel supply is obtained by "stripping" coal gas with heavy oils whereby benzene is recovered. Again, low-temperature carbonisation of coal, in the production of smokeless fuel, yields a tar which contains about twice as much benzene as "high-temperature" tar.

The lecturer then outlined the Bergius process for the conversion of coal into oil by combining it with hydrogen. In this process it is claimed that the net motor fuel would be from 20-40 galls. per ton of coal. Further research is necessary before the process can be regarded as an economic possibility; there are many difficulties, e.g. 35,000 cu. ft. of hydrogen is required per ton of coal and no sufficiently cheap method of production of this gas is available.

Coke when heated strongly with lime is converted into calcium carbide, which on treatment with water yields acetylene. Now when acetylene is heated to 650° in presence of charcoal it yields an oily product, which on fractionation yields a motor fuel; one ton of calcium carbide yields about 20 galls. of benzene. At present, however, the high price of calcium carbide does not permit the use of this method as a source of motor fuel. Again, acetylene may be converted into ethylene, which is then absorbed by sulphuric acid, the product diluted with water and alcohol obtained on distillation.

Prof. Kipping also mentioned the production of "synthin" and synthol from water gas.

The lecturer concluded by briefly discussing the possibilities which lay in the conversion of the enormous supplies of cellulose (much of it waste material) into alcohol either direct by the aid of some organism still to be discovered, or by previous conversion of the cellulose into sugar and then fermenting the sugar with yeast.

CORRESPONDENCE

THE SUGAR INDUSTRY IN SOME OF ITS CHEMICAL ASPECTS

SIR,—My attention has just been called to the note upon "The manufacture of white sugar" by Director Farnell, of the British Sugar Processes, Ltd., in your issue of February 4, with respect to my article upon the "Sugar industry in some of its chemical aspects" published in CHEMISTRY AND INDUSTRY for January 14, 1927. My paper, as indicated in the footnote, was read on January 18, 1926, before the Montreal Section of the Society of Chemical Industry, which is over a year before the publication of Mr. Farnell's note. Nearly two sugar campaigns have elapsed since my paper was written, and had I known that it was to be published I would have asked for an opportunity to bring it more completely up-to-date in several particulars. I should explain, perhaps, that the statement to which Mr. Farnell objects refers to the so-called plantation white sugar made directly from cane juice, with or without charcoal, by a single crystallisation. Of the hundreds of different samples of such sugar examined by me during a period of over 20 years, not one was found to equal the best refined granulated sugar in purity or uniformity of grade. Of course the remelting, decolorising and re-crystallising of raw sugar (using either animal or vegetable charcoals) can be performed upon the cane sugar plantation, but when this is done the product is then a refined sugar, and not a plantation white sugar according to the ordinary meaning of the latter term. I have made no personal examinations of plantation refined sugar, but have been informed that recent shipments of such sugar, refined by vegetable carbon, have been found to be inferior for some purposes to sugars refined by animal charcoal because of their higher ash content.

Respectfully yours,

C. A. BROWNE, *Chief*

U.S. Dept. of Agriculture,
Bureau of Chemistry,
Washington, D.C.
March 8, 1927.

OBITUARY

PROFESSOR ALFRED MICA SMITH, F.I.C.

The death of Prof. Alfred Mica Smith, F.I.C., nephew of the late Dr. R. Angus Smith, F.R.S., Chief Inspector of Alkali etc. Works, took place at Ballarat, Australia, on May 14 of last year. He was born in Perth, Scotland, in 1844, and was educated in his native town and in London, where he took the degree of Bachelor of Science. He was research assistant to Prof. Playfair at Edinburgh, but came to Victoria, Australia, on account of ill-health. In 1876 he became the chief of staff of the Bendigo School of Mines, and in 1881 he went to Ballarat School of Mines, where he held the position of lecturer in chemistry and metallurgy for 42 years, until he resigned some three years ago. Recently, a bust of Prof. Smith was unveiled at the school, which was presented by old Ballarat School of Mines students now living in Western Australia, and the Mica Smith Scholarship has been established in Ballarat in recognition of his work. Prof. Smith was a collector of rare china and of paintings, and two months before he died he presented his collec-

tions to the Ballarat Art Gallery. The interment took place in Ballarat, and representatives of the School Council and Staff attended the funeral to pay the last respects to their beloved friend. Prof. Smith directed in his will that £1500 should be given to the Victoria University of Manchester for the establishment of a scholarship in sanitary science, or for such other scientific purpose as the Council of the University should determine. He also directed that £300 should be held in trust, half of the income from the sum to be paid to the present students' association, and the other half to the past students' association of the Ballarat School of Mines, with which he had been associated for so many years.

ALFRED C. FRYER

PERSONAL AND OTHER ITEMS

The King has consented to become Patron of the Imperial College of Tropical Agriculture.

Sir Alfred Mond and a number of directors of the Imperial Chemical Industries Ltd., left the Croydon air station on March 21 to fly to Brussels and Paris to attend international conferences of delegates of the chemical industries from various European countries.

Sir Max Muspratt, president of the Federation of British Industries and chairman of the United Alkali Company, was entertained to dinner on March 22 by the directors and officials of the company, and was afterwards presented with his portrait in oils in recognition of his 14 years' successful chairmanship of the company. Dr. G. C. Clayton, one of the directors made the presentation.

Dr. Herbert Levinstein has been re-elected to a seat on the board of the Nura Art-Silk Co., Ltd.

Mr. John Hugh Smith, a director of the Associated Lead Manufacturers, Ltd., has been appointed a joint managing director of Hambros Bank.

Mr. F. F. Renwick has been elected to the presidency of the Royal Photographic Society.

The Ministry of Agriculture announces that it is prepared to receive applications for grants in aid of scientific investigations bearing on agriculture.

At a meeting of the University Court of St. Andrews, Principal Sir James Irvine announced that an anonymous benefactor had given £100,000 in recognition of the progress in the development of the University.

The bicentenary of the death of Sir Isaac Newton is being celebrated this week. Isaac Newton was born on December 25, 1642 (the year in which Galileo died), and died on March 20, 1727.

Sir John Turney, who established the important tanneries of Turney Brothers, at Trent Bridge, Nottingham, has died at the age of 88.

The late Rt. Hon. Sir Ellis Griffith, Bt., P.C., lately a director of the Mond Nickel Co., Ltd., left £10,884, with net personalty £5,547.

The late Mr. J. Taylor, a well-known authority on dyes, and director of the United Indigo & Chemical Co., Ltd., left £1,081.

We regret to learn of the death, at the age of 78, of

Prof. G. Krause, the founder of the "Chemiker-Zeitung," a well-known German contemporary which recently celebrated its 50th anniversary.

Dr. H. J. Müller, who died recently, aged 65, was one of the best known figures in the German portland cement industry.

Imperial Chemical Industries, Ltd.

Work on the great building which will house the staff of Imperial Chemical Industries, Ltd., is proceeding apace. Difficulties have been met with in laying the foundations, but these have been overcome. Sir Frank Baines is the supervising architect of the new building, which is situated on the Embankment, on the Chelsea side of the Houses of Parliament.

Centenary of the Friction Match

Next month the town of Stockton-on-Tees will celebrate the centenary of the invention of the friction match, by John Walker, a citizen of that town. Although Walker made the discovery in 1826, his first recorded sale was made in April 7, 1827. Walker refused, it is stated, to patent his discovery, and the production of his friction match soon spread both in Great Britain and on the Continent, until it was superseded, in 1834, by friction matches containing yellow phosphorus, which, in turn, were superseded by matches containing the non-toxic red phosphorus, the manufacture of which was patented by Messrs. Albright & Wilson in 1855.

Glass Containers for Food

In a report issued by the Ministry of Health and written by Mr. G. Hancock, M.R.C.S., on the "Occurrence of Glass Fragments in Foods packed in Glass Containers," the following conclusion is stated: "I do not think that any real objection can be taken to the use of glass containers as receptacles for food. Glass-packed foods of one or other sort, are eaten by the million daily, while glass particles of appreciable size are but seldom found in them. When present, the glass is usually in powdered or microscopic form and there is little, if any, evidence to show that in this form it is capable of exerting any injurious effect when swallowed with the food. It would, however, be unwise to accept such negative evidence as wholly conclusive, for glass, in whatever form is manifestly an undesirable ingredient in foods. It has been shown that food manufacturers are for the most part well aware of the need for using good glassware and for avoiding contamination with glass of the contents of a vessel during the various operations to which it is subjected in the factory; and it is doubtless largely due to these measures that the larger particles of glass, derived from the burstings and breakages which are inevitable in such factories, are so seldom met with in food."

The Even Dyeing of Viscose Silk

Owing to the manufacturing methods peculiar to the production of artificial silk, certain unavoidable irregularities occur in the quality of the finished product. These irregularities in turn give rise to irregular results in colouring, and it is no uncommon thing to find in an artificial silk dyehouse a large number of girls employed solely in sorting dyed material into lots which roughly match one another. The problem has engaged the

attention of dyestuff manufacturers both at home and abroad for many years, and it is most gratifying to learn that a British dyestuff firm has discovered the solution, for the British Dyestuffs Corporation has introduced a new series of colours, the "Icyl" colours, which are specially designed to yield even results on viscose artificial silk of irregular quality. The colours illustrated in the new B.D.C. pattern card of "Icyl" colours do not represent the full series; new members will be added as time goes on, and it is hoped eventually to provide for the production of every hue which may possibly be devised.

Research and the Metal Industries

An exhibition which has been arranged and opened to the public at the Science Museum, South Kensington, affords some indication of the assistance given to British metal industries by the research and auxiliary services of an industrial research organisation. The exhibit is that of the British Non-Ferrous Metals Research Association, which, with the co-operation of the industry through membership of the Association, carries on a two-fold service, firstly in the prosecution of research work either of a fundamental and scientific character or of direct practical utility, and, secondly, in maintaining a highly organised information service which operates for the general benefit of the Association as a whole and to meet the specific needs of individual member firms.

The present exhibit is concerned chiefly with eight of the Association's researches, chosen from among eighteen major investigations at present in progress. Those selected are typical of the character and wide range of the work which is being carried out, and the exhibits have been set out to give some idea of the scope of each piece of work and the progress which has so far been made.

Some indication of the range of work can be gathered from the subjects chosen for exhibition, which are as follows: (1) Effect of impurities up to 1% on the properties of copper. (2) Gases in copper castings. (3) Brass casting. The surface and internal soundness of ingots. (4) The jointing of metals. (5) Die casting alloys: Section I. Brass and bronze alloys; Section II. Aluminium alloys. (6) "Wiped" plumbers' joints. (7) Spectroscopic assay of zinc. (8) Atmospheric corrosion.

There is also shown one case which gives information in regard to the Association's administrative, library and information services, with some examples of the work normally carried out in these departments.

The exhibition is open to the public daily and literature descriptive of the material on view, and of the other work being carried out by the Association may be obtained at the Science Museum or from the Secretary, B.N.F.M.R.A., 71, Temple Row, Birmingham.

U.S. Production of Nitrogen Compounds

The U.S. Department of Commerce announces that, according to data from the biennial census of manufactures taken in 1926, nitrogen and fixed nitrogen compounds valued at \$31,409,682 were produced for sale by establishments engaged primarily in the manufacture of chemicals. This total represents increases of 3.2% and 49.1% respectively, as compared with \$30,435,909 for 1923 and \$21,059,976 for 1921.

Physical and Chemical Survey of the National Coal Resources

In connexion with the physical and chemical survey of the national coal resources, which is one of the main aspects of the fuel research work of the Department of Scientific and Industrial Research, the following committee has been appointed to deal with the physical and chemical survey of the coalfields of Durham and Northumberland:—

Mr. A. Kirkup, Dr. H. Peile, and Mr. G. Raw (representing Durham Coal Owners' Association); Mr. S. Bates, Major H. S. Streatfeild, and Mr. R. Warham (representing Northumberland Coal Owners' Association); Colonel W. C. Blackett (representing the North of England Institute of Mining and Mechanical Engineers); Prof. H. V. A. Briscoe; Dr. J. T. Dunn; Prof. G. Hickling; Prof. G. Poole; Mr. R. G. Carruthers (representing the Geological Survey of Great Britain); Dr. C. H. Lander (*ex officio*) (Director of Fuel Research); Mr. F. S. Sinnatt (*ex officio*) (Superintendent of the National Survey).

Committees are already at work in Lancashire and Cheshire, South Yorkshire, Nottinghamshire and Derbyshire, and North Staffordshire. Another committee is dealing with the coalfields of Scotland.

Chemical Treatment of Flour

The Ministry of Health has published the report of the Departmental Committee on the Treatment of Flour with Chemical Substances. Whilst the Committee recognises the importance of guarding the treatment of flour against unnecessary treatment with foreign substances, it is not prepared, on present knowledge, to recommend the complete elimination of bleaching agents and improvers, though it thinks that chlorine, nitrogen trichloride and benzoyl peroxide should not be amongst the substances used. The Committee thinks that it should be compulsory for manufacturers of chemical substances for use either as bleaching agents or "improvers," or both, to declare to their purchasers the nature of the ingredients of which they are composed, and that millers should be required to inform their customers whether their flour has undergone a process of chemical bleaching or "improving," or both, and if so with what substances and in what proportion.

REVIEWS

THE CHEMISTRY OF DYEING. By JOHN KERFOOT WOOD. New and revised edition. Pp. 97. London: Gurney & Jackson, 1926. Price: 3s. 6d.

This is a subject which has attracted much research, but agreement has not yet been reached on a subject dealing with so many fibres and varying processes, nor does it appear likely that one theory can cover the whole ground.

The work already published is so large that Dr. Wood's monograph is very welcome to students and those practical dyers who may bother about theory by summarising it in a connected way, whilst giving ample references to the original publications. The field is now being so intensively worked that already much new work has been published since this second edition was prepared.

Artificial silks should be included in the list of chief textile fibres (p. 3). It is not true, except in the most general sense, to say that viscose resembles cotton in its behaviour to dyestuffs: many direct cotton dyestuffs suitable for cotton are unsuitable for application to viscose, and the explanation, when found, will probably illuminate the theory of one branch of dyeing. It is also not true to say that cellulose acetate presents the greatest difficulty to the dyer: the excellent work done by British technologists in producing suitable dyestuffs and simple methods of application has made its dyeing a simple process which, from micro-photographs at various stages of dyeing, appears to be explained by Witt's solid-solution theory. In dealing with vat dyestuffs (pp. 14-15) the German and Swiss, but no British, generic names are given. Is it not true that British textbooks were illustrated by British examples, especially so in this case, since the production of vat dyestuffs by British manufacturers has been one of the most fruitful of their activities?

C. M. WHITTAKER

GRAPHITE. By Dr E RYSCHKEWITSCH. Pp. xii + 323. Leipzig: S. Hirzel 1926. Price: paper, 14.50 m., bound, 16.50 m.

This book gives a systematic survey of the chemical and physical properties of graphite, of its mineralogical character, and of its preparation, purification, and industrial uses. The subject is a large one, and the author is to be congratulated on having covered the ground so thoroughly within the limits of a moderate sized volume.

The first chapter deals with the chemical and physical properties of graphite, and is followed by one dealing with the mineralogy thereof. The third chapter on the winning and refining of graphite from its ores deals fully with the different processes used, ranging from simple grinding and grading to the more elaborate hydromechanical, flotation, chemical, and electro-chemical processes of refining. The following chapter is devoted to the artificial production of graphite by the Acheson and other processes. The last chapter on the applications and uses of graphite is perhaps the most interesting to the average chemical technologist. It is divided into five sections, the first four of which deal respectively with the use of graphite as a heat-resisting material for crucibles, etc.; as a conductor of electricity, as a pigment, and as a lubricant, whilst the fifth contains statistical data of the production and use of graphite. All these sections are excellent, that on graphite as a pigment containing a brief but useful summary of the manufacture of pencil 'leads'. Good author and subject indexes conclude the volume.

The book is well printed and illustrated and contains many interesting and useful graphs. It appears to be remarkably free from errors, but British geography is a slight stumbling block to the author, who transfers the counties of Merioneth and Montgomery to North Scotland, and misspells Cunnock as Cumcock. In spite of the existence of other useful books on graphite by E. Donath and H. S. Spence, this book contains so much that is specially good that it must be cordially recommended to all interested in the production and use of graphite.

PERCY MAY

REPORT

Report of the Committee of the Privy Council for Scientific and Industrial Research for the Year 1925-26. (Cmd. 2782. Pp. iv + 178. H.M. Stationery Office, 1927. Price 3s.)

The Committee of the Privy Council, in its Report for 1925-26, sees no grounds for anxiety in the field of pure science, but points out that there is still much to be done before our industrial position is re-established, though it emphasises the achievements of the past ten years, which are full of encouragement for the future if the efforts already made can be continued and increased.

New research associations continue to be formed, the latest being for the preserved food industry, and for the paint, colour, and varnish trades. Further grants have been made to other research associations, such as the silk, cast-iron, refractories, rubber and tyre, leather manufacturers', and other associations, but it has not been found possible to give further aid to the shale oil and sugar associations. During the financial year grants to associations totalled £88,216, the balance of the Million Fund at March 31, 1926, being £429,984, the uncommitted balance, amounting to £144,647.

The estimated net expenditure of the Department on research and administration for 1926-27 amounts to £442,877, compared with £380,263 for 1925-26 and £328,281 for 1924-25.

The Report of the Advisory Council opens with a discussion of the relations of the State and industry to scientific research. It is considered that far too many men are specialising in chemistry, whereas there is lack of those who combine chemistry with other subjects, such as agriculture, biochemistry, botany, and so on. Considering the state of industrial research, it is pointed out that industrial research must be regarded, not as a cure for, but as a prevention of, bankruptcy. The country needs a full realisation of the value of a continuous policy of research and scientific development in many important branches of industry, and of the fact that progress can be more efficiently secured by scientific methods than by the expensive process of trial and catastrophe on the large scale. More industrial research is being carried out than ever before, but far greater expansion and far greater co-ordination of effort is needed. For industries consisting of many small firms there are two means to this end: the formation of large industrial combines and the encouragement of co-operative research. It is considered that, so far as industrial research is concerned, there are great advantages in the formation of large combines, though much can be said in favour of the co-operative research associations.

The policy of the Department is to build up gradually an organisation to form a link between pure scientific research and industrial applications. It aims at accepting full responsibility for investigations of wide importance to the community which cannot be left altogether to private enterprise, and it holds to be essential that both large-scale and laboratory research should be carried out under strict scientific control and with the utmost accuracy of measurement. Thus the Department has set up organisations maintained out of public funds to meet the needs of industry in relation to forest

products, fuel, food, and building. Important as is the work of the Fuel Research Station, its success will depend, it is considered, largely on its effect in stimulating and assisting research elsewhere and by its capacity to look ahead beyond the immediate requirements of the country. The Council states it has every reason to believe that the Fuel Research Station has stimulated and assisted independent efforts. The work on food will be devoted to the prevention of waste, which is beginning to be explored systematically. Further, the Council is considering the possibility of setting up some research organisation to deal with the complex problems relating to water pollution, in co-operation with the Ministry of Health and the Ministry of Agriculture and Fisheries. The setting-up of a joint organisation with the Medical Research Council is also being contemplated, with the object of undertaking research on the production of drugs and allied problems, and also of assisting and stimulating similar research in universities and the chemical industry. At present it is impossible to get a new remedy exhaustively investigated by a competent authority, whilst development is also hindered by the comparative lack of scientific knowledge of the real action of chemical substances on the human body.

The Report then gives a valuable discussion of the state of research in these industries for which the establishment of special research organisations was not considered necessary, and, in dealing with engineering and metallurgy, it is pointed out that so extensive are the general facilities for research, that the task is rather to select the most important problems for investigation and to encourage closer co-operation with industry, than to extend substantially the existing facilities.

In dealing with the chemical industry, it is remarked that it differs from the electrical, metallurgical and engineering industries in that it has had comparatively little help from Government research, though university institutions have done much for it. The Council considers that there is no pronounced need for research in Government laboratories for the direct benefit of the chemical industry. Suggestions for assistance in important investigations that are not being adequately dealt with, would be gladly considered by the Council, but, though suggestions have been invited, none has been received. The Council has recognised the difficulty of forming research associations in the chemical industry as it was organised. Hence, it regards the recent fusion of prominent chemical manufacturing firms as an event of first-class importance from the view-point of technical progress. In command of scientific ability and natural resources and in location of markets, British chemical industry is considered to be at least as fortunate as that of any other country, and the Council hopes that to these natural advantages will now be added a determined progressive policy in research.

The Report gives a summary of the work carried out under the various research organisations of the Department, many of which have been dealt with previously in separate reports and concludes with appendices showing the composition of the research boards and committees of the department, a list of existing research associations and a review of the organisation of research in other parts of the Empire.

COMPANY NEWS

IMPERIAL CHEMICAL INDUSTRIES, LTD.

The statutory general meeting was held on March 18, the Rt. Hon. Sir Alfred Mond, Bart., P.C., M.P. (chairman), presiding. The statutory report stated that the agreement to the fusion of interests on the part of the shareholders of the participating companies had been practically unanimous. The total number of shares of the company allotted to date and credited as fully paid up in respect of the exchange value of the shares of the participating companies whose holders, up to February 22 last, had signified their agreement to the fusion was 15,470,647 7¹/₂% cumulative preference shares of £1 each, 29,915,971 ordinary shares of £1 each, and 18,256,228 deferred shares of 10s. each. Since February 22 the holders of further shares had consented, and the shares to be issued in exchange would be allotted shortly. The capital issuable in respect of shares surrendered for exchange to date represented over 95% of the total capital issuable in respect of the shares of the participating companies. The preliminary expenses were estimated at £1,270,000, as follows:—Company capital duty, £650,000; other stamp duties, £570,000; other expenses, £50,000; total, £1,270,000. Sir Alfred Mond referred to the large amount paid to the Government for stamp duty and said that before embarking on the scheme adopted, careful consideration had been given to this question, and although alternative methods of attaining their object would have saved a small proportion of the duty paid, investigations showed that by far the most efficient method was the one adopted. A large part of the capital had already borne duty once, but such was the state of the law that it had had to bear duty a second time merely because of the company's effort towards increased efficiency. This double duty was clearly a tax on efficiency. The present Government realised this when considering the position of the mining industry. They realised that one of the most fruitful sources of efficiency in that industry lay in amalgamation, and to encourage this they swept away for that industry the liability to double taxation. Surely, what was good for one industry was good for all. The chairman stated that the Committee which sat to inquire into the amendment of the Companies Act recommended the abolition of this double taxation, and he hoped that in the Bill which was shortly to be introduced in the House of Commons to implement the findings of the Committee, this subject would find its due place. If that was so, he thought that the company should have any benefit of such legislation extended to them, even in a retrospective form.

Referring to the response to the invitation to exchange into the new company, he said the exchange represented 96% of the total capital issuable in respect of the shares of the participating companies, and it was anticipated that the balance of 4% would mostly come in in a short time, as a good deal of it was held by people abroad. In a few weeks they had obtained practically a 100% merger, and he believed that such a result was unique in the history of mergers. It showed the great confidence which the shareholders in the old companies have had in the advice given to them by their Boards.

and in the Board of the new company, and it immensely facilitated the task of the new organisation in utilising the constituent powers of the merger to the very best advantage. Although the company had only been in existence relatively a few weeks, the ideas which led to the formation of the merger were proving fully justified, and alterations and changes had taken place which would increase the joint profits of the combined concerns. Already the exchange of technical information and research was proving to the benefit of the whole organisation. The fruits of some of the work being done to-day would not show immediately, but would show as time goes on, and he was confident that the step taken was the wise and right one, and was to the advantage of the industry, those engaged in the industry, and to the shareholders. As regards research the co-ordination of the work of the various laboratories and consultations between the various experts who are at the head of these laboratories, and the able technical chiefs of the various organisations were already leading to fruitful results, and in the future would lead to new developments of very considerable magnitude. It was only in this way that the industries of Great Britain could maintain themselves against the industries of the Continent or the industries of the United States. The year 1926, with a general strike and the coal dispute, was a bad year for industry, and that the balance sheets of the constituent companies showed no worse results than they did was due to the enormous inherent strength of their positions. The year 1927 opened under brighter auspices. Revival of trade was taking place, and unless some new catastrophe arose, they could look forward in 1927 to at least a normal trade. In spite of the disturbed condition of the market of China, the trading by Brunner Mond (China), Ltd., one of the subsidiaries of Imperial Chemical Industries, was, on the whole, remarkably satisfactory. It was difficult to predict exactly what would happen in 1927, but it was a curious fact that as soon as the wave of disorder and artificial agitation against British goods and British people passed, the real Chinese readily came back and took up their commercial relations with their old friends and customers.

In concluding his address, the chairman said that since the formation of the merger, there had been baseless rumours that it was the intention of the company to reduce wages, that the conditions of labour would be worse, and that the old regard for the workmen which the various firms had shown for over two generations was going to be disturbed. Such statements were entirely untrue and baseless. He had always looked upon it as a duty for the captains of industry to pay as much regard to the fair claims and needs of those who were co-operating with them in labour as any other body of people working with them. In fact, the views of the company were of an entirely opposite nature. The company intended to give close consideration to this problem in the near future. Unless there was hearty co-operation between those engaged in the ranks and those engaged at the top, and unless there was the understanding that the prosperity of industry was not merely for the benefit of the shareholder but for the benefit of the worker, there would be difficult and troublous times.

BRUNNER, MOND AND CO., LTD.

The accounts for the nine months to December 31, 1926, show a gross income, after providing £150,000 for depreciation, of £1,011,369, compared with £1,828,285 for the previous twelve months. After meeting all charges, the net profit was £856,335 (against £1,633,669), and with £150,427 brought in, makes available £1,006,762. Dividends on the preference capital absorbed £225,000 for the nine months, and the interim of 3½% on the ordinary absorbed £342,576. A final dividend has been recommended on the ordinary shares, making 7½% for the nine months, leaving £10,965 to be carried forward.

BRITISH ALUMINIUM CO.

The profit for 1926 amounted to £144,644, including the balance brought forward, and after providing for taxation, expenses in connexion with the prior lien debentures and debenture stock, placing £50,000 to depreciation reserve, £100,000 to reserve fund, and £10,000 to staff benefit fund. A final dividend has been recommended of 6% on the ordinary shares, making 10% for the year, leaving £26,567 to be carried forward.

BELL'S UNITED ASBESTOS CO., LTD.

It is proposed to pay a balance dividend of 2s. per share on the ordinary shares, making 12½% for the year (same for previous year). After placing £2000 to staff pensions account, £43,973 will be carried forward, compared with £24,962 brought in.

BRITISH ALIZARINE CO., LTD.

The report for the year ended December 31 last shows a profit of £11,899, plus £57,488 brought in, making £69,387, compared with a profit of £25,977 for 1925. The directors have written off £20,000, and recommend that the balance of £49,387 be carried forward. The directors recommend that Mr. W. H. Dawson should be appointed a director of the company. They also recommend that the number of directors should be increased to ten, and that Sir Edward A. Brotherton be elected to the Board.

SALT UNION, LTD.

The gross profits for 1926 were £323,592 (£396,034 for 1925), the net profit being £217,565, against £273,813. Dividends have been proposed of 2s. 4d. per share on the preference and 2s. 6d. per share on the ordinary shares (same), leaving £24,057 to be carried forward, after allocating £1000 to the staff fund. The report states that the quantity of salt delivered showed a considerable decline, as compared with 1925. Better business was done in some markets in 1926 than in 1925, but in others, especially in India, the effects of the coal stoppage were severely felt. Imports of foreign salt into Great Britain amounted to 62,301 tons, showing a slight decrease of 2318 tons, but this competition compelled the company to accept unremunerative prices for a considerable portion of its production.

THE NON-INFLAMMABLE FILM CO., LTD.

A circular has been issued by this company, of which Sir Herbert E. Blain, C.B.E., is chairman, and Dr. Herbert Levisstein, M.Sc., deputy-chairman, which states that at the company's works at Rickmansworth

film and acetate of cellulose have been, are being, and will be produced on commercial-sized machinery as required for the company's purposes. There was at the works sufficient full-sized film machinery to supply the first year's output under the contract with British Safety Films, Ltd., whilst the existing acetate machinery was being sufficiently increased to enable the necessary quantity to be produced. The directors, besides being engaged on the necessary extension of these works and their equipment with further machinery, were considering the desirability of several sites offered them for the purposes of the larger works which it was made quite clear in the prospectus were necessary in order to enable the total output therein mentioned to be produced. With regard to British Safety Films, Ltd., this was an entirely separate and independent company, in which Non-Inflammable Film Co. had no financial interest. The contract freed the company from setting up a selling organisation, called for the entire output of kinema film, with the exception of supplies to the Government, and was regarded as a satisfactory one by the company. They had the right to nominate a representative on the Board. The company's acetate of cellulose had been tested by three important artificial silk-manufacturing firms, who reported that it was exceedingly satisfactory for the manufacture of artificial silk, and several inquiries for bulk supplies had resulted. These could not be dealt with until additional works were ready.

ASSOCIATED PORTLAND CEMENT MANUFACTURERS, LTD.

A dividend has been recommended on the ordinary shares of 4% for 1926, as against 6% for 1925.

BRITISH METAL CORPORATION, LTD.

The ordinary annual general meeting, held on March 9, was presided over by the chairman, Mr. Charles V. Sale, who commenced his remarks by expressing the regret of the company at the loss by death of Mr. F. A. Govett, a member of the board since 1924. During the year there had been a continuous increase in production and a very slow recovery in European consumption in contrast with a constantly increasing demand on the other side of the Atlantic. Comparing consumption in America in 1926 with all other countries, America used 77% of the world production of copper, 55% of tin, 11% of lead, and 44% of spelter. Owing to the strikes in England and the general depression in Germany following the stabilisation of currency, the improvement in European consumption noticed in 1925 was partially lost in 1926. The use of copper had been extended in many directions during the last few years, but the increase was only reflected in the larger consumption in America. In that country electric manufactures absorbed 40% more copper in 1926 than in 1922: motors, telegraphs and telephones 50% more, and electric light and power lines 100% more. During this period the average price of standard copper, which was £62 in 1922, rose to £66 in 1923, and fell to £63 in 1924, £62 in 1925, and £58 in 1926. The supply of tin showed little sign of expansion, prices having ranged from £260 to £320, as against £230 to £290 in 1925. [For the accounts, see CHEMISTRY AND INDUSTRY, March 11, 1927, p. 223.]

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; **Powder,** £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime—£7 10s. per ton, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
Copper Sulphate,—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammiac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included.
Sod. Chlorate.—2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
Arsenic, Sulphide, Yellow.—2s. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 2d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithophone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
Sulphur Chloride.—4d. per lb., carboys extra.
Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
Vermilion, pale or deep.—5s. 3d. per lb.
Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
Charcoal.—£7—£10 per ton, according to grade and locality.
Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
Red Liquor.—9d.—1s. 16° Tw. per gal.
Wood Creosote.—1s. 9d. per gal., unrefined.
Wood Naphtha.—Miscible, 4s. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 6d. per lb. Crude 60's, 1s. 8½d.—1s. 9½d. per gal.
Acid Cresylic, 99/100.—2s. 3d.—2s. 4d. per gal. Steady. 97/99.—2s.—2s. 1d. per gal. Pale, 95%, 1s. 10d.—2s. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil—Strained, 8d.—8½d. per gal. Unstrained, 7½d. 8d. per gal. Both according to gravity.
Benzole.—Crude 65's, 1s. 2½d.—1s. 3½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 2d.—2s. 5d. per gal., ex works in tank wagons.
Toluole.—90%, 1s. 11½d. to 2s. 3d. per gal. Firm. Pure, 2s. 3d.—2s. 5½d. per gal.
Xylol.—2s. 2d.—2s. 6d. per gal. Pure, 3s. per gal.
Creosote.—Cresylic 20/24%,—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d. 9d. per gal. Salty, 7d. per gal., less 1½%.
Naphtha.—Crude, 9d.—9½d. per gal., according to quality. Solvent 90/160, 1s. 8d.—2s. 1d. per gal. Solvent 95/160, 1s. 9d.—1s. 10d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
Naphthalene.—Crystals, £11 10s.—£12 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
Pitch, medium soft.—85s.—100s. per ton, f.o.b. according to district. Nominal.
Pyridine.—90/140.—9s. 6d.—13s. per gal. Nominal. 90/180.—7s. 6d. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
Acid Gamma.—8s. per lb.
Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
Acid H.—3s. 3d. per lb. 100% basis d/d.
Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
Aniline Salts.—7d. per lb., naked at works.
Anthranilic Acid.—6s. per lb. 100%.
Benzaldehyde.—2s. 3d. per lb.
Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
Benzoic Acid.—1s. 8½d. per lb.
o-Cresol 20/31° C.—4d. per lb.
m-Cresol 98/100%.—2s. 8½d. per lb.
p-Cresol 32/34° C.—2s. 8½d. per lb.
Dichloraniline.—2s. 3d. per lb.
Dimethylaniline.—2s. per lb. d/d. Drums extra.
Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
Dinitrochlorobenzene.—£84 per ton d/d.
Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
Diphenylamine.—2s. 10d. per lb. d/d.
a-Naphthol.—2s. per lb. d/d.
β-Naphthol.—11d.—1s. per lb. d/d.
a-Naphthylamine.—1s. 3d. per lb. d/d.
β-Naphthylamine.—3s. per lb. d/d.
p-Nitraniline.—1s. 9d. per lb. d/d.
m-Nitraniline.—3s. per lb. d/d.
o-Nitraniline.—5s. 9d. per lb.
Nitrobenzene.—6d. per lb., naked at works.
Nitronaphthalene.—1s. 3d. per lb. d/d.
R. Salt.—2s. 2d. per lb. 100% basis d/d.
Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
o-Toluidine.—8d. per lb., naked at works.
p-Toluidine.—2s. 2d. per lb. ex works, naked.
m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Firm
Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
Acid, Camphoric.—19s.—21s. per lb.
Acid, Citric.—1s. 4d.—1s. 5d. per lb. Less 5%. Very firm, but quieter.
Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
Acid, Salicylic.—B.P. 1s. 4d.—1s. 5d. per lb. Technical 11½d.—1s. per lb.
Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
Acid, Tartaric.—1s. 1½d. per lb. Less 5%. Very firm market.
Amidol.—9s. per lb. d/d.
Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
Amidopyrin.—8s. 6d. per lb.
Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
Atropine Sulphate.—11s. per oz. for English make.
Barbitone.—6s. 6d. per lb.
Benzonaphthol.—3s. 3d. per lb.
Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—8s. 9d. per lb.
Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carriage paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium.—1s. 10d.—1s. 11d. per lb. Sodium.—2s. 1d.—2d. 2d. per lb. All spot.

Calcium Lactate.—1s. 3½d.—1s. 4½d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Cresote Carbonate.—6s. per lb.

Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perochloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £33 per ton net.

Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.

Mercurials.—Red oxide, 6s. 11d.—7s. 1d. per lb., Levig. 6s. 6d.—6s. 7d. per lb.; Corrosive sublimate, Lump, 5s. 2d.—5s. 4d. per lb., Powder, 4s. 8d.—4s. 9d. per lb.; White precip., Lump, 5s. 4d.—5s. 6d. per lb., Powder, 5s. 6d.—5s. 7d. per lb., extra fine, 5s. 7d.—5s. 8d. per lb.; Calomel, 5s. 9d.—5s. 11d. per lb.; Yellow Oxide, 6s. 4d.—6s. 5d. per lb.; Persulph B.P.C., 5s. 7d.—5s. 8d. per lb.; Sulph. nig., 5s. 4d.—5s. 5d. per lb.

Methyl Salicylate.—1s. 7d. per lb.

Methyl Sulphonal.—11s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. per lb.

Phenazone.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 94s.—100s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb.

Solol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyamide.—4d. per lb., carr. paid.

Sod. Hypsulphite.—Photographic, £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

S. d. Nitroprusside.—16s. per lb.

S. d. Potass. Tartrate (Rochelle Salt).—77s. 6d.—85s. per cwt. net, according to quantity.

S. d. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal 1s. 10d.—1s. 11d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per according to quantity, 1-cwt. kegs included.

Sulphonal.—7s. 6d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 1d. per lb.

Thymol, Puriss.—11s. 3d.—11s. 9d. per lb., according quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (*ex Anethole*).—10s. 3d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb.

Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.

Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.

Cinnamic Aldehyde.—Natural, 17s. 6d. per lb.

Coumarin.—10s. 9d. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—9s. 6d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—3s. per lb.

Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb.

Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 16s. per lb.—(*ex Shui Oil*) 12s. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—9s. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—36s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—11s. per lb.

Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—11s. 3d. per lb.

Camphor.—63s. 6d. per cwt. Cananga, Java, 22s. 6d. per lb.

Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 20s. 9d. per lb. Lemon.—11s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb.

Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 19s. 3d. per lb. Japanese, 8s. 6d. per lb.

Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 20s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than May 14th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Mar. 31st. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Carpenter, and South Metropolitan Gas Co. Treating gases with solids. 6852. Mar. 11.

Fraser. Grinding-mills. 6964. Mar. 12.

I.-G. Farbenind. Production of emulsions. 6999. Mar. 10. (Ger., 10.3.26.) Production of catalysts. 6965. Mar. 12. (Ger., 13.3.26.)

Leitz. Polarimeters. 6570. Mar. 9. (Ger., 31.5.26.)

Ludwig. Utilisation of heat in drying-drums. 6810. Mar. 11. (Ger., 11.3.26.)

Marks (Dorr Co.). Rotary filters. 6360. Mar. 7.
 Sharples Specialty Co. Centrifugal machines. 6708.
 Mar. 10. (U.S., 26,326.)

I.—Complete Specifications

32,235 (1925). I.-G. Farbenind. Manufacture of solutions. (245,129.)

378 (1926). Handley. Filters. (266,857.)

8968 (1926). Smallwood and Fallon. Furnaces. (266,923.)

12,593 (1926). I.-G. Farbenind. Manufacture of solutions. (252,203.)

13,141 (1926). Bendixen, and Milkovic, Ltd. Mixing apparatus. (266,950.)

15,138 (1926). Corini. See VII.

17,854 (1926). I.-G. Farbenind. Manufacture of active colloids. (255,863.)

II.—Applications

Alexander. 6375. See IX.

Allgem. Ges. f. Chem. Ind. Converting high-boiling into low-boiling hydrocarbons. 6878—80. Mar. 11. (Ger., 12.3.26, 19.6.26, and 17.9.26.)

Bamag-Meguini A.-G., and Heller. Apparatus for low-temperature distillation. 6809. Mar. 11. (Ger., 1.4.26.)

Bowen, Elvins, and Nash. Production of olefines etc. 6560. Mar. 9.

Deutsche Erdöl A.-G., and Bomeke. Gas-purifying apparatus. 6419. Mar. 8.

Dvorkovitz. Treatment of carbonaceous matter. 6453. Mar. 8.

Gruetter. Combustion with aid of catalyst. 6738. Mar. 10. (U.S., 23.8.26.)

Huessy. Fuel oils etc. 6663. Mar. 10. (Ger., 10.3.26.)

Humphrey, and Synthetic Ammonia & Nitrates, Ltd. Production of coke in briquette form. 6832. Mar. 11.

I.-G. Farbenind. Production of fine fuel dust. 6304. Mar. 7. (Ger., 8.3.26.) 6700. See VII.

Johnson (I.-G. Farbenind.). Production of hydrocarbons. 6701. Mar. 10. Production of stable suspensions of coal. 6843. Mar. 11.

Kohlenveredlung A.-G. Producing illuminating etc. gas. 6297. Mar. 7. (Ger., 9.3.26.) Gas generators. 6298. Mar. 7. (Ger., 5.3.26.)

Koks- und Halbkoks Briкетierungs Ges. Production of semi-coke briquettes. 6609. Mar. 9. (Ger., 14.10.26.)

Leon. Manufacture of activating carbons etc. 6702. Mar. 10.

Plassmann. Low-temperature distillation of fuels. 6596. Mar. 9.

Seelig. Apparatus for cracking oils. 6811 and 6818. Mar. 11. (Ger., 25.3.26 and 16.4.26.)

Soc. Internat. des Proc. Prudhomme-Houdry. Manufacture of synthetic liquid fuels. 6409. Mar. 8. (Fr., 9.3.26.)

II.—Complete Specifications

30,475 (1925). Clancy. Manufacture of hydrocarbons and cyanides. (266,809.)

30,796 (1925). Cooper, Henshaw, and Holmes & Co., Ltd. Drying of fuel gases. (266,825.)

30,973 (1925). Soc. de Recherches et d'Exploit. Petrolières. Manufacture of agglomerated adsorbent carbon. (261,692.)

3280 (1926). Internat. Combustion Eng. Corp. Treatment of coal. (249,086.)

17,403 (1926). Misch. Water-gas generator for bituminous fuel. (255,447.)

20,565 (1926). Schroder. Coke-ovens. (266,996.)

21,454 (1926). Koller. Gasification of caking coals. (257,633.)

22,991 (1926). Carpmal (I.-G. Farbenind.). See VII.

26,787 (1926). Bergedorfer Eisenwerk. Removing from fluid hydrocarbons the solid hydrocarbons precipitating at low temperature. (267,038.)

*12,461 (1926). Allgem. Ges. f. Chem. Ind. Refining mineral oils with liquid sulphur dioxide. (267,071.)

*19,860 (1926). Continentale A.-G. f. Chem. Fuel for internal-combustion engines. (267,079.)

*23,416 (1926). Geipert. Distilling small samples of coal. (267,082.)

*3036 (1927). Internat. Combustion Eng. Corp. Low-temperature distillation of coal. (267,095.)

*6086 (1927). Soc. Internat. des Proc. Prudhomme-Houdry. Hot desulphurisation of gases. (267,138.)

*6298 (1927). Kohlenveredlung A.-G. Retorts, gas-generators, and the like. (267,153.)

*6304 (1927). I.-G. Farbenind. A.-G. Production of fine fuel dust. (267,154.)

III.—Application

Graesser-Monsanto Chemical Works, Ltd., and Mather. Treatment of tar oils etc. 6383. Mar. 8.

III.—Complete Specification

*15,076 (1926). Meiro. Distillation of coal tar, tar oils, etc. (267,074.)

IV.—Applications

Carpmal (I.-G. Farbenind.). Manufacture of vat dye-stuffs. 6723. Mar. 10. Nitration of dianthrone etc. 6891. Mar. 11.

Manufacture of triphenylmethane dye-stuffs. 6892. Mar. 11.

Manufacture of dyestuffs from indoline bases 6893. Mar. 11.

I.-G. Farbenind. Production of vat dye-stuffs. 6306—7. Mar. 7. (Ger., 22.6.26, and 1.7.26.)

Production of benz-anthrone derivatives. 6308. Mar. 7. (Ger., 10.8.26.)

Imray (I.-G. Farbenind.). Manufacture of dyestuffs. 6311. Mar. 7.

Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. 6448. Mar. 8. (Switz., 8.3.26.)

IV.—Complete Specifications

24,781 (1925). Carpmal (Bayer & Co.). Manufacture of azo-dyestuffs. (266,771.)

30,713 (1925). Imray (Moister, Lucius, & Brining). Manufacture of condensation products of the anthracene series. (244,120.)

7071 (1926). I.-G. Farbenind. Manufacture of dye-stuffs of the triarylmethane series. (249,160.)

8779 (1926). I.-G. Farbenind. See XX.

8918 (1926). I.-G. Farbenind. Manufacture of dyestuffs of the triarylmethane series. (250,576.)

10,957 (1926). I.-G. Farbenind. Manufacture of coeruleum sulphonic acids. (251,968.)

*5749 (1927). Comp. Nat. de Mat. Col. et Manuf. de Prod. Chim. du Nord. Manufacture of products and vat dyestuffs derived from perylene diketones. (267,121.)

*5965, 6305, and 6452 (1927). I.-G. Farbenind. See XX.

*6448 (1927). Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. (267,162.)

*6449 (1927). I.-G. Farbenind. Manufacture of ortho-amino-aldehydes and ortho-amino-ketones of the anthraquinone series. (267,163.)

*6450 (1927). I.-G. Farbenind. Manufacture of ortho-amino-carboxylic acids of the anthraquinone series and substitution products thereof. (267,164.)

V.—Applications

Canadian Electro Products Co., Ltd. Cellulose derivatives. 6539. Mar. 9. (U.S., 4.5.26.)

Imray (I.-G. Farbenind.). Manufacture of coloured solutions of nitrocellulose. 6706. Mar. 10.

Peltzer & Co. Manufacture of carbon papers etc. 6455. Mar. 10. (Ger., 23.10.26.)

Robins. 6812. See XXI.

V.—Complete Specifications

27,150 (1925). British Celanese, Ltd., and Ellis. Treatment of cellulose acetate. (266,777.)

29,107 (1925). British Enka Artificial Silk Co., Ltd. Manufacture of artificial silk. (259,528.)

30,779 (1925). Rushton and Hill. Artificial silk spinning. (266,821.)

30,958 (1925). Rushton and Lever. Artificial silk spinning-machines. (266,835.)

32,988 (1925). Hatfield, and Achille Serre, Ltd. Dry cleaning. (266,850.)

9941 (1926). I.-G. Farbenind. Manufacture of a non-hygroscopic pulverulent product from sulphite cellulose waste liquor. (250,956.)

21,446 (1926). Soc. Fabr. Soie Rhodiaseta. Manufacture of artificial threads or filaments. (259,190.)

*4880 (1927). Handelmaatsch. Fibra. Producing wood pulp. (267,107.)

VI.—Application

IIöltzing. Apparatus for dyeing hanks of yarn. 6551. Mar. 9. (Ger., 19.11.26.)

VI.—Complete Specifications

2914 (1926). I.-G. Farbenind. See XV.

3378 (1926). I.-G. Farbenind. Producing fast coloured resists under aniline black. (247,211.)

VII.—Applications

Appareils et Evaporateurs Kestner. Recovery of caustic soda from residual lyes. 6711. Mar. 10. (Fr., 12.3.26.)
Eclipse Textile Devices. Dyeing. 6845. Mar. 11. (U.S., 11.3.26.) Dyeing yarn etc. 6846-7. Mar. 11. (U.S., 8.4.26.)

I.-G. Farbenind. Production of hydrogen. 6700. Mar. 10. (Ger., 10.3.26.)

Laury. Precipitating insoluble zinc compounds. 6348. Mar. 7.

Merek & Co. Iodine compositions. 6996-7. Mar. 12. (U.S., 13.3.26.)

Wagner. Producing iron oxide hydrate from iron. 6406. Mar. 8.

VII.—Complete Specifications

30,475 (1925). Clancy. See II.

15,138 (1926). Cerini. Apparatus for purifying solutions of caustic soda etc. (265,126.)

22,991 (1926). Carpmiel (I.-G. Farbenind. A.-G.). Decomposition of hydrogen sulphide and its removal from industrial gases. (267,018.)

VIII.—Application

Frink. Apparatus for melting and forming glass etc. 6826. Mar. 11.

IX.—Applications

Alexander. Manufacture of bituminous products. 6375. Mar. 7. (U.S., 4.6.26.)

Chamberlain. Protection of wood against rot etc. 6956. Mar. 12.

Curtin. Wood preservatives. 6365. Mar. 7.

Dicker (Nederlandsche Bims-Cement- en Asphaltind.). Preparing artificial asphalt. 6299. Mar. 7.

Kyber. 6477. See X.

IX.—Complete Specifications

26,252 (1925). Hills. Production of cementitious material. (266,775.)

27,582 (1925). Jakob. Production of artificial stones. (244,724.)

29,471 (1925). Jakob. Production of artificial stones. (266,789.)

30,605 (1925). Knipe. Manufacture of cement concrete. (266,814.)

11,716 (1926). Bouzin. Rotary tubular cement kilns etc. (266,939.)

19,032 (1926). I.-G. Farbenind. Manufacture of acid-proof cements. (256,258.)

23,079 (1926). I.-G. Farbenind. Manufacture of acid-proof cements. (258,616.)

X.—Applications

Boringer and Stevens. Calcining tin ores etc. 6544. Mar. 9.

Coles. Reduction of zinc oxide. 6764. Mar. 11.

Comp. des Métaux Overpelt-Lommel. Reduction of zinc ores etc. 6618. Mar. 9. (Belg., 26.1.27.) Roasting etc. fine ores etc. 6619. Mar. 9. (Belg., 26.1.27.)

I.-G. Farbenind. Decomposing titanium ores. 6842. Mar. 11. (Ger., 11.3.26.)

Jackson (Siemens & Halske A.-G.). Producing electrolytic deposits of metals etc. 6441. Mar. 8.

Jessup. Preparation of magnesium and alkaline-earth metals. 6882. Mar. 11. (Fr., 22.4.26.)

Kabushiki Kaisha Nihon Seikoshō. Manufacture of steel. 6984. Mar. 12. (Japan, 22.6.26.)

Kyber. Simultaneous manufacture of iron phosphide and fused cement. 6477. Mar. 8. (Ger., 10.3.26.)

Michelsen. Conversion of slags. 6740. Mar. 10. (Czechoslovakia, 10.3.26.)

Schantz. Recovering metal from iron pyrites etc. 6981. Mar. 12.

Smith. Treatment of platinum ores. 6704. Mar. 10.

X.—Complete Specifications

21,998 (1925). Penniman and Shackelford. Making iron chromium alloys. (244,413.)

29,855 (1925). Flodin and Gustafsson. Producing carbon-binding metal or metal alloy. (243,743.)

30,106 (1925). Tennant (Philips) Gloeilampenfabr.). Separating a mixture of hafnium and zirconium. (266,800.)

6713 (1926). Aarts. Condensation of zinc vapours. (249,123.)

15,240 (1926). Yoshikawa. Lead alloys. (253,920.)

18,845 (1926). Udylyte Process Co. Cadmium plating. (266,985.)

21,863 (1926). Dietrich. Apparatus for separating iron and slag. (267,008.)

23,969 (1926). Everitt, and Allen & Co., Ltd. Steels. (267,024.)

*20,777 (1926). Metals Protection Corp. Chromium plating. (267,080.)

*4529-30 (1927). Williams. Refining of lead bullion. (267,104-5.)

XI.—Applications

Höllingen. Production of insulating material. 6283. Mar. 7.

Jackson (Siemens & Halske A.-G.). 6441. See X.

McLachlan and Smith. Photo-electric cells. 6979. Mar. 9.

Neale. Light-sensitive cells. 6259. Mar. 7.

XI.—Complete Specifications

27,051 (1925). Lübeck. Electric accumulators. (242,290.)

30,248 (1925). Lawaczek. Electrolytic decomposing cells. (266,803.)

45 (1926). Burgess Battery Co. Dry batteries. (245,464.)

18,045 (1926). Carpmiel (I.-G. Farbenind.). Apparatus for treating gases and vapours with silent electric discharges. (266,983.)

XII.—Application

Maschinenfabrik Elite A.-G. Manufacture of soap flakes. 6598. Mar. 9. (Ger., 29.3.26.)

XII.—Complete Specifications

29,798 (1925). Colloidal Products Co. Making soaps and detergents. (243,735.)

*2191 (1927). Krupp Grusonwerk A.-G. Treatment of oil-containing fruits. (267,092.)

XIII.—Application

Turner. Paints or protecting compositions. 6381. Mar. 7.

XIV.—Application

Dunlop Rubber Co., Ltd., Murphy, and Twiss. Manufacture of rubber etc. 6088. Mar. 10.

XV.—Applications

Andrew, and Betjemann & Sons. Treatment of fish skins. 6330. Mar. 7.

Simpson. Manufacture of imitation leather etc. 6935. Mar. 12.

XV.—Complete Specifications

2914 (1926). I.-G. Farbenind. Dyeing leather with acid azo-dyestuffs. (247,187.)

27,742 (1926). Ehrenreich. Manufacture of glues, gelatins, etc. (267,041.)

XVI.—Applications

Boehringer und Soehne. Manure. 6749. Mar. 10. (Ger., 3.4.26.)

Wade (Mason). Treating agricultural crops. 6614. Mar. 9. Drying agricultural produce. 6615. Mar. 9.

XVI.—Complete Specification

1778 (1926). Crusius. Transforming organic refuse. (246,484.)

XVI.—Application

Capps. Treating sugar-beet juices. 6519. Mar. 9.

XIX.—Applications

Agelasto and others (Searamanga). Preserving milk. 6875. Mar. 11.

Greville. Treatment of cereals. 6922. Mar. 12

Jones. Animal etc. foods. 6632. Mar. 10.

Matzka. Preserving fruit juices etc. 6290. Mar. 7.

U.S. Farm Feed Corp. Manufacture of livestock food. 6288. Mar. 7. (U.S., 11.6.26.)

XIX.—Complete Specifications

5857 (1926). Owe. Production of vitamin preparations. (266,905.)

13,399 (1926). O'Callaghan. Improvement of creams and production of butter. (266,951.)

26,325 (1926). Patrouilleau. Treating miller's wheat. (260,283.)

XX.—Applications

Bowen, Elvins, and Nash. 6560. See II.

Canadian Electro Products Co., Ltd. Manufacture of benzoic acid esters. 6540. Mar. 9. (U.S., 4.5.26.)

Chem. Fabr. vorm. Schering. Manufacture of alkaloid salts of camphoric acid. 6722. Mar. 10. (Ger., 15.4.26.)

I.-G. Farbenind. Production of organic compounds. 6305. Mar. 7. (Ger., 8.3.26.) Manufacture of ortho-amino-aldehydes etc. Mar. 8. 6449. (Ger., 8.3.26.)

Manufacture of ortho-amino-carboxylic acids etc. 6450. Mar. 8. (Ger., 8.3.26.) Manufacture of organic compounds. 6452. Mar. 8. (Ger., 8.3.26.)

Parke, Davis & Co. Measles toxin and anti-toxin. 6494. Mar. 8. (U.S., 15.3.26.)

Pollak. Manufacture of condensation products. 6970. Mar. 12.

XX.—Complete Specifications

30,759 (1925). Stickings, and May & Baker, Ltd. Manufacture of basic bismuth salts of aryl-arsinic acids. (266,820.)

30,791 (1925). Carpmael (Chem. Fabr. vorm. Schering). Manufacture of organic metallic mercapto-sulphonic acids and salts. (266,824.)

8779 (1926). I.-G. Farbenind. Manufacture of ortho-aminophenyl-propionic acid, its substitution products or homologues. (250,250.)

11,732 (1926). Carpmael (I.-G. Farbenind.). Manufacture of acid sulphuric acid esters of oxy-alkyl compounds of the aromatic series. (266,940.)

*5965 (1927). I.-G. Farbenind. Manufacture of side-chain aromatic compounds or their sulphonic acids. (267,132.)

*6305 (1927). I.-G. Farbenind. Manufacture of organic compounds. (267,155.)

*6452 (1927). I.-G. Farbenind. Manufacture and production of organic compounds. (267,165.)

XXI.—Applications

Howard and Robertson. Photographic films. 6581. Mar. 9. Robins. Non-inflammable films. 6812. Mar. 11.

XXI.—Complete Specification

7403 (1926). Schweitzer. Obtaining photographic points in colours. (249,530.)

XXII.—Application

Luis. Explosives. 6575. Mar. 9.

XXIII.—Applications

Lawrence, Thomson, and United Water Softeners, Ltd. Apparatus for purifying water etc. 6898. Mar. 11.

Quick. Filter beds. 6833. Mar. 11.

XXIII.—Complete Specifications

1795 (1926). I.-G. Farbenind. Insecticidal and like powders. (250,180.)

4446 (1926). Lovett. Treatment of sewage. (266,893.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Egypt*: Linoleum, soap, boot and furniture polish (276); Photostat paper and chemicals (B.X. 3341). *Northern Ireland*: Bakers' sundries (247). *Poland*: Tyres (273).

News from Advertisements

Applications are invited for the appointment of Assistant Government Chemist for Forest Research in the Federated Malay States. (p. viii.)

PUBLICATIONS RECEIVED

CHEMICAL ENGINEERING AND CHEMICAL CATALOGUE. Third edition. Compiled with the co-operation of leading British Manufacturers. Edited by D. M. Newitt, Ph.D., B.Sc. Pp. 404. London: Leonard Hill, 1927. Price 15s.

L'ALCOHOL D'INDUSTRIE. By A. Richard. Les Automobiles sans Pétrole. Encyclopédie Léauté (2me Série). Pp. xi + 222. Paris: Masson & Cie and Gauthier Villars & Cie., 1927. Price 18 fr.

REPORT OF THE COMMITTEE OF THE PRIVY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH FOR THE YEAR 1925—26. Presented to Parliament by Command of His Majesty. Cmd. 2782. Pp. iv + 178. H.M. Stationery Office, 1927. Price 3s. net.

AN INVESTIGATION OF THE CAKING POWER OF COAL. By J. T. Burdakin, M.Sc. Ph.D. Fuel Research Board. Physical and Chemical Survey of the National Coal Resources. No. 8. Department of Scientific and Industrial Research. Pp. iv + 21. H.M. Stationery Office, 1927. Price 1s. net.

ANNUAL REPORT OF THE COMMITTEE OF MANAGEMENT TO THE MEMBERS OF THE MANCHESTER STEAM USERS' ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS, AND FOR THE ATTAINMENT OF ECONOMY IN THE APPLICATION OF STEAM. Pp. 8. Manchester: Morris & Yeaman, 1927.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY

CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the ~~Coke~~ Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW
SERIES

LONDON, APRIL 1, 1927

No. 13

EDITORIAL

The Chemical Society's Dinner

DURING the winter, now over, and the spring, now welcoming the few dragged stocks and other tender herbs which have lived through the winter, the chemists cultivate the dining habit. Formerly this was a mystery to us; we wondered why the analysts, the biochemists, the colour chemists, the dyers, the engineers, the fuel technologists, and so on right through the alphabet, assembled and met together so that a collector of such occasions could enumerate from forty to sixty in a season. It puzzled us, and we were no more able to solve the problem than the ingenious lady who could not make out whether the London fogs produced the serious people or the serious people produced the fogs. We have ceased to investigate the cause; the fact is that in the old days the wife was glad to have her husband at home; now she is thankful if, once a week, the husband will take her out to a banquet. Any excuse will do, a poor one is better than none; this year centenaries are fashionable, Beethoven, Berthelot, and Newton will do for the spring, and others are preparing later. Next year the dinners are to be grouped in industries, and in 1929 there is to be a gathering of the unvaccinated chemists in March, the bridge-playing chemists in May, and the froth-blowers in October. At the Chemical Society's dinner we had few speeches, and those good. Lord Sumner had just that degree of playfulness which is appropriate to an after-dinner speech; he seemed to be always on the verge of experimenting on the tensile strength of the lower extremities of his listeners; nothing that we remember of his speech was either meaningless or solemn; they say grey heads have green thoughts; we were able to enjoy the freshness of many ideas which,

on this occasion, were imprisoned neither by the wig nor the coronet. Prof. Matignon spoke of the audacity of the British men of science, contrasting this with the caution, even the timidity, of the French men of science. We wonder whether this will bear investigation; our knowledge of French science is meagre in the extreme, and we should like to have some convincing proof of the timidity of Lavoisier, of Pascal, of Buffon, Cuvier, Pasteur, Laplace, and a few others whose names are honoured here, though their works are remembered only by the learned. Prof. Matignon and Prof. Schlenk both spoke of the international character of science; chemistry is particularly international in its history, in its industrial ramifications, and in its hospitality. We think that all were glad to welcome the distinguished German and French chemists who honoured us by coming so far to make our acquaintance and each other's. Prof. Schlenk spoke good English, and has evidently had many opportunities of cultivating his acquaintance with our language. We regret that he is known to so few of us personally; twelve years is a wide gap in chemistry; we hope that there will be no more such gaps.

Motives

We have been considerably impressed by a letter from Prof. Hilditch, which we hasten to print in this issue. Despite our modesty, we could not refrain from a certain glow when we noted the kindness of Prof. Hilditch's reference to our editorial remarks, but we were not a little puzzled in trying to retrace the analytical process by which he was led to classify our composition as a Sonatina. We have re-read our note, and, though we can discern traces of structure, we should hesitate to define its form so boldly as does Prof. Hilditch.

It is, we might have ventured, composed in the binary form, but, according to the traditional view, it might be classed as a ternary movement, since it complies with rule in ending on a full close in the tonic key. Some modern critics might find evidence of cyclic structure, though we meant it but as a divertimento, as a faint shadow of a great occasion, and did not assign to it even a suitable key signature or even a tempo. To many, the word sonatina will recall hours of fruitless drudgery devoted to the unwilling attempt to correlate muscular action and nerve control, but the qualifying adjective which our correspondent uses prevents us from suspecting a comparison with the dull Clementi, and suggests an antique character, not devoid of nobility, implying an attitude which we shall attempt to maintain with even greater assiduity. We are still more pleased, for we recollect that Beethoven himself wrote sonatinas which are of more substantial structure than one or two other compositions which he styled under the more important name of sonata. Be the form as you will, we are glad that Prof. Hilditch has been moved by our effusion to set down such charming thoughts, though we fail to see how he could justify his claim that we intruded the "jarring notes of self-interest and the mercenary motive." Our harmonies may not have been all resolved, but we cannot trace any discord in our remarks. As we observed, we believe that it is unprofitable for any professional worker to confine himself strictly within the bounds of his profession, but we did not mean to imply that the profit was of that kind which is reflected in the increasing cordiality of the bank manager. Such a profit is reflected in an increased fullness, a greater richness of life, a gain in the art of living, and it follows that the scientific worker who is possessed of at least some interest in the things which interest his fellow men will be all the better a worker for it. Be it far from us to think that culture should be acquired for any mercenary motive; the insincerity of such a procedure would defeat its own purpose, and the end would be worse than the first state. We once knew a brilliant investigator—he was not a chemist, and chemists are not alone in having to face a rapidly rising flood of literature—who was warned that he was becoming narrow in his outlook. The remedy he discovered was to read poetry on Wednesday evenings from 7.15 to 9.15 sharp, and the classics on Saturdays from 8 to 10. The end was painful, and we will not relate it. Culture, whether it be a love of Beethoven or Piers Plowman, a passion for Stravinsky or Anatole France, or an enthusiasm for the Flemish primitives, can only be acquired for its own sake. We are not anxious for scientific workers to debate the merits of the Hallé orchestra compared with the Savoy bands; we do not mind if they have decided preferences for or antipathies against Honegger or Scarlatti, but, watching the fast rising tide of scientific output, we do feel the danger that, in the effort of "keeping up," the scientific worker may lose sight of the firm shore of humanity. On such an occasion as the recent celebration it is right to consider its implications and to remind ourselves of the wide world that lies outside our profession of chemistry, vast and important as it is. So may we profit, and that without mercenary motive.

METALLURGICAL SPECTRUM ANALYSIS*

By F. TWYMAN, F.R.S.

PART I.—QUALITATIVE SPECTRUM ANALYSIS

Development up to 1861

Newton's discovery of the dispersion of light, published in 1672, may be called the first step towards spectrum analysis. But if we except that first step, the development commenced in 1800 with the discovery by W. Herschel that all parts of the spectrum have power to heat bodies, and that this power is assisted by an invisible extension of the spectrum beyond the red end. This discovery paved the way for that of Ritter, published in the next year, that the power of light to blacken silver chloride is possessed also by an invisible extension of the spectrum beyond the violet end.

Wollaston in 1802 first observed regions in the sun's spectrum, presenting the appearance of dark bands and lines, where the spectrum was less intense than at others. Wollaston also observed a discontinuous emission spectrum for the first time.

The year 1817 is made notable by the publication of several important discoveries of the great instrument maker Fraunhofer.

The description of the first spectroscope, and of its use for the observation of metallic emission lines (the yellow doublet of sodium); accounts of the first measurements of the lines of the solar spectrum and of the first observation of the spectrum of the stars, of measurements of refractive indices of various glasses for the principal lines of the solar spectrum and of observations of the spectrum of the electric spark, were all published by him in that same year.

In 1821 was first published Fraunhofer's invention of the diffraction grating as a means of producing spectra and the measurements made therewith of the position in the solar spectrum of the dark lines, thereafter called Fraunhofer lines.

In 1823 J. F. W. Herschel published the first systematic observations of metallic emission spectra with an attempt to record their positions graphically.

In 1832 Brewster published experiments leading to the conclusion that the original light from the sun forms a continuous spectrum, and that the dark Fraunhofer lines are due to the vapours surrounding the sun, though it is very doubtful whether Brewster himself at that time apprehended any such conclusion with clearness.

In 1835 W. H. F. Talbot published a clear statement of the spectrum analysis of lithium and strontium. Talbot's words are distinguished by great clearness, and I therefore quote them:—"The strontium flame exhibits a great number of red rays well separated from each other by dark intervals, not to mention an orange, and a very definite bright blue one. The lithium exhibits one single red ray. Hence I hesitate not to say that optical analysis can distinguish the minutest portions of these two substances from each other with as much certainty if not more, than any other known method."

* Read before the Birmingham and Midland Section on February 23

In 1842 Becquerel and Draper independently obtained on a daguerrotype plate the first photographs of a spectrum, in both cases the solar spectrum.

In 1855, Angstrom first clearly showed that the spectrum of a spark discharge between metallic electrodes is distinctive of the metal. He published drawings of the spark spectra of many metals and of some alloys.

The publication by Kirchhoff and Bunsen in 1861 of their discovery that the vapour of a metal produces absorption lines identical in position with the emission lines of its flame spectrum, and their accompanying description of their spectrometer, and of the first use in that spectrometer of a collimator, brought spectrum analysis to a point beyond which it was not to develop to any considerable extent for many years.

Arrested Development

Kirchhoff and Bunsen used spectrum analysis (the name which they gave to this new technique) in the daily work of their laboratory. The method won many brilliant successes, among them the discovery of numerous new elements. Yet it was to be nearly 50 years before it began at all widely to fulfil the original

which are of industrial interest, even when they are present in a metal or alloy in small quantities, are not then always easily detected by the examination of their visible spectrum.

The Development of Analysis by Spectrography

The illustration (Fig. 1) shows, by means of photographs taken with a quartz spectrograph, what a valuable region of the spectrum is excluded if one has a visual instrument only. Wave-length 4023 represents the extreme of the visible spectrum, the region from 3800 to 1854 being invisible.

It is easy to understand then how it is that the vigorous resuscitation of spectrum analysis which has commenced in the last few years has been associated with the use of the quartz spectrograph; and this, notwithstanding that the most useful instrument for the general inorganic chemist to have at his elbow, after the balance, is a good visual spectrometer.

The revival of spectrum analysis is to be referred chiefly to the work of W. N. Hartley with his co-workers, and to A. de Gramont. Hartley, using the spark spectra of solutions of metals, first noted that it is not always

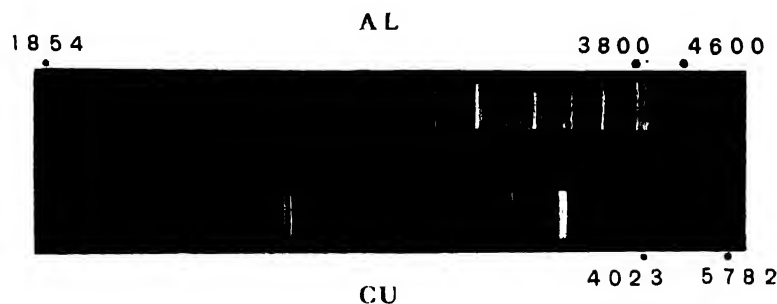


FIG. 1

expectation that it would find use as a general method of qualitative analysis, although there were never wanting a few chemists who constantly referred to the spectroscope in their daily work.

The time is too short for me to give an account of the numerous reasons which have been put forward to explain this hiatus; it suffices to remind you that the important developments of spectroscopy and the spectroscope which took place in those years were mainly under the auspices of the physicists and the astronomers, for whom it rapidly became an instrument of supreme importance.

Those chemists (they are still greatly in the minority) who use the spectroscope, use it very often, and find it almost indispensable. As a means of detecting minute quantities of the metals it is unrivalled. A metal can be readily distinguished in the presence of any other element, compound, or mixture without the necessity of separation. The qualitative analysis of the metallic constituents of a substance, which the spectroscope gives so easily, is a sure basis for planning a chemical analysis. As the determination of each element proceeds the purity of precipitates may be checked as often as desired.

If the spectroscope has been neglected in general chemistry, it is not surprising that it was neglected in metallurgical chemistry; for many of the impurities

the strongest lines of the metal which are the most persistent when that element is present in a substance in small and decreasing amounts. Already in 1882, he had investigated the proportions of certain metals which would be evidenced in compounds by the presence of their lines in the spectrum, and had, as a result, estimated the amount of beryllium contained in certain cerium compounds.

Hartley's work was continued, also at Dublin, by Pollok and Leonard, and this group of workers studied the metals named in the next two tables, numbers 2 and 3. Pollok and Leonard, also using the spark spectra of solutions, distinguished the lines of each particular metal by Greek letters, which show the persistence of the spectrum line as the quantity of metal present was reduced (see Tables 1 and 2).

TABLE I

(Pollok's nomenclature for the sensitive spectrum lines of metals in solution as photographed on a Hilger quartz spectrograph.)

To distinguish briefly between the different phases of the lines, with diminishing concentration, use has been made of some of the letters of the Greek alphabet, with the following meanings:

- τ = seen with the metal, but not with strong solutions.
- σ = seen with strong solutions, but not with 1% solutions.
- ϕ = seen with 1% solutions, but not with 0.1% solutions.
- χ = seen with 0.1% solutions, but not with 0.01% solutions.
- ψ = seen with 0.01% solutions, but not with 0.001% solutions.
- ω = seen with 0.001% solutions.

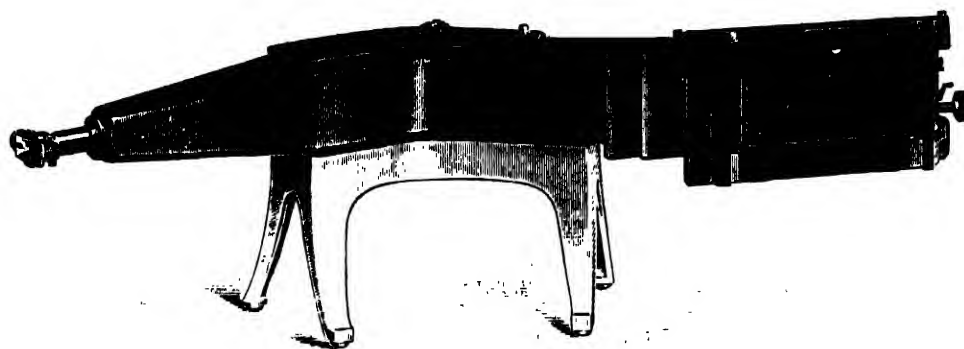


FIG. 2

TABLE II
Quantitative spectrum of cobalt chloride

Wavelength	Intensity and Persistence	Wavelength	Intensity and Persistence
4531.1	4σ	3412.8	7φ
4409.7	1σ	3405.3	8φ
4121.5	8φ	3086.0	6φ
4118.9	8σ	3072.5	0φ
3995.5	8φ	2694.7	8ω
3804.2	10φ	2603.6	8χ
3873.2	10φ	2587.2	8φ
3845.6	10φ	2582.1	8χ
3602.4	8χ	2580.4	8φ
3180.5	10φ	2564.2	8φ
3474.1	10χ	2559.5	8χ
3465.0	8φ	2528.7	7χ
3453.6	8φ	2525.1	7χ
3449.0	7φ	2519.0	8ω
3443.8	7φ		
3433.2	7φ		

In this way Hartley and his co-workers laid the basis of an approximate quantitative spectrum analysis, and although it is only in rare cases that this method can compare with the balance it provides a means of readily distinguishing between a considerable percentage of a material and mere traces only, which is often very valuable. More important still, it is now unnecessary in hunting for a small quantity of a substance in a sample to look for any but the few lines known to be persistent.

A. de Gramont, working on the spark spectra of solids, found that the persistent lines (which he called "Raies

sensibles"):—1. Were not always the strongest lines in the spectrum of the pure metal. 2. Are present in the spark, but belong to the arc spectrum of the element, where they are generally of great intensity. 3. Are generally present also in the spectra of very hot flames (oxyhydrogen or oxyacetylene).

A number of de Gramont's lines are shown in Fig. 1.

A. de Gramont found that these conclusions hold for alloys, minerals, and fused salts, and states that his observations are in general agreement with those of Pollok and Leonard in the case of solutions, which greatly increases the value of the tables of all these observers.

The order of sensibility is that found by photography, either with a quartz or with a uviol crown glass spectrograph, and it is in the ultra-violet that the "Raies Ultimes" almost always lie. But where "Raies sensibles" are recorded in the visible spectrum they are often of high sensibility for the eye.

Modern Spectrographs, and Ways of Using Them

The instruments with which Hartley and de Gramont first worked, although quartz spectrographs, were not of the modern convenient kind. As the work done by de Gramont, Hartley, Pollok and Leonard was published, it became obvious that for general use a convenient photographic instrument was needed, and in 1909 I designed the fixed adjustment quartz spectrograph

TABLE III
Raies de grande sensibilité et raies ultimes des éléments
All these Wavelengths are in International Angstrom

Symbol.	A l'observation oculaire	Spectrographe crown uviol.	Spectrographe quartz.
Mg Molybdène	5570.5; 5533.2; 5500.6	3903.0, (1); 3864.1, 3798.3, (1); 3645.2	
Nd Néodyme	(3)	4303.6; 4177.3; 3951.2	
Nc Nèon	(1)		
Ni Nickel	5476.9; 5081.1; 4711.1	3619.4; 3524.5; 3515.1; 3414.8, 3380.6	2437.9; 2416.2, 2316.1, 2303.0
Or Or	6278.2; 5837.4; 4792.6		2802.2; 2676.0, 2428.0
Os Osmium	(1)		
O Oxygène	(2)		
Pd Palladium	(4) 5547.0; 5295.6; 5163.8	3634.7, 3609.6, 3421.2, 3404.6	
P Phosphore	(3) 5475.8; 5390.8; 5301.0; 5227.6	3966.4, 3923.0; 3208.4	2555.0; 2553.3, 2535.6, 2534.0
Pt Platine	5808.9; 5605.5	4057.8, 1; 3683.5, 2; 3639.6	3084.7; 2929.8; 2850.4
Pb Plomb	7099.0; 7669.4; 5832.0; 5801.8	4047.2, 1; 4044.2, 2; 3447.4; 3146.4	2614.2; 2203.6; 2175.8
K Potassium	6782.4		
Pr Praseodyme	(1)		
Ra Radium	(1)		
Rh Rhodium	(4)	4825.9; 4682.2; 3814.5 (?)	
Rb Rubidium	7047.6; 7800.3	3709.3; 3002.4; 3658.0; 3434.9	
Ru Ruthénium	(4)	4215.6, 2; 4201.8, 1	
Sa Samarium	(1)	3499.0, 3436.7	
Sc Scandium	(4)		
Se Sélénium	(2)	1240.9; 3051.9; 3630.8, 3613.8, 1	
Si Silicium	6370.9; 6346.8	3905.5	2881.6, 2528.5; 2516.1, 2506.0

(1) Non étudiés par l'auteur.

(3) En cours d'étude; résultats provisoires.

Masqués par des raies du fer.

(2) Ne donnant ni raies ultimes ni raies de grande sensibilité.

(4) Étudiés seulement au crown uviol; résultats provisoires.

Runge et Precht.

(Fig. 2) which, with slight modifications, is that in general use at the present time. In 1912, in order to deal more readily with the very complex spectra of modern steels, a still larger size quartz spectrograph was made, giving three times the dispersion of the former one.

Now let me say a few words concerning the process of taking a spectrogram.

LIGHT SOURCE

There are four main ways of producing from a substance radiation suitable for its spectroscopic analysis: by the flame, the arc discharge, the spark discharge, and the vacuum tube discharge.

In the flame it is only certain metals which emit radiations capable of analytical interpretation. In the arc all the metals and in addition the five non-metals, carbon, silicon, boron, phosphorus and arsenic, reveal their presence by characteristic spectra. In the spark many of the non-metals, among them fluorine, chlorine, bromine, iodine, oxygen, nitrogen, sulphur and selenium, become detectable as well as the metals, and the method is applicable to solutions as well as solids, which is not

(b) A spectroscope of low dispersion and high luminosity is the best.

(c) The ultra-violet spectrum in flame spectra being too weak to have any value for analysis, a visual spectroscope is all that is required.

(d) Although in the case of sodium the phenomenon lasts a considerable time, yet in other cases such as those of potassium and rubidium it is very evanescent, and the observation should therefore be made at the instant of introducing the salt into the flame.

Arc Spectra.—Arc spectra are, I think, the most generally useful, and when electric supply at from 150 to 220 volts D.C. is available the production of the arc between metal electrodes is very simple.

When the voltage available is less than this, or when A.C. only is available most metallic arcs will not run; but the difficulty may be avoided by using carbon electrodes, and putting the substance to be examined on the lower pole.

A simple hand feed holder is connected to the supply through a resistance, a current of from 3 to 6 amperes being used. Electrodes, as pure as possible, of carbon,

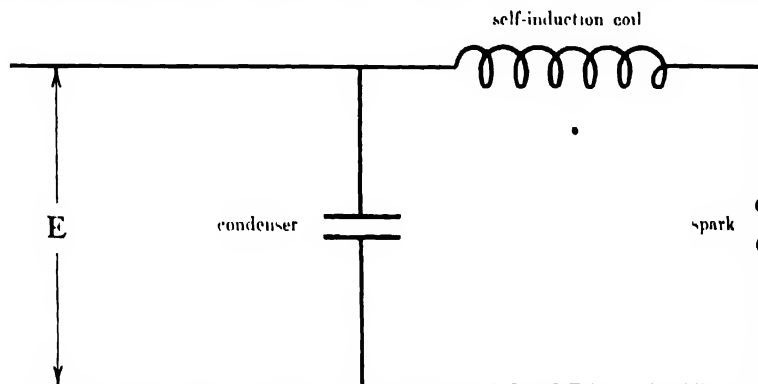


FIG. 3

the case with the arc.* With the spark, "air lines"† are usually in evidence, but these can be removed by the use of a self-induction coil.

Under ordinary conditions in the vacuum tube the substance of the electrodes gives no spectrum, the lines present being only those of the rarefied gas in which the discharge takes place.

The wavelengths of the spectrum of a metal are not affected either by its state of chemical combination, or by the presence of other metals.

Flame Spectra.—Every chemist is familiar with the production of flame spectra. They are obtainable from certain metals or their salts when these are put into a Bunsen flame.

Innumerable variants of this device are to be found in the mass of literature which has accumulated since the time of Bunsen, who originated this method in 1859, but it suffices to state here that as far as analytical purposes are concerned:

(a) Flame spectra are of value only in identifying the alkali and alkaline earth metals with the addition of indium and thallium.

* The last-named eight elements do not, however, give their spectra under such conditions as to render their spectroscopic detection in a substance generally feasible.

† i.e., lines of oxygen and nitrogen.

copper or iron, or of the metal to be examined, are held in the holder, and the arc is struck by allowing the electrodes to touch and then separating them by two or three millimetres. The following procedures suffice for practically all cases likely to arise.

Metallic Specimens.—Where the specimen is in the form of metallic rods or metallic pieces large enough, these can themselves be used as electrodes.

Small metallic or other specimens, powders, precipitates, dry resinsates from solutions, etc.—Specially pure carbon electrodes are used, and a small cup is scooped out in the lower carbon. Into this the specimen is dropped and the arc struck. A variant of this procedure is to use copper electrodes, a few milligrams of the substance being placed on the lower copper pole when the latter is hot. The substance adheres to the pole, and the spectrum of its metallic components is observable for some time.

Spark spectra.—The apparatus required for producing the spark consists of an induction coil, or preferably, a $\frac{1}{4}$ -kw. transformer giving 15,000 volts on open circuit, with a condenser and self-induction coil. If alternating current is not available, a small converter must be added. These are arranged as in Fig. 3.

(To be continued)

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

ANNUAL REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY—VOL. XI.

This volume of the Annual Reports (covering the year 1926) is now ready, and copies have been despatched to those who have subscribed for them.

The price of the volume is 7s. 6d. to members of the Society and 12s. 6d. to non-members. Fellows of the Chemical Society, who are not members of the Society of Chemical Industry, can purchase the book at the price of 10s.

Orders for copies, accompanied by the appropriate remittance, should be sent to the General Secretary of the Society.

DEATHS

Dodds, James M. (elected 1917), of 6, Clare Road, Cotham, Bristol. Works Manager. On March 1, 1927.

Stewart, Robert (elected 1890), of 46, Westbourne Road, Luton. Director of Messrs. B. Laporte, Ltd. On March 21, 1927.

AMERICAN SECTION

The meeting on February 11, in Rumford Hall of the Chemists' Club, was a joint meeting with the New York Section of the American Electrochemical Society and the American Section of the Société de Chimie Industrielle. Dr. Allen Rogers was in the chair.

Prof. Edward Bartow, of the University of Iowa, who spoke on the subject of "Sewage and trade wastes," described the activated sludge process, and illustrated his remarks with slides of various large-scale sewage-disposal plants. He then spoke of the treatment of waste from corn products plants, and summarised the tremendous reductions made in the population equivalent of the waste by more careful manufacturing operations. The paper will be published in full at a later date.

Following the remarks of Prof. Bartow, Prof. D. D. Jackson discussed the methods of treatment used by New York City of distribution in the surrounding water. This capacity is largely taken up at the present time, so that in the not distant future other means must be used.

Mr. E. B. Besscheyre described a proposed activated-sludge plant for New York City, and outlined the legislation regarding sewage and trade waste in other States. Mr. William R. Copeland followed with a discussion of conditions in Connecticut and the problems involved by State lines. Discussion by members and guests followed.

Seventy-five members and guests attended the dinner which preceded the meeting, and about 150 attended the meeting.

BIRMINGHAM SECTION

Mr. D. W. Parkes, B.A., B.Sc., read a paper at the meeting on March 22, his subject being "The removal and recovery of phenols from ammonia sulphate still effluents."

The author observed that the besetting problems of the production of sulphate of ammonia are the removal of the tar acids from the liquor, and the second the

recovery of the tar acids removed. The problem of the removal of the tar acids appeals chiefly to those responsible for the cleanliness of streams and rivers and for the proper working of sewage disposal plants; whilst recovery of the tar acids appeals more to the ammonia distillers, who, in due course, will probably be compelled by law to carry out some form of purification, and who hope, by recovering the phenols removed, to defray at least part of the cost of purification. Experimental work had been done on a process which aimed solely at the removal of the noxious constituents of waste liquor. Briefly, the process consisted in running the liquor down scrubbing towers up which hot fire gases are blown with a steam injector. While considerable improvement was obtained by this treatment, the results were not considered entirely satisfactory, and an attempt was made further to purify the liquor by bacterial action. The dephenolating towers reduced the phenols by 71% and the oxygen absorption figure by 42%, but did not affect the thiocyanate in the liquor. Hitherto most processes which had aimed at the recovery of the phenols had been based on the principle of washing the liquor with benzol or other solvent, and subsequent extraction of the solvent with strong soda. Another interesting proposal had been put forward—to wash the crude ammonia liquor before distillation.

In this process the waste liquor is first saturated with carbon dioxide, whereby a considerable amount of sludge is precipitated and allowed to settle out. The settled liquor is then brought into contact with activated carbon, whereby the whole or any desired proportion of the phenols is removed. At the same time there is a considerable reduction in the thiocyanate content and a drop in the oxygen absorption figure. When the carbon is saturated with phenols, it is freed as far as possible from adhering liquor, and distilled in a current of superheated steam, whereby 80% of the tar acids adsorbed can be recovered, chiefly in the form of liquid tar acids and a saturated aqueous solution. The carbon is then ready for the treatment of a further quantity of liquor. The speaker then dealt briefly with the various parts of the investigation which led to their present method of procedure.

Opening the discussion, the Chairman (Mr. Mann) emphasised the importance of the subject, and said unless something were done at an early date to cope with the trouble, some of the industries would either have to incur a very large expense or shut up altogether. He believed Mr. Parkes had struck the right line. It would appear that the chief heads he had to work upon were to account for the decomposition of phenols in the early stages where he used carbon for the first time, and to obtain a suitable carbon. That was most difficult to obtain. Brilliant promises of what the carbon would do were not realised in performance.

Dr. A. Parker said the gas industry viewed the subject with such concern that it had in operation at the present time a Gas Effluents Research Committee, working on the treatment and disposal of sulphate effluents. The programme before them was very big, and the paper had touched on one possible way of dealing with gas effluents. There were many other possible ways. The first item of importance was that of cost. Was the process likely

to be profitable, assuming there was a supply of really good active carbon. The difficulty of obtaining carbon was by no means a new one. He wondered whether Mr. Parkes could elaborate the point with regard to the decomposition of phenols in the early stages, because the same thing occurred with benzol.

Dr. E. W. Smith congratulated Mr. Parkes upon a really valuable contribution to the subject. To Mr. Parkes the gas industry must give its thanks; and more particularly to the progressive policy of Messrs. Robinson Brothers for allowing him to publish material which many might consider premature to make known. The effluent was an essential and necessary evil in the gas industry working, and there would come a time when it would have to be treated compulsorily; therefore, too much could be made of the question of cost. It was not necessary, he meant, to show a profit. A further point which arose was whether the charge for dealing with the effluent was one that should be borne by the industry itself. Gas undertakings were large ratepayers, and for the rates paid they had a right to claim consideration from the disposal methods that were adopted for domestic effluents. Another point which gas undertakings must consider was that effluent difficulties could be very largely reduced by not making as big a proportion of the oxygen absorbing bodies as were being made, unnecessarily, in the liquor products of a gas undertaking.

Mr. F. R. O'Shaughnessy said, with regard to the question of costs, that the increased cost of the treatment of sewage, receiving over 1% of this waste liquor, must be taken into consideration. When they got over 1% of the liquor in sewage, the cost of treatment went up by leaps and bounds.

Mr. Rowell pointed out that buying activated carbon was obviously costly, and the products were not too valuable.

Replying on the discussion, Mr. Parkes said he could not give any figures as to cost. They had regarded the matter from the standpoint that some process would have to be used. They knew beforehand that phenols were being removed from the liquor at a considerable loss, therefore they worked on a different process which seemed fairly hopeful. He could not give any information about the decomposition of phenol; there was no doubt it did decompose. With regard to the washing recovery processes, he believed they were in operation in some places on the Continent, but from the figures supplied he could never see how they worked out their profit. As to the determination of phenols, they could not use the distillation method. Regarding a suggestion that they might treat phenol liquors with formalin with a view to the production of synthetic resin, the trouble was that formalin and phenol in weak solutions would not combine.

CHEMICAL ENGINEERING GROUP

A joint meeting of the Institution of Mechanical Engineers and the Chemical Engineering Group of the Society of Chemical Industry took place on March 25 in the lecture theatre of the Institution, when, under the chairmanship of Sir Henry Fowler, President of the Mechanical Engineers, Dr. Ormandy read a paper on "Lubrication." Such was the interest shown in this

subject that standing room only was available for late comers.

Lubrication being a problem of liquid and solid interfaces, the author first considered the case of polar and non-polar molecules in contact with surfaces, and then gave a brief résumé of the method and experiments by which Langmuir has been able to calculate the cross-section and estimate the length of the molecule. After considering how the arrangement of the carbon atoms in the long chain compounds had a direct bearing on the problem of lubrication, Dr. Ormandy next dealt with the surface energy of solids, and showed that all solid surfaces have sufficient free energy to enable them to absorb liquids or gases, and that liquids such as oils having a low surface tension will wet these surfaces more readily than liquids possessing a high surface tension. Spreading of fatty acids etc. on clean metallic surfaces would only take place if the surface has been previously wetted. On the physical side it was shown that Hardy and his collaborators had found that the coefficient of friction between surfaces which had been wetted with thin layers of non-polar bodies immediately attained a minimum value, whereas if the surfaces were wetted with polar bodies appreciable time must elapse before this minimum was reached. With composite bodies such as mixtures of non-polar and polar oils a definite time must elapse before this minimum was arrived at, but the lag would be of much shorter duration than for the polar oil alone. This coefficient of friction between plane faces also diminishes with increase of pressure between the surfaces up to a point, after which it becomes independent of the load. The author also described experiments relating to the movements of discs and spheres through liquids, and discussed the relative importance of such factors as viscosity, flash point, volatility, and resistance to oxidation of lubricating oils. It was clearly demonstrated in the paper that the problem of lubrication is not merely a question of pressure, time and viscosity, but embodied many chemical and physical properties of the metals as well as the liquids employed.

An interesting discussion followed, in which the problem of lubrication was considered from the physical, chemical and engineering aspects, and it was suggested that the time was ripe for further united research by the chemist, physicist, and engineer and producer into this very important problem. Amongst those who took part in the discussion were Sir William Hardy, Drs. Haig, Hele-Shaw, and Watson, and Messrs. J. E. Southcombe and A. G. Marshall.

LIVERPOOL SECTION

The annual meeting of the Section was held on March 16 in the Muspratt Lecture Theatre, the University, Prof. W. H. Roberts in the Chair. The following elections were made for the session 1927-28:—Chairman, Dr. Alfred Holt; Vice-Chairman, Assoc. Prof. W. H. Roberts; Hon. Treasurer, Dr. Alfred Holt; Hon. Secretary, E. Gabriel Jones; Representative on Chemical Engineering Group, Mr. W. Ramsay Sibbald. Dr. A. C. Cumming, Mr. Edwin Thompson, Dr. E. L. Peck, and Mr. J. L. F. Vogel were elected to fill the vacant seats on the Committee.

In the secretary's report for the session, which was read and adopted, it was stated that there was a slight decrease in membership compared with last year, and an appeal was made for members to obtain new recruits. The number of associate members had decreased, and it was hoped that new ones would be enrolled. With regret, the deaths of five members were recorded: Messrs. J. M. Gibson, J. W. Kynaston (both original members of the Society), Roscoe Brunner, J. L. Lee, and A. T. Smith. Up to last month five meetings had been held, the average attendance being 50. Joint meetings were held with the Fuel Section and with the Manchester Section. The number of Liverpool members who attended the joint meeting with Manchester was disappointingly small, and it was hoped that members would not cease to support these inter-section meetings, which afforded excellent opportunities of keeping in touch with their Manchester friends to mutual advantage. In conclusion, the hon. secretary recorded his indebtedness to the chairman for his assistance and advice in connexion with his secretarial duties, and said all regretted that illness had prevented the chairman from attending some of the meetings. The Section was extremely glad he was able to preside at that meeting, the last of the session.

The chairman invited suggestions or criticism and appealed to the Section to endeavour to obtain new members.

The business meeting was followed by a joint meeting with the Liverpool and North Western Section of the Institute of Chemistry, and an address was delivered by Prof. J. C. Drummond, D.Sc., F.I.C., entitled "Biochemical aspects of the nature of life."

The differentiation between life and death, or between systems which may be regarded as living or non-living, said Prof. Drummond, has occupied the minds of philosophers from the early days of human thought. The consideration of animism founded by the great philosophers survived after the Middle Ages, and took definite shape as far as chemists were concerned in the vitalistic theories flourishing in the early part of last century. These theories were rudely shaken by the discovery of Wöhler, and have ever since lost ground. The evolution of the inorganic world stands revealed by the researches of chemists and astro-physicists. The researches of Moore and Baly have taught us something of the transition from the inorganic to the organic. At the other extreme there stretch the extensive ramifications of the evolutionary paths of plants and animals. Between lies that unexplored region which holds the secret of the transition from the living to the non-living. Some glimpses of this area are being obtained by studies of remarkable organisms, such as the ultra-microscopic viruses, and the bacteriophages of d'Herelle.

The phenomena of life may, for purposes of our argument, be taken as growth, assimilation, respiration, reproduction and movement, all of which represent complex energy exchanges, the ebb and flow of which differentiates, at any rate recognised, forms of life from inert systems. The researches of Warburg have recently shown that the phenomenon of respiration is to a large extent controlled in the cell by the presence of iron, and wherever we seek in the living kingdom we

find iron occupying an essential part in one form or another. In all cells there is an iron-containing pigment known as cytochrome, which stands in direct relationship to the great family of blood pigments known as the hæmoglobins, and evidence is accumulating to show that in the evolution of these pigments of the higher animals there has been a steady change of the molecular type so that the properties of the pigment will be adapted to the conditions under which it is to serve the organism. The specificity of the hæmoglobins is bound up with the protein part of the molecule since it has been shown that all these pigments contain the same iron-containing unit. Even more essentially a "life" process than respiration is the phenomenon of reproduction, and yet, if we examine this process from the biochemical aspect we find that even the processes of fertilisation and cell division can be controlled in the laboratory by simple physical and biochemical methods. The modern theory of heredity based on an association between inherited characters and the presence of certain structural units known as chromosomes interest us in the nature of these remarkable bodies. The chromosome of the chromatin material from reproductive cells on examination by biochemical means is revealed as being a simple nucleo-protein, and the high degree of specificity implied by the chromosome theory of heredity seems to lie in the protein moiety. The remarkable work of Dakin and his colleagues has taught us that biological specificity of proteins is probably correlated with the arrangement of amino-acids in the protein molecule, and if this view is correct it is not improbable that a large proportion of the life processes of an animal are controlled by this simple biochemical fact.

CALENDAR OF FORTHCOMING EVENTS

- Apr. 1. SOCIETY OF CHEMICAL INDUSTRY. *Joint meeting of the Chemical Engineering Group and the Institution of Mechanical Engineers*, to be held at Storey's Gate, St. James's Park, S.W.1, at 6 p.m. "Lubricating oils—laboratory tests in relation to practical results," by A. G. Marshall and C. H. Barton.
- Apr. 1. SOCIETY OF CHEMICAL INDUSTRY, *Manchester Section*. Annual General Meeting, 16, St. Mary's Parsonage, Manchester, at 7 p.m. "The work of the National Physical Laboratory," by Dr. W. Rosenheim.
- Apr. 1. WEST OF SCOTLAND IRON AND STEEL INSTITUTE. Annual Meeting. Royal Technical College, Glasgow, at 7 p.m.
- Apr. 4. SOCIETY OF ENGINEERS. Ordinary Meeting. Apartments of the Geological Society, Burlington House, Piccadilly, W.1, at 5.30 p.m. "Some aspects of reinforced concrete," by G. C. Workman.
- Apr. 4. INSTITUTION OF THE RUBBER INDUSTRY, *London and District Section*. Engineers' Club, Coventry Street, W.1, at 8 p.m. "Rubber statistics," by H. E. Miller.
- Apr. 4. SOCIETY OF CHEMICAL INDUSTRY, *London Section*. *Joint meeting with the Fuel Section*. Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. "The international conference on bituminous coals at Pittsburgh," by Dr. R. Lessing.

- Apr. 5. **SOCIETY OF CHEMICAL INDUSTRY, Birmingham and Midland Section.** University Buildings, Edmund Street, Birmingham, at 7.15 p.m. "Ultra violet light," by A. A. King.
- Apr. 5. **HULL CHEMICAL AND ENGINEERING SOCIETY,** Hull Photographic Society's Rooms, Grey Street, Park Street, Hull. Annual Meeting.
- Apr. 6. **SOCIETY OF PUBLIC ANALYSTS,** Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. (1) "The sequence of strokes in writing," by C. Ainsworth Mitchell and T. J. Ward. (2) "Some observations on the wasting of gluten from flour"; and (3) "A numerical expression for the colour of flour," by D. W. Kent-Jones and C. W. Herd. (4) "The determination of free mercury in commercial products," by H. B. Dunicliff and Kishen Lal. Informal dinner at 6.30 p.m. at the Popular Café, Piccadilly, W.1.
- Apr. 6. **INSTITUTION OF CIVIL ENGINEERS,** Great George Street, Westminster, S.W.1, at 6 p.m. Discussion on "Methods of preserving structures," opened by F. E. Wentworth-Sheilds.
- Apr. 7. **OPTICAL SOCIETY,** Imperial College of Science and Technology, South Kensington, S.W., at 7.30 p.m. Ordinary Meeting.
- Apr. 7. **OIL AND COLOUR CHEMISTS' ASSOCIATION,** Rooms of the National Federation of Paint Manufacturers, 8. St. Martin's Place, Trafalgar Square, W.C.2, at 8 p.m. "The yellowing of linseed oil," by Dr. R. S. Morrell and S. Marks.
- Apr. 7. **CHEMICAL SOCIETY,** Burlington House, Piccadilly, W.1, at 8 p.m. Ordinary Scientific Meeting. (1) "Trypanocidal action and chemical constitution. Part VI. Amphoterie α -carbamidoarylsarbinic acids," by H. King. (2) "On active nitrogen. Part III. Active nitrogen and the metals," by E. J. B. Willey.
- Apr. 8. **SOCIETY OF DYERS AND COLOURISTS, Manchester Section.** Literary and Philosophical Society, 36, George Street, Manchester, at 7 p.m. Annual Meeting. (1) "Photographic effects on cellulose acetate," by A. J. Hall and R. A. Hill. (2) "Note on the effect of light on coloured cotton fabric," by Miss Hibbert. (3) "The dyeing of cotton containing neps," by J. G. Lawrie. (4) "A new aim for the Society," by R. V. Taylor. (5) "Some notes on an emulsifying medium," by G. M. Williams.
- Apr. 8. **SOCIETY OF CHEMICAL INDUSTRY, Chemical Engineering Group.** The meeting arranged for this date has been postponed.
- Apr. 8. **INSTITUTE OF METALS, Sheffield Local Section.** The University, St. George's Square, Sheffield, at 7.30 p.m. "Refined silver for electro-plating anodes," by E. A. Smith.
- Apr. 11. **INSTITUTION OF ELECTRICAL ENGINEERS,** Savoy Place, Victoria Embankment, London, W.C.2, at 7 p.m. "The maintenance of small electric power plants." Discussion opened by T. Hodge.
- Apr. 11. **CERAMIC SOCIETY,** North Staffordshire Technical College, Stoke-on-Trent, at 7.30 p.m. Annual Meeting.
- Apr. 12. **INSTITUTION OF PETROLEUM TECHNOLOGISTS,** House of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m. "Jet and jetonised material," by E. H. Cunningham-Craig.

CHEMICAL SOCIETY

The Annual General Meeting was held on March 24, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., occupying the Chair. The Report of the Council, Balance Sheets, and Statements of Accounts were, on the proposal of Mr. Grant Hooper, seconded by Mr. J. H. Coste, adopted; the vote of thanks to the auditors was proposed by the Treasurer, Prof. J. F. Thorpe, C.B.E., F.R.S., seconded by Dr. P. C. Austin, and acknowledged by Dr. G. W. Monier-Williams, O.B.E. Dr. O. L. Brady, Dr. A. E. Dunstan, and Dr. G. W. Monier-Williams were elected to act as Auditors for 1927. A vote of thanks to the Treasurer, Secretaries and Foreign Secretary, Council and Committees for services during the past year was proposed by Dr. J. A. Voelcker, seconded by Prof. A. Findlay, and acknowledged by Prof. J. C. Philip, O.B.E., F.R.S.

The President next presented the Longstaff Medal for 1927 to Prof. Robert Robinson, F.R.S., remarking that it is the highest honour which the Society can bestow; in expressing thanks for such encouragement, Prof. Robinson acknowledged the great assistance which he had received in his investigations from his colleagues.

For conspicuously meritorious work, particularly in the separation of the pure hormone from the thyroid gland and the synthesis of thyroxin, which is indistinguishable both chemically and physiologically from the natural product, the Harrison Memorial Prize was awarded to Dr. C. R. Harington by the President on behalf of the Harrison Memorial Prize Selection Committee. Dr. Harington, in his acknowledgement, said that his work, although chemical, had been conceived, and would be applied, in the domain of medicine.

Prof. Baker then delivered the Presidential Address, entitled "Experiments on molecular complexity." The observation that if liquids of varying types were subjected to prolonged drying the boiling points were considerably raised, suggested that the molecules increase in complexity when the catalyst (water) is removed, and that all liquids may be capable of association. Although the inability of molecules to associate together in the absence of water might be conceived, dry liquids boiling at sub-normal temperatures had not yet been obtained. The investigation, however, had now been extended to catalysts other than water, involving determinations of vapour pressure and surface tension.

Preliminary results, whilst not quantitatively reproducible, demonstrated the influence of the presence of charcoal on the vapour pressure of ether, methyl alcohol, and benzene; an extension of the investigation showed that a catalyst acts very slowly, sometimes at first even in a direction contrary to that finally observed, and that a pure liquid appears to possess no constancy of composition. However, experiments in which the vapour pressure of the liquid alone was balanced against that of the liquid with the catalyst showed an increase of the vapour pressure of the liquid in contact with the catalyst over that of the liquid alone.

Measurement of the vapour pressure of water in the presence of charcoal, platinum, or thoria showed that heating has the same ultimate effect, but that the interval

between the actual heating and the appearance of the effect varies with the different catalysts.

Ramsay and Shields' method was employed for the determination of the surface tension, the containing tubes being made of specially resistant glass. Marked changes in the molecular weight of acetic acid and water were observed, but the catalyst (charcoal, platinum black, or thoria) did not appear to produce its maximum effect immediately. Moreover, the process of filling the tube, involving boiling the liquid to remove air, evidently caused dissociation, the control liquids requiring three weeks to return to the normal molecular weight. Again, heating for a short period only generally increases the molecular complexity, whilst heating for a long period decreases it, as would be expected.

Quantitative agreement between the vapour pressure and surface tension results would not be anticipated, since the latter indicate the average complexity of the molecules, whereas the former are largely attributable to the smaller molecules present. Nevertheless, it would appear that all liquids may be regarded as analogous to a dissociable gas such as nitrogen peroxide, although their dissociation and association are much slower processes than those in gases.

The President exhibited a two-limbed tube into which, three weeks previously, there had been placed equal volumes of bromine, and, in one limb only, a piece of charcoal. In the interval bromine had distilled from one limb to another, leaving the charcoal almost dry.

A vote of thanks to the President for his services in the Chair and for his address was proposed by Prof. W. P. Wynne, F.R.S., seconded by Prof. A. Lapworth, and briefly acknowledged.

The President then announced that the following would hold office for the ensuing year: President, Prof. H. Brereton Baker, C.B.E., F.R.S.; Vice-Presidents who have filled the office of President, Prof. H. E. Armstrong, F.R.S., Prof. H. B. Dixon, C.B.E., F.R.S., Prof. P. F. Frankland, C.B.E., F.R.S., Dr. A. Scott, F.R.S., Prof. W. P. Wynne, F.R.S.; Vice-Presidents who have not filled the office of President, Prof. J. B. Cohen, F.R.S., Prof. G. G. Henderson, F.R.S., Sir Robert Robertson, K.B.E., F.R.S., Prof. R. Robinson, F.R.S., Dr. N. V. Sidgwick, F.R.S., Prof. A. Smithells, C.M.G., F.R.S.; Treasurer, Prof. J. F. Thorpe, C.B.E., F.R.S.; Secretaries, Dr. T. Slater Price, O.B.E., F.R.S.; Prof. C. S. Gibson, O.B.E.; Foreign Secretary, Prof. F. G. Donnan, C.B.E., F.R.S.; Ordinary Members of Council, Mr. M. P. Appleby, Prof. H. Bassett, Mr. E. R. Bolton, Prof. H. V. A. Briscoe, Prof. J. E. Coates, O.B.E., Prof. J. C. Drummond, Dr. F. A. Freeth, O.B.E., F.R.S., Mr. F. W. Gamble, Prof. R. Whytlaw Gray, O.B.E., Dr. J. Kenyon, Dr. T. J. Nolan, Prof. K. J. P. Orton, F.R.S., Dr. R. H. Pickard, F.R.S., Mr. B. D. Porritt, Dr. E. K. Rideal, M.B.E., Prof. J. F. Spencer, Mr. G. Stubbs, C.B.E., Prof. F. J. Wilson.

In the evening the Anniversary Dinner was held at the Edward VII Rooms, Hotel Victoria, London, the President occupying the Chair.

The Loyal Toasts having been honoured, the Right Hon. Viscount Sumner, G.C.B., proposed the toast of the Chemical Society, expressing the hope that the prosperity which had attended the Society since 1841

would long continue. In a delightfully humorous speech, he remarked that lawyers differ from chemists in their lack of desire to know more of things in the abstract, although the investigator perpetually found himself on the verge of the unknowable as well as the unknown.

The President, replying, commented happily on the international character which the gathering had acquired by the presence, as guests, of Prof. Camille Matignon and Prof. Schlenk; he regretted the absence through indisposition of Prince Ginori Conti, President of the Italian Chemical Society. During the past year the Society had sustained a heavy loss in the deaths of Dr. A. W. Crossley and Sir William Tilden, respectively the youngest and oldest Past Presidents. Earlier in the day he had given, as his Presidential Address, a purely experimental paper, saying that he shared with Sir Isaac Newton the motto: "Hypotheses non fingo." Maturer consideration led him completely to reverse that description of his attitude; he was, in fact, an inveterate maker of hypotheses which, however, he never published. Prof. Baker referred in this connexion to Liebig's account of his error in mistaking bromine, subsequently discovered, for "liquid chloride of iodine," and advised his younger colleagues: "Make as many theories as you like, but don't publish them."

Sir William J. Pope, K.B.E., F.R.S., who proposed the toast of the Guests, coupled with the names of Sir Ernest Rutherford, O.M., President of the Royal Society, Prof. Camille Matignon, representing the Société Chimique de France, and Hofrat Prof. Dr. Wilhelm Schlenk, President of the Deutsche Chemische Gesellschaft, humorously spoke of the obsolete character of the term "physics"; the President of the Royal Society was the most notable *chemist* of the first quarter of the twentieth century.

Sir Ernest Rutherford dwelt on the close relationship existing between chemistry and physics. The interaction of these branches of science would doubtless lead to a greater elucidation of atomic structure, when that complex but fundamental problem of chemical combination might be attacked. The study of the crystalline forms of elements, and afterwards of compounds, seemed to offer a promising line of advance.

Prof. Matignon and Prof. Schlenk both replied in terms of cordial goodwill.

SOCIETY OF GLASS TECHNOLOGY

A meeting was held in the University of Birmingham, on March 16, Mr. Herbert Webb in the Chair. Two papers were presented:—

"Some further developments in recuperative glass furnaces," by Th. Teisen, C.E. A new design of recuperator was described in which there was an increase in efficiency for two reasons:—(1) The greater heating surface ensured a higher temperature of the secondary air; (2) The reduction in space resulted in smaller radiation and convection losses. The recuperator comprised a main tube of special design, combining the features essential for efficiency, and certain auxiliary shapes, which together with the tube, were required for building up a unit. When built on the 2-recuperator principle, the design outlined had certain drawbacks, to overcome which a new design was developed on what

the author called his "Tetra" recuperative principle. This design had 4 recuperators instead of 2, arranged symmetrically in each corner of the base, and, for large furnaces, afforded the following advantages, compared with the 2-recuperator principle:—

(1) Short length of recuperator, enabling it to be cleaned or repaired from the front in its full length; (2) More efficient waste heat recovery; (3) In case of repair or cleaning, one recuperator could be shut off altogether and the furnace kept going with the remaining three; (4) The waste gas collecting flues and the glass pits could be arranged (nearly) symmetrically in relation to each other. For very large types, provision had been made to divide the side pockets into two, so as to make each recuperator of a pair absolutely independent of each other. The author also described a simple application of a patent system of oil firing. All new pot furnaces were designed with a view to being fired on this system in case of emergency, as it entailed only slight modification of the design of the pocket. Furnaces working on this system could be fired, either with oil alone, or with coal or producer gas in the ordinary way, combined with oil as auxiliary fuel.

"The properties of some soda lead oxide glasses," by Violet Dimbleby, M.Sc., S. English, D.Sc., Prof. W. E. S. Turner, and F. Winks, M.Sc.Tech. Prof. Turner, in presenting this paper, observed that although potash was more often used than soda in these glasses, nevertheless, the properties of one kind had a bearing on the properties of the other. The investigations made were systematic, and aimed at the determination of the effect, which was produced by increasing progressively the proportion of lead oxide at the expense of the soda. In this way it was found that successive replacement of soda by lead oxide gave glasses with progressively decreasing annealing temperature and thermal expansion. Comparison was also made with glasses containing barium oxide, which were of much commercial interest. The action of boiling water on the glasses was investigated, and the percentage loss in weight determined. It was found that lead oxide glasses were better than those containing lime, while those containing barium oxide were the worst of the series. A new set of factors was determined by which the thermal expansion of lead oxide and barium oxide glasses could be calculated. The factors originally proposed by Winkelmann and Schott in 1895, had been found to need revision, and the following were the new values: SiO_2 , 0.15; ZnO , 0.21; Al_2O_3 , 0.52; ZrO_2 , 0.69; MgO , 1.35; PbO , 3.18; CaO , 4.89; BaO , 5.2; Na_2O , 12.69; K_2O , 11.7.

The reading of the third paper on the agenda was postponed, namely, "The thermal expansion of some boric oxide containing glasses," by Prof. W. E. S. Turner and F. Winks, M.Sc.Tech.

PHYSICAL SOCIETY

At the meeting held on March 11, a paper on "A comparison of the behaviour in thermal diffusion of nitrogen and carbon monoxide, and of nitrous oxide and carbon dioxide" was communicated by T. L. Ibbs and L. Underwood, in which the thermal diffusion of the former pair of gases in hydrogen, carbon dioxide and nitrous oxide, and of the latter pair of gases in hydrogen,

oxygen, nitrogen and carbon monoxide were investigated. The thermal diffusion of ethylene and hydrogen was also examined. By thermal diffusion it is to be understood the separation which occurs in a binary mixture of gases when a temperature gradient is established in the mixture. It has been independently shown by Enskog and Chapman that the effect depends on the masses and diameters of the gas molecules, upon the proportions in which the gases are mixed, and upon the field of force of the molecules. The pair of gases nitrous oxide and carbon dioxide have practically the same molecular weights and sizes. The same is true of the pair nitrogen and carbon monoxide. Theory predicts that in such cases the effect will disappear whatever the nature of the fields of force. The molecule of C_2H_4 has the same weight as the molecule of CO and N_2 , but is different in size and the number of atoms in the molecule. As the thermal conductivities of the respective pairs are practically the same, direct observation of thermal diffusion in the pairs was difficult. The phenomenon was therefore observed of the thermal diffusion of the respective gases in the series of gases referred to above. The results confirm those predicted by theory; in all cases the heavier molecules move to the cold side and the lighter molecules to the hot side. The form of the composition-separation curves was symmetrical when the rates of masses of the component gases was small, e.g., O_2 and CO_2 . For mixtures containing hydrogen in which the mass-ratio is large the curves are unsymmetrical, the maximum separation corresponding with a mixture considerably richer than 50% in hydrogen. The thermal diffusion of a gas in nitrogen or carbon monoxide is practically the same. This is true also of the pair nitrous oxide and carbon dioxide. The separation obtained in mixtures of ethylene and hydrogen is less than that obtained in mixtures of nitrogen or carbon monoxide and hydrogen. The molecular fields of N_2 and CO are closely alike, whilst the CO_2 molecule is slightly harder than the molecule of nitrous oxide.

R. R. Nimmo discussed the "Relighting of a neon-filled lamp when momentarily extinguished at voltages below the striking potentials," and showed that the time during which the continuous discharge of a neon lamp may be interrupted without extinguishing the lamp is of the order 500 micro-seconds, and depends on the operating voltage and current in the lamp. The ensuing discussion indicated that individual lamps differ markedly amongst themselves—a result possibly attributable to the impurities present in the filling gas.

Dr. G. M. B. Dobson and I. O. Griffiths submitted a paper on "Measurements of absorption coefficients of light filters." A portion of the slit of a spectrograph is covered by the filter, and the transmitted light is incident upon a photographic plate after passing through a neutral wedge. The plate is also illumined in another part by light which has traversed the wedge only. From a knowledge of the distance between two points in the respective spectrograms, which are of the same density, the absorptive coefficient of the filter can be ascertained.

A paper by G. B. Deodhar on "Electricity of dust clouds" was taken as read.

CORRESPONDENCE

THE MERCENARY MOTIVE

SIR,—I have read your recent Editorials with much pleasure, and especially the note on Beethoven in the issue of March 25. But why spoil a delightful sonatina by intruding the jarring notes of self-interest and the mercenary motive—"the average chemist . . . must do the things and love the things which his fellow voyagers consider essential to culture" because "to live within the narrow confines of his own profession is unprofitable . . ."? We must be a sordid lot indeed if the only way to make us alive to outside interests is the hint that the boss likes it, and, anyhow, it is the thing to do.

Renaissance music with its often beautiful melodies but somewhat stereotyped or staid forms, the equally lovely melodies and more varied form of the Handel and Bach periods, developed into what, to some, seems the most happy blend of tunefulness with complexity of form and richness of harmony which characterises much of the subsequent work of the nineteenth century, and some would say that harmony has nearly vanished, and melody quite, from some kinds of present-day music.

Yet each of these has its special appeal for one or other of most of us, and rightly so. The lover of Beethoven does not care whether his liking is "profitable" (nor, by the way, whether the current welcome opportunities of revelling in the master's music are strictly artistic or partly mechanistic in origin, *i.e.*, based merely on the coincidence of the lapse of a conventional time-unit since Beethoven's biochemical mechanism ceased to operate).

These things are an allegory: freedom of taste is essential to the pursuit of culture, and the latter, whether as regards Beethoven or bridge, is *not* profitable if undertaken as a compulsory form of relaxation because it is profitable—which is a self evident paradox.—I am, Sir, etc.

T. P. HILDITCH

The University,
Liverpool

TREATMENT OF EMPLOYEES

SIR,—I was astounded to read in the report of the Imperial Chemical Industries, Ltd., published last Saturday, that the chairman (Sir Alfred Moud, Bt., P.C., M.P.) remarked that he had seen statements, although in irresponsible quarters, that the I.C.I. were not regarding the welfare of employees. That such statements are entirely baseless and untrue—to quote Sir Alfred's own words—can be easily ascertained and verified by a visit to Billingham, where the synthetic ammonia undertaking is being carried on.

In that village, the reports of wage-reduction, worse conditions of labour and the two-generations-old regard for the welfare of employees showing signs of collapse, is treated with the utmost scorn and ridicule.

Never were workmen more satisfied, better cared for and well treated—and this applies not only to servants, but to all employees.

Even in the event of decease, dependents are not forgotten. In proof of which, a very near relative of mine, who had only been in the service of the Synthetic

Ammonia Company (since associated with the I.C.I.) for about five years, died quite recently. Not only was the rent of the house he had lived in reduced, but provision was made for the immediate needs of his widow, his daughter was given employment with the company, and assistance was rendered towards providing for the future careers of two sons.

I am confident that this is not by any means an isolated instance of the generosity and full-heartedness of the firm, whose conduct towards employees has been, in some quarters, so grossly and shamefully maligned.

Yours faithfully,

HENRY ALLEN ASHTON

PERSONAL AND OTHER ITEMS

Mr. Henry Thomas Tizard, C.B., A.F.C., F.R.S., has been appointed by His Majesty the King in Council to be Secretary to the Committee of the Privy Council for Scientific and Industrial Research on the retirement of Sir H. Frank Heath, K.C.B., from that office on June 1 next.

The Institution of Mining and Metallurgy has awarded its gold medal to Emeritus Professor William Frecheville in recognition of his services to the mining industry during a long and distinguished professional career and to mining engineering education.

This week the Goldsmiths' Company is celebrating its 600th anniversary.

The late Mr. Roscoe Brunner, lately chairman of Brunner, Mond and Co., Ltd., left unsettled property of the gross value of £146,948.

The late Mr. T. Warburton, O.B.E., managing director of the Bleachers' Association, Ltd., left £65,092, with net personalty £60,770.

The late Mr. F. Whowell, J.P., a managing director of the Bleachers' Association, Ltd., left £103,975, with net personalty £63,818.

Conference of Teachers in Technical Institutions

The Annual Conference of the Association of Teachers in Technical Institutions will be held this year at Plymouth, from Friday, June 3, to Tuesday, June 7. The provisional programme includes, in addition to the business of the Conference, a number of visits. Arrangements are being made to visit, amongst other places, the Seale Hayne Agricultural College and the Marine Biological Laboratory. An important feature will be an educational and industrial exhibition in the Guildhall from June 4 to 10.

Trade Alloys

The Institute of Metals receives such numerous enquiries for the names of the manufacturers of the thousands of "trade alloys" that exist, that it has been decided to compile a list of "trade alloys," together with particulars of their composition and uses, as well as the names of manufacturers or agents in Great Britain. Persons interested are invited to forward to the Secretary, 14, Members' Mansions, London, S.W.1, the following particulars:—(1) Name of alloy. (2) Manufacturer or agent supplying. (3) Composition. (4) In what form supplied. (5) Uses.

Canadian Pulp and Paper Industry

The properties of the Mattagami Pulp & Paper Co., Ltd., have passed into the hands of the Abitibi Power & Paper Co. The Smooth Rock Falls, Ont., mill, which was acquired, has a manufacturing capacity of 50,000 tons of high-grade sulphite pulp per annum, of which 30,000 tons is bleached pulp. The timber limits taken over are approximately 965 square miles of spruce pulpwood lands.

Eucalyptus in Artificial Silk Manufacture

Some recent work in Australia is reported to have shown the possibility of using eucalyptus wood for the manufacture of artificial silk. Slight modifications only are needed in the methods actually used in producing the pulp to enable the pulp to be used in making artificial silk.

Nitrogen Fixation in the U.S.A.

Lazote, Inc., which utilises the Claude process at its Belle synthetic ammonia factory, has sued the Niagara Ammonia Co. and the Ammonia Corporation for alleged infringement of three of the Claude patents. The Ammonia Corporation owns the American rights to the Casale process, and its subsidiary, the Niagara Ammonia Corporation, is operating a Casale ammonia plant at Niagara Falls.

Chilean Nitrate and the I.-G.

It is reported that the German Dye Trust has applied for a Chilean patent to cover a process which, it is claimed, will enable the production of Chilean nitrate to be improved.

A New Anæsthetic

It is reported from Berlin that the German Dyestuffs Trust has produced a new anæsthetic, known as "E 107," which is administered rectally, produces complete anaesthesia in 7 or 8 min., and does not give rise to reflexes, relaxation being complete and the pulse normal. There seem to be no after-effects, except, in a few cases, intestinal irritation and cyanosis, and elimination takes place quickly. The chemical composition of "E 107" has not been disclosed. On account of certain disadvantages, which, it is hoped, will be overcome, the new anæsthetic will apparently not be placed on the market as yet.

New Process for making Cellulose Pulp

A group of United States financiers has bought the American rights to a process invented by a Hungarian chemist, Dr. B. Dorner, which, it is stated, enables the highest grade chemical pulp to be made on a commercial scale from maize stalks more cheaply than from wood or cotton. Three tons of maize stems (cornstalks) are required, against 2.5 tons of wood, to make a ton of chemical pulp, but the maize is waste material which costs very little, and is generally burned. The pulp is said to contain 99.3% of pure cellulose.

Swiss Exports of Dyes to Germany

According to the U.S. Trade Commissioner at Berlin. Swiss dye producers are now able to export to Germany, the exports in September and October last reaching values of 870,000 francs and 1,030,000 francs respectively. The reason, it is stated, is ascribed to the high prices charged by the I.-G.

REVIEWS

REMINGTON'S PRACTICE OF PHARMACY. By E. FULLERTON COOK, P.D., Ph.M., and CHARLES H. LA WALL, Ph.M., Pharm.D., Sc.D., F.R.S.A., and collaborators, Seventh edition. Pp. xxiv + 2090. London: J. B. Lippincott Company, 1926. Price: 45s. net.

The seventh edition of this well-known work is a valuable corollary to the issue of the Tenth Decennial Revision of the United States Pharmacopœia, 1926. It contains, in addition to the official drugs and preparations of the U.S.P., those of the National Formulary, fifth edition, 1926, and many new and unofficial preparations. As in former editions, the monographs are not arranged alphabetically, similar substances being dealt with in groups. To the sections dealing with Inorganic and Organic Chemical Compounds, new chapters have been added entitled "Theory of Inorganic Chemistry" and "Theory of Organic Chemistry." These occupy 17 and 14 pages respectively, of which two are allotted to the determination of "Ionic Dissociation," as the hydrogen-ion concentration is designated. The information in these chapters is too meagre to be of much value, and may even be misleading, as in the statement:—"The hydrazines are related to the diazo compounds except that the union between the nitrogen is by one bond, and that one of the nitrogen atoms is attached to hydrogen only," by its remaining two bonds." The words italicised are not an essential condition to a hydrazine, which may be considered as diamidogen with any or all of its hydrogen atoms replaced by radicles.

Other new chapters deal with Perfumery and Cosmetics, Commercial Law, Business Administration, Manufacturing Pharmacy, Biological Products, Serums, Vaccines and Protein Therapy. Brief mention is made of vitamins, and details are given for carrying out feeding tests on cod-liver oil for the determination of antirachitic and vitamin A potency.

The section dealing with Pharmaceutical Analysis has been considerably extended. "Urinalysis" has a chapter to itself, and the volumetric and proximate assays of the Pharmacopœia are fully explained, and in addition methods are given for the analysis of hypodermic tablets, with proposed tolerances which range from 7.5 to 10%. The method for arecoline hydrobromide tablets consists of titrating the bromine radicle by means of silver nitrate. The active constituent arecoline is not determined.

Under biological assays are given particulars of those used for digitalis, squill, strophanthus, aconite, cannabis, ergot, epinephrine and pituitary.

The formulæ for pharmaceutical preparations are given both in the metric system as in the U.S.P. and also in avoirdupois and U.S. fluid measure. The latter, it should be remembered, is not equivalent to English measure.

The edition is exceedingly well put together, the English is good and almost free from American phonetic spelling, the type is clear, and it is very readable. Printing errors are few; on page 543, W. M. Clark is given as M. W. Clark, and the brackets in the formulæ for the conversion of specific gravity to Baumé degrees on page 59 have been omitted. In the formula for epinephrine on page 1195, CH₂ should read CH₃.

Although the number of pages has been increased by 103, the thickness of the volume has been reduced materially by the use of thinner paper. The book will be found very useful for reference on all pharmaceutical matters, and although intended primarily as a handbook for the United States pharmacist, much of the information will be invaluable to pharmacists in any country.

T. TUSTING COCKING

TECHNOLOGIE DER FETTE UND ÖLE. By KARL LÖFFEL. Pp. viii + 510. Brunswick: F. Vieweg & Son, 1926. Price: paper, 35 r.m.; bound, 38 r.m.

After an opening section, comprising some 80 pages, dealing with the chemistry of glycerin, fatty acids and the fatty oils, the author proceeds to deal fully with the raw materials (and their production) from which fatty oils are derived. In considerable detail the operations of crushing and extraction of oil-bearing seeds and fruits, and the rendering of animal fats and marine animal and fish oils are dealt with, whilst the section devoted to oil refining and deodorising is very thoroughly treated. Following this, important technical details regarding the individual oil-bearing fruits and seeds, the characteristic features and uses of the oils derived from them are given; similarly, the principal features relative to tallow, butter, whale, fish and liver oils are given adequate consideration. The final section, comprising some 130 pages, deals with such manufacturing operations as the production of margarine and compound fats, oil hydrogenation, the numerous methods of saponification in use, and the distillation of fatty acids and the production of glycerin and its subsequent distillation.

The author is to be congratulated on a well-written volume dealing very fully and in a practical manner with the industries embraced within the scope of the work, whilst the numerous drawings, besides being clear, add considerably to an understanding of the subject matter. Books of this type are too often burdened with a bulk of information properly belonging to those of an analytical character, thus leading to a scanty treatment of the technological aspect of the subject matter, but the present volume is free from this defect, and is likely to prove of valuable assistance to those engaged in the fatty oil industries.

There are but few references to original technical papers, though numerous patents are quoted, mainly of German origin; this constitutes the only serious fault in an otherwise well-written, well-printed, and carefully indexed volume.

H. M. LANGTON

A HANDBOOK OF ORGANIC ANALYSIS: QUALITATIVE AND QUANTITATIVE. By Dr. H. T. CLARKE, with an introduction by Prof. J. NORMAN COLLIE, Ph.D., F.R.S. Fourth edition. Pp. xii + 363. London: E. Arnold & Co., 1926. Price: 8s. 6d.

The paucity of text-books on the examination of unknown organic compounds is good evidence of the difficulty of framing a really systematic and up-to-date course. Dr. Clarke, whose book, which first appeared in 1911, has now been enlarged and largely rewritten, is to be congratulated on his success in this direction.

Chapter I deals with preliminary investigations of organic compounds, and the only paragraph in this which could be amended is that on the test-tube method of

determining setting-point. Chapter II, describing the examination for radicles, contains a number of important reactions, which seldom find a place in the ordinary theoretical text-book. It may be mentioned in passing that primary and secondary, as well as tertiary aromatic (and only aromatic) amines form sparingly soluble hydroferrocyanides. Chapter III describes the separation of organic compounds. Chapter IV, which is exceptionally complete, consists of over 180 pages of classified tables of the common organic compounds, and gives physical constants of at least two derivatives in each case.

Chapters V and VI, covering 42 pages, represent the total space assigned to purely quantitative work, and for that reason the book seems somewhat out of balance. The author himself emphasises the importance of quantitative work in his scheme of ultimate identification, and one would have wished that more space had been given to this side of the subject. The estimation of carbon and hydrogen in nitrogenous compounds, and the desirability of a blank test prior to the estimation deserve mention in a practical text-book. The reviewer would suggest also the incorporation of estimations involving the use of nitrite, titanous chloride, and diazonium solutions, all of which are of great technical importance. The book closes with a chapter on the determination of physical properties, followed by an excellent index.

The work still remains the best of its kind, and all students of organic chemistry are indebted to its author for bringing within their reach a very useful and valuable book.

W. M. CUMMING

THE PHYSICAL CHEMISTRY OF STEEL-MAKING PROCESSES: A GENERAL DISCUSSION HELD BY THE FARADAY SOCIETY AND THE IRON AND STEEL INSTITUTE. Pp. 128. London: The Faraday Society, 1926. Price: 8s. 6d.

The reactions which occur during the conversion of pig iron and steel are of great interest to physical chemists as well as to metallurgists, since they involve equilibria between solids, liquids and gases under conditions of varying temperature and composition of the phases concerned, whilst the large scale on which they are carried out introduces new and interesting factors. The problems which they involve are of far more than academic interest, for the successful manufacture of steel demands an accurate control of the relations of metal, slag, and gas. A knowledge of the kinetics of chemical change in the steel furnace is essential to the improvement of the practice of steel making, and there are few branches of applied chemistry in which the contact between theory and practice is so close. The subject of the discussion held by the Faraday Society and the Iron and Steel Institute is therefore a very important one, and several of the papers which were read are of real value for the understanding of the reactions of the steel furnace. Many chemists have determined the equilibria between the oxides of iron and carbon and the two elements, and between the same oxides and hydrogen, but the values of different investigators have not always been concordant, largely owing to the slowness with which equilibrium is reached. Dr. McCance has undertaken the comparison of existing data, and by grouping the balanced reactions in such a way that they may be made to check one

another, by using a system of simultaneous equations, has been able to provide a test for the probable accuracy of series of observations, and by elimination has arrived at values for the equilibrium constants which have a high degree of probability. This is an excellent piece of work, and its value should be appreciated by all metallurgists. The possible equations are very numerous, and the completion of the scheme will involve much further labour. The papers by Mr. Colclough on the basic open-hearth furnace and by Mr. Sisco on the basic electric process contain much useful information. An ingenious attempt to represent the balanced reactions in a new way, without assuming any values for heats of reaction or oxygen pressures, is made by Mr. Feild, but the calculations are based on a single basic heat, and the reasoning will not be generally accepted by chemists. The other papers are also of interest, and in the course of the discussion several metallurgists were able to criticise the views submitted by the principal speakers on the basis of practical experience. This is one of the most useful of the Symposia held under these auspices.

C. H. D.

DIE TROCKNUNG UND SCHWELUNG DER BRAUNKOHLÉ DURCH SPÜLGASE. By DR. B. HILLIGER. Pp. 123. Berlin: Julius Springer, 1926. Price: paper, 10.50 r.m.

Nowhere more than in Germany has necessity been the mother of invention. Faced, during recent years, with a shortage of home-raised coal, she has fallen back upon her considerable reserves of lignite for fuel briquettes. Faced, also, with an increasing consumption of fuel oils and her own poverty in natural oil deposits, she has set to work to found an oil-producing industry by the low-temperature carbonisation of her lignite. This industry is still, at the moment, in an experimental stage, but Dr. Hilliger's monograph gives a concise review of the ground already covered.

The problem handled is that of the production from lignite of primary tar and serviceable semi-coke by low-temperature carbonisation, using hot, inert gases (generally obtained by burning producer gas) as internal heating medium, and with it is bound up the previous drying of the lignite, which, in its raw state, contains roughly 50% of moisture. The book is written from both the practical and theoretical standpoint, and contains, amongst other considerations, descriptions and illustrations of the various types of plant that have been proposed, a review of the relevant patent literature, an account of the properties of the products obtained with cost sheets for their recovery, as well as detailed mathematical calculations of the quantity of inert gas required for drying and carbonising the mechanism of internal heating, and the efficiency realized.

Whilst the initial stimulus to the low-temperature carbonisation of lignite was given by the necessity for producing fuel oils, it is evident that this can be carried out economically only if a market is found for the semi-coke simultaneously produced, and there appears to be an opening for it as powdered fuel. Little or no use has hitherto been made of the gases of carbonisation, owing to their dilution with the inert heating gases, and there is evidently scope here for increasing the efficiency of the process.

It is inevitable that, in considering this problem of lignite utilisation, which has been the particular concern of chemists and engineers in Germany, the author should refer exclusively to work done and results obtained in that country. Nevertheless, it is certain that a study of this work will be of interest and value to all who have at heart the more efficient utilisation of all classes of low-grade coals.

W. T. K. BRAUNHOLTZ

PARLIAMENTARY NEWS

Poison Gas

Sir L. Worthington-Evans informed Major-General Sir Alfred Knox that the study of gas warfare was being actively pursued in Soviet Russia. Numerous factories were already set up, or were in course of erection, which would be able to produce poison gas on a very considerable scale. No useful purpose would be served by detailing the number and location of such factories, or by indicating their present and potential output.—March 15.

Leadless Glaze

Replying to Mr. Clowes, Sir W. Joynson-Hicks said that the number of potteries with leadless glaze certificates was 193. This figure included 22 low solubility glaze factories, which had satisfied the Chief Inspector of Factories that leadless glaze was used for a substantial part of the output, and were entitled under No. 2 of the Regulations to the same exemption as leadless glaze factories. The number of potteries with low solubility glaze certificates, excluding the 22 already mentioned, was 171, making a total of 364. The information given also included results of analyses.—March 15.

Coal Exports from India

Earl Winterton informed Mr. Gardner that according to the returns, 49,088 tons of coal was exported to the United Kingdom from India in 1926. The greater part of this arrived in the first two months of the present year. Only about 44,000 tons in all appear to have arrived here, the balance having presumably been diverted on the way. The declared value at the port of import averaged 59s. per ton.—March 21.

Spirits

In a written answer to Colonel Day, Mr. McNeill stated that the quantity of spirits distilled in Great Britain during the 12 months ended January 31 in each of the years 1925, 1926 and 1927 was as follows: 34,718,000 gallons, 36,895,000 gallons, and 27,780,000 gallons respectively.—March 21.

Beet Sugar Manufacture (Drying Processes)

Mr. Guinness informed Colonel Burton that two interim reports on experiments in drying processes for manufacturing beet sugar had been published, one as a White Paper by His Majesty's Stationery Office last year, and one as an article in the Journal of the Ministry of Agriculture for February, 1927. A full technical report was in an advanced stage of preparation, and would be published with as little delay as possible. Further, he was informed that a company had purchased certain patents for a process known as crop-drying or mass-drying which had been applied to sugar beet manufacture. These patents were partly owned by the Institute for Agricultural Engineering at Oxford, and

it was expected that considerable sums would be realised which would be expended on the scientific work of the Institute. No patents had been taken out in respect of recent investigations specifically into the manufacture of beet sugar. The experimental factory which had been erected for the purpose of these investigations had been sold, and a considerable part of the proceeds expended on the investigations would be returned directly to the Exchequer.—March 21.

Beet Sugar Industry

Mr. Guinness informed Mr. Runciman that the total amount of subsidy on sugar and molasses paid to British beet sugar factories in the manufacturing season 1925—26 was £1,124,207, and for the season 1926—27 was expected to be £3,200,000. The subsidy in the coming financial year, it was estimated, would amount to £4,500,000.—March 22.

In reply to Mr. Runciman, Mr. Ronald McNeill said that guarantees had been given to sugar-beet companies under the Trade Facilities Acts in respect of loans amounting to £2,215,000. March 24.

COMPANY NEWS

BRITISH DYESTUFFS CORPORATION, LTD.

The accounts for nine months to December 31, 1926, show a profit, before providing for depreciation on plant and buildings, of £82,934, or at the rate of £110,578 per annum, as compared with £253,517 for the previous twelve months. After providing £45,000 for depreciation, against £80,000, there remained £37,934, in addition to £78,005 brought in. The proportionate decline in the profit is attributed by the directors to the coal stoppage, which involved not only a substantial increase in manufacturing costs, but a reduced demand for the company's products. It is proposed to maintain the ordinary dividend at 2½%, less tax, absorbing £71,634, leaving £44,306 to be carried forward. Shareholders who exchanged their shares for shares in Imperial Chemical Industries, Ltd., retain their dividend rights up to December 31, 1926, and will consequently participate in the dividend to be paid on April 6, 1927.

BRITISH ALUMINIUM CO.

The report for 1926 shows a net profit of £438,776, plus £24,958 brought in, making £463,735 (£550,434 for 1925). Provision for taxation and proportion of profits payable to the directors absorbs £55,866, prior lien debenture service fund £60,000, debenture stock service fund £43,223, reserve for depreciation £50,000, reserve account £100,000, and staff benefit fund £10,000, leaving £144,644. A final dividend has been proposed on the ordinary shares of 6%, making 10%, less tax, leaving £26,567 to be carried forward.

BELL'S UNITED ASBESTOS CO., LTD.

There was a net profit for 1926 of £51,303, against £50,409 for 1925. The directors propose to maintain the dividend at 12½%, by a final payment of 10%, and to place a further £2,000 to pensions account, carrying forward £43,973, against £34,961 brought in.

SALT UNION, LTD.

The thirty-eighth annual meeting was held on March 22, Mr. G. H. Cox, J.P. (chairman), presiding. Despite

the disturbances in the industrial world during the last year, satisfactory results were shown in the report of the year's trading of the company, due to their successful coal buying, to the strenuous efforts made by their officials and staff, and to the loyalty of their employees. Although the gross profit declined by £89,000, more than half of this was due to the previous year's profits being swollen by amounts which were not ordinary trading items, and which therefore could not be repeated. Shipments to India declined by over 44,000 tons, owing to the strikes and interference with the facilities for shipment. With regard to the home trade, the Salt Manufacturers' Association had continued its efforts to regulate prices and to maintain its constituents' sales so far as possible in the face of the severe competition arising partly from new producers in this country and partly from foreign salt, notably German ground rock and solar salt for fishery purposes. The total import for the past year of all foreign salt showed a decline of 2,318 tons, but the total was still over 62,000 tons. The research department had developed a special germicidal salt which was being patented, which it was claimed would prevent the pink disease in hides. With regard to the Union's chief subsidiary, the Mersey Power Company, a dividend has been declared of 5%, being the first for six years owing to the installation of the electrical power plant.

HADFIELDS, LTD.

Presiding at the annual meeting held on March 28, Sir Robert Hadfield said the increasing severity of the conditions required to be met in the chemical engineering industries was placing greater and greater responsibility on the metallurgist and the chemical engineer. High-temperature conditions demanded materials of a character quite distinct from that used in the construction of apparatus working at ordinary temperatures and pressures. The phenomenon of heat-scaling provided another example of the urgent call for new materials, and particularly for those possessing resistance to chemical action, necessarily intensified by reason of the high temperatures involved. In this connexion distinct progress had been made, and the company's heat-resisting steel had been adopted for many parts in no less than sixteen of the new cruisers constructed for the British Admiralty, as well as for important parts of aeroplanes. The remedy which would ensure peace in industry was commonsense and goodwill; if we did not check the sequence of upheavals which had disorganised our trade and commerce during recent years, we should cease to be an industrial nation, and consequently would be unable to support our population.

BENZOL AND BY-PRODUCTS CO., LTD.

Payment of one year's arrears of preference dividend of 6%, less tax, will be made on April 1. The dividend is in arrear from March 31, 1925.

JOHN KNIGHT, LTD.

Presiding over the twentieth annual general meeting on February 18, Mr. Samuel Barnett (chairman) said that, despite the general strike and the coal strike, the balance sheet for the year showed a profit sufficient to cover the usual dividends and was actually larger in amount than that shown in two out of the last four

years. Sales of their principal products showed an increase over 1925. The profit made amounted to £148,509, against £156,507 for 1925 and £144,464 for 1924. In consequence of the increased prices due to the strike, an additional £12,000 had been paid for coal, oil, and electricity. It was proposed to place £10,000 to a pension reserve. The election of Mr. A. Webber as a director was confirmed, and the retiring directors (Mr. W. L. Helm and Mr. A. H. K. Squire) were re-elected.

EVANS, SONS, LESCHER AND WEBB

The report for 1926 states that the provisions of the scheme of arrangement sanctioned on October 19, 1925, have been carried out, and, in addition, the remaining half of the debenture stock has been redeemed. Out of the surplus arising from the terms under which the new company was reconstructed, the directors have been able to liquidate the whole of the expenses of the scheme, to write off good-will and trade marks in the old company's accounts, to provide substantial reserves on property, plant and debtors, and to place to a capital reserve account £12,248. The new company therefore commences operations free of debentures and with tangible assets only. After writing off all establishment expenses, and making provision for depreciation and bad and doubtful debts, there was a trading profit for the year of £23,536. A dividend has been recommended of 6% on the preference shares, and £7,660 will be carried forward.

PINCHIN, JOHNSON & CO., LTD.

Mr. E. Robson, presiding over the annual general meeting, on March 16, said the net profits for 1926 amounted to £148,339 (including £12,000 received as compensation for cancellation of an agreement). With £30,519 brought forward, there was an available balance of £178,858. The payment of the half-yearly dividend on the preference shares paid on January 1 last, and the interim dividend of 10% already paid on the ordinary shares, was confirmed, and a further dividend of 20% actual, less tax, was declared on the ordinary shares, making 30%, less tax, for the year. The general strike and the coal strike involved the company in a serious temporary setback, but it spoke well for the basic strength of their business that within a very short period of the end of the general strike they had made good the losses entailed. The company had built up a very substantial and successful business in China and the Far East, and the disturbances in China during the year had militated against the normal profit capacity of that market.

Sales for 1926 showed a satisfactory increase, whilst for 1927 an advance had been made over the corresponding period of last year. The meeting was followed by an extra-ordinary general meeting, which passed a resolution increasing the ordinary share capital by 300,000 shares, of which only 240,000 shares were to be issued for the present, for the purpose of giving effect to the deed of covenant entered into by the company for the acquisition of the business of Messrs. Docker Bros., of London and Birmingham. The directors considered that this development will prove an immediate source of substantially increased balance-sheet strength and earning capacity to the company.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—8s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£36 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammonic.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
 Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—2s. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 2d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£7—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—1s. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 6½d. 7d. per lb. Crude 60's, 1s. 8d.—1s. 9½d. per gal.
 Acid Cresylic, 99/100.—2s. 4½d. per gal. Steady. 97/99.—2s.—2s. 2d. per gal. Pale, 95%, 1s. 10d.—2s. 2d. per gal. Dark, 1s. 9d.—2s. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 2½d.—1s. 3½d. per gal., ex works in tank wagons; Standard motor. 1s. 9d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s. 1d.—2s. 5d. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 1½d. to 2s. 2½d. per gal. Firm. Pure, 2s. 3d.—2s. 5½d. per gal.
 Xylol.—2s. 1d.—2s. 6d. per gal. Pure, 3s. per gal.
 Creosote.—Cresylic 20/24%—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—9½d. per gal., according to quality. Solvent 90/160, 1s. 8d.—2s. 1d. per gal. Solvent 95/160, 1s. 8d.—1s. 9d. per gal. Solvent 90/190, 1s. 3½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—77s. 6d.—95s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—9s. 6d.—13s. per gal. Nominal. 90/180—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—8s. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d. per lb. Fair enquiry.
 m-Cresol 98/100%.—2s. 8½d. per lb. Only limited enquiry.
 p-Cresol 32/34° C.—2s. 8½d. per lb. Only limited enquiry.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—8d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4½d.—2s. 6d. per lb. Firm and brisk.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 4½d.—1s. 5d. per lb. Less 5%. Firmer.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 5½d. per lb. Technical 11½d.—1s. per lb. Both in good demand.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 2d. per lb. Less 5%. Firm market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonnaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—12s. 3d.—14s. 3d. per lb. Bismuth Citrate.—9s. 3d.—11s. 3d. per lb. Bismuth Salicylate.—10s.—12s. per lb. Bismuth Subnitrate.—10s. 6d.—12s. 6d. per lb., all according to quantity. Bismuth Nitrate.—6s. 9d. per lb. Bismuth Oxide.—13s. 9d. per lb. Bismuth Subchloride.—11s. 9d. per lb. Bismuth Subgallate.—9s. 9d. per lb.
 Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d.—2s. 5d. per lb. Potassium.—1s. 11d.—2s. per lb. Sodium.—2s. 2d.—2d. 3d. per lb. All spot.

Calcium Lactate.—1s. 2½d.—1s. 3½d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £33 per ton net.

Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 10s. 6d.—12s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.

Mercurials.—Up to 1 cwt. lots—Red oxide, 7s.—7s. 1d. per lb., Levig. 6s. 6d.—6s. 7d. per lb.; Corrosive sublimate, Lump, 5s. 3d.—5s. 4d. per lb. Powder, 4s. 8d.—4s. 9d. per lb.; White precip., Lump, 5s. 5d.—5s. 6d. per lb., Powder, 5s. 6d.—5s. 7d. per lb., extra fine, 5s. 7d.—5s. 8d. per lb.; Calomel, 5s. 10d.—5s. 11d. per lb.; Yellow Oxide, 6s. 4d.—6s. 5d. per lb.; Persulph B.P.C., 5s. 7d.—5s. 8d. per lb.; Sulph. nig., 5s. 4d.—5s. 5d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 7d. per lb.

Methyl Sulphonal.—11s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. per lb.

Phenazone.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 96s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.O.R. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb. Very limited enquiry.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—Pulv. 77s. 6d.—82s. 6d. per cwt. net, according to quantity. Crystals 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—7s. 6d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 1d. per lb.

Thymol, Puriss.—11s. 3d.—12s. 6d. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (ex Anethole).—10s. 3d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 6d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.

Cinnamic Aldehyde.—Natural, 17s. 6d. per lb.

Coumarin.—10s. 9d. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—9s. 6d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—3s. per lb.

Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—19s. per lb. Geraniol.—6s. 6d.—10s. 6d. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 16s. per lb.—(ex Shui Oil) 12s. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. per lb.—(ex Shui Oil) 14s. 6d. per lb.

Methyl Anthranilate.—9s. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—36s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—11s. per lb.

Rhodinol.—28s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—17s.—18s. 6d. per lb. Good demand.

ESSENTIAL OILS

Almond.—11s. 6d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—11s. 3d. per lb.

Camphor.—63s. 6d. per cwt. Cananga, Java, 22s. 6d. per lb.

Cassia, 80/85%.—8s. 9d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 20s. 9d. per lb. Lemon.—11s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 10s. 3d. per lb. Japanese, 8s. 6d. per lb. Petitgrain.—8s. 3d. per lb. Sandalwood.—Mysore, 26s. per lb., Australian, 17s. 3d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than May 21st. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on April 7th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Allis-Chalmers Manuf. Co. Crushers. 7213. Mar. 15. (U.S., 24.4.28.)

Arnot. Filters. 7386. Mar. 17.

Chappuis. Furnaces. 7454. Mar. 17. (Fr., 20.3.26.)

Hutchins. Production of lumps etc. of agglomerated material. 7106. Mar. 14.

I.-G. Farbenind. Preparation of emulsions. 7652. Mar. 19.

Jacobsen. Separation of solids from air etc. 7372. Mar. 17.
 Morris. Pulverising etc. apparatus. 7423. Mar. 17.
 Pyrene Co., Ltd. Low freezing-point solutions. 7074.
 Mar. 14. (U.S., 14.3.26.)
 Rice. Drying apparatus. 7071. Mar. 14.
 Salerni. Heating or cooling liquids, gases, etc. 7209.
 Mar. 15.

Spencer-Boncourt, Ltd., and Vaughan. Plant for recovering waste heat. 7094. Mar. 14.

Stevens. Apparatus for drying, heating, or cooling 7527.
 Mar. 18.

I.—Complete Specifications

30,636 (1925). Akt. Separator. Edge filters. (244,111.)
 31,122 (1925). Marks (Karrner Engineering Corp.). Treating hygroscopic materials. (267,215.)
 13,830 (1926). Exeelsior Feuerlöschergeräte A.-G. Producing fire-extinguishing foam. (254,285.)
 14,651 (1926). Godel. Separation and recovery of gases and vapours by solid absorbents. (267,369.)
 26,926 (1926). Schleifenbaum et Cie., and Irmer. Grinding or pulverising mills. (267,426.)
 31,130 (1926). Grueber Maschinenbau A.-G., and Pfeiffer. Ball or tube mills. (262,785.)
 *6899 (1927). I.-G. Farbenind. Manufacture of emulsions. (267,534.)
 *6966 (1927). I.-G. Farbenind. Production of catalysts. (267,554.)
 *7074 (1927). Pyrene Co., Ltd. Low freezing-point solutions. (267,561.)

II.—Applications

Anglo-Persian Oil Co., Beale, Coxon, and Dunstan. Treatment of liquid hydrocarbons. 7180. Mar. 15.
 Arnold (Standard Development Co.). Apparatus for cracking hydrocarbons. 7115. Mar. 14.
 Bowater. Manufacture of water gas. 7438. Mar. 17.
 Canning and Clark. Manufacture of coal gas. 7216. Mar. 15.
 Clark. Manufacture of gas. 7032. Mar. 14.
 Hansgirt and Stransky. Cracking hydrocarbon oils. 7474. Mar. 17. (Austria, 18.3.26.) Refining hydrocarbon oil distillates. 7475. Mar. 17. (Austria, 18.3.26.)
 Holzverkohlungs-Ind. A.-G. Fuel for internal-combustion engines. 7600. Mar. 19. (Ger., 20.7.26.)
 John. Extracting oil from coal etc. 7600. Mar. 18.
 Kousnetzoff and Mirlesse. Regeneration of lubricating oils. 7075. Mar. 14. (Fr., 7.4.26.)
 Lyne. Apparatus for gas manufacture. 7227. Mar. 15.
 Menell. Retort for distilling solid fuels etc. 7487. Mar. 17.
 Mond (Metallbank und Metallurgische Ges.). Producing rich gas and semi-coke. 7214. Mar. 15.
 Oliver. 7003. *See* XII.
 Salerni. Heat treatment of carbonaceous etc. materials. 7205. Mar. 15. Gas-scrubbers etc. 7245. Mar. 15.
 Distillation of carbonaceous materials. 7353 and 7370.
 Mar. 16. Manufacture of briquettes. 7455. Mar. 17.
 Schroter. Dewatering peat. 7586. Mar. 18.
 Wade (Silica Gel Corp.). Refining liquid hydrocarbons. 7117. Mar. 14.
 Wegelin. Production of active charcoal. 7212. Mar. 15.

II.—Complete Specifications

24,747 (1925). Evans, and Wakefield & Co., Ltd. Oils and the treatment thereof. (267,174.)
 28,329 (1925). Donnelly. Conversion of heavy or complex hydrocarbon oils into lighter oils. (243,339.)
 31,572 3 (1925). Naugle. Treating carbonaceous material. (267,240 -1.)
 12,072 (1926). I.-G. Farbenind. Manufacture of liquid fuels. (252,019.)
 13,524 (1926). Henry. Ionising-retort. (267,358.)

13,895 (1926). I.-G. Farbenind. Obtaining light oils by washing gases. (254,287.)

13,973 (1926). Todd and Sumpf. Conversion of mineral oils etc. of high b.p. into aliphatic hydrocarbons of low b.p. (267,364.)

18,530 (1926). Haddan (Gulf Refining Co.). Production of lower-boiling distillates from higher-boiling petroleum hydrocarbons. (267,386.)

32,325 (1926). Stettiner (Hamotte-Fabrik. Coking or carbonising ovens. (263,801.)

*6297 (1927). Kohlenveredlung A.-G. Producing gas. (267,505.)

*6409 (1927). Soc. Internat. Des Proc. Prudhomme-Houdry Plant for the manufacture of synthetic liquid fuels. (267,512.)

*6700 (1927). I.-G. Farbenind. Manufacture of hydrogen (267,535.)

III.—Application

Wade (Silica Gel Corp.). 7117. *See* II.

III. Complete Specification

13,525 (1926). Henry. Manufacturing benzol and like aromatic hydrocarbons. (267,359.)

IV.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of copper compounds of substantive azo compounds. 7570. Mar. 18.

I.-G. Farbenind. Metallic compounds of *o*-hydroxyazo dyestuffs. 7439. Mar. 17. (Ger., 31.3.26.) Production of vat dyestuffs. 7440. Mar. 17. (Ger., 8.10.26.)

Johnson (I.-G. Farbenind.). Production of vat dyestuffs. 7062. Mar. 14. Production of derivatives of N-dihydro-1:2:1'-2' anthraquinonazine fast to chlorine. 7562. Mar. 18.

Scottish Dyes, Ltd., Anderson, Thomas, and Thomson. Production of dyestuff intermediates. 7583. Mar. 18.

Standfast Dyers & Printers, Ltd., Jones, and Kilby. Dyes and dyeing. 7235. Mar. 15.

IV.—Complete Specifications

25,438 (1925). Imray (Soc. Chem. Ind. in Basle.). Manufacture of vat dyestuffs and intermediates. (267,177.)

11,084 (1926). I.-G. Farbenind. Manufacture of condensation products containing sulphur. (252,694.)

14,256 (1926). Carpmael (I.-G. Farbenind.). Manufacture of oxycarboxy-*p*-diammodiarylsulphones and of oxycarboxy-*p*-aminooxydiarylsulphones. (267,366.)

16,244 (1926). I.-G. Farbenind. Manufacture of tetrahalogen-4:4'-dimethylthioindigos. (254,340.)

16,674 (1926). I.-G. Farbenind. Manufacture of hexa-substituted thioindigos. (254,743.)

V.—Applications

Dreaper. Viscose solutions etc. 7640. Mar. 19.

Gminder. Obtaining fibrous material from stalks. 7485. Mar. 17.

Heymann. Artificial silk. 7238. Mar. 15.

I.-G. Farbenind. Treatment of fibres etc. 7060. Mar. 14. (Ger., 18.3.26.)

Pringsheim. Depolymerising acetyl cellulose. 7199. Mar. 15. (Ger., 15.3.26.)

V.—Complete Specifications

31,409 (1925) and 18,013 (1926). Walker. Manufacture of cellulose. (267,226.)

*31,731 (1926). Gminder. Fibres. (267,470.)

*6711 (1927). Soc. Anon. Appareils et Evaporateurs Kestner. Recovery of caustic soda from residual lyes after manufacture of artificial silk. (267,536.)

*7199 (1927). Pringsheim. Depolymerising acetyl cellulose. (267,569.)

VI.—Applications

Adolph and Pietzsch. Bleaching. 7076. Mar. 14. (Ger., 29.3.26.)

Durand et Huguenin Soc. Anon. Products for dyeing etc. textile fibres etc. 7458. Mar. 17. (Ger., 17.3.26.)

Johnson (I.-G. Farbenind.). Production of fast yellow dyeings etc. 7563. Mar. 18.

King. Dressing textiles. 7124. Mar. 14.

Standfast Dyers & Printers, Ltd., Jones, and Kilby. 7235. See IV.

VII.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of complex bodies containing mercury. 7339. Mar. 16. Manufacture of complex metallic etc. compounds. 7470. Mar. 17. Manufacture of phospho-tungsto-molybdenum compounds etc. 7496. Mar. 17.

Dalozé. Manufacture of lead carbonate. 7661. Mar. 19. (Fr., 3.7.26.)

Holzverarbeitungs-Ind. A.-G. 7541. See XX.

Krebbs. 7072. See XI.

Mulliez Frères et Cie. 7657. See IX.

VII.—Complete Specifications

28,509 (1925). Waring, and Assoc. Lead Manuf., Ltd. Manufacture of lead oxide. (267,191.)

31,008 (1925). Cederberg. Apparatus for catalytic combustion of mixtures of ammonia and oxygen. (244,134.)

31,328 (1925). Cochrane Corp. See XXIII.

31,901 (1925). Johnson (I.-G. Farbenind.). Recovery of sulphur. (267,246.)

14,274 (1926). Roessler & Hasslacher Chem. Co. Manufacture of sodium peroxide. (265,124.)

27,946 (1926). Allegem. Ges. f. Chem. Ind. Eliminating water from liquid sulphurous acid. (261,732.)

*5610 (1927). Lederer, Stanczak, and Kassler. Precipitating metal hydroxides free from iron. (267,491.)

*6477 (1927). Kyber. See X.

*6700 (1927). I.-G. Farbenind. See II.

*6711 (1927). Soc. Anon. Appareils et Evaporateurs Kestner. See V.

*6996 (1927). Merck & Co. Iodine compositions. (267,557.)

*7072 (1927). Krebs. See XI.

VIII.—Complete Specifications

29,606 (1926). Brit. Thomson Houston Co., Ltd. Moulding silica. (262,110.)

1845 (1927). Brit. Thomson Houston Co., Ltd. Treating silica articles. (264,863.)

IX.—Applications

Asphalt Cold Mix., Ltd., Gabriel, and Levy. Bituminous emulsions. 7471. Mar. 17.

Gardiner. Preservation of timber. 7644. Mar. 19.

Kahl, and Rutgerswerke A.-G. Production of labile bitumen emulsions. 7598. Mar. 18. (Ger., 13.8.26.)

Mulliez Frères et Cie. Manufacture of lime or cement products etc. 7657. Mar. 19. (Fr., 20.3.26.)

Scheidhauer & Giessing A.-G., and Ackermann. Manufacture of bricks. 7393—4. Mar. 17. (Ger., 17.3.26.)

IX.—Complete Specifications

31,184 (1925). Spuckman. Making hydraulic cement. (244,756.)

20,029 (1926). I.-G. Farbenind. Manufacture of acidproof cementing-compositions. (267,396.)

*6477 (1927). Kyber. See X.

X.—Applications

Bradbury & Hall. Aluminium alloy. 7429. Mar. 17.

Cole. Protecting iron from rust. 7681. Mar. 19.

Cörsalli. Melting metals. 7665. Mar. 19. (Ger., 19.3.26.)

General Motors Corp. Electrolytic deposition of chromium. 7594. Mar. 18. (U.S., 30.6.26.)

Kelly. Alloys. 7411. Mar. 17.

Krupp A.-G. Non-magnetic cast iron. 7535. Mar. 18. (Ger., 9.7.26.) Sintered hard metal alloys etc. 7536 and 7542. Mar. 18. (Ger., 25.10.26.)

Oberhoffer and Piwowarsky. Production of high-grade iron etc. 7315 and 7327. Mar. 16. (Ger., 18.3.26 and 15.7.26.) Production of alloys. 7532. Mar. 18. (Ger., 18.3.26.)

Twynam. Recovery of tin from scrap etc. 7388. Mar. 17.

X.—Complete Specifications

27,887 and 27,922 (1925). Rheinische Metallwaren- und Maschinenfabrik. Case-hardening of steel articles. (242,978 and 244,431.)

32,934 (1925). Automatic & Electric Furnaces, Ltd., and Wild. Heat-treatment of iron and steel. (267,253.)

1732 (1926). Guertler. Silver alloys. (267,263.)

20,777 (1926). Metals Protection Corp. Chromium plating. (267,080.)

23,510 (1926). Mitchell. Extrusion of metals. (267,412.)

28,338 (1926). Carpmæl (I.-G. Farbenind.). Treatment of minerals, slags, or the like. (267,433.)

*6477 (1927). Kyber. Manufacture of iron phosphide and fused cement. (267,518.)

*6740 (1927). Michelsen. Conversion of slags. (267,539.)

*6842 (1927). I.-G. Farbenind. Decomposing titanium ores. (267,547.)

XI.—Applications

Burlison and Dereham. Galvanic batteries. 7056—7. Mar. 14.

Comp. Lorraine de Charbons, Lampes, et App. Electriques. Manufacture of electric cell carbons. 7452. Mar. 17. (Fr., 16.2.27.)

Cornish. Electrolyte for rectifying alternating electric current. 7409. Mar. 17.

General Motors Corp. 7594. See X.

Krebs. Apparatus for electrolysing solutions of alkali chlorides. 7072. Mar. 14. (Ger., 15.3.26.)

Pechkranz. Electrolyser diaphragms. 7311. Mar. 16. (Switz., 14.5.26.)

XI.—Complete Specifications

30,845 (1925). Leitner. Electric accumulators. (267,205.)

20,605 (1926). Weissmann. Electric cells. (262,049.)

*7072 (1927). Krebs. Apparatus for electrolysing solutions of alkali chlorides. (267,560.)

XII.—Application

Oliver. Manufacture of concentrated emulsions of oil and water. 7003. Mar. 14.

XII.—Complete Specification

24,747 (1925). Evans, and Wakefield & Co., Ltd. See II.

XIII.—Applications

Alecock, Weber, and Laporte, Ltd. Titanium pigments. 7181. Mar. 15.

King and Threlfall. Materials for forming impregnating-agents etc. 7198. Mar. 15.

Sichel Kommandit-Ges. Manufacture of colour-binding means. 7217. Mar. 15. (Ger., 10.5.26.)

Trist. Composition for inking printing-rollers. 7685. Mar. 19.

XIII.—Complete Specifications

28,509 (1925). Waring, and Assoc. Lead Manuf., Ltd. See VII.

30,881 (1925). Whatmough. Manufacture of lake colours or pigments. (267,207.)

XIV.—Applications

Anode Rubber Co., Ltd. (Klein). Production of caoutchouc. 7341. Mar. 16.

Anode Rubber Co., Ltd. (Klein, Gábor, and Szegvári). Production of coherent caoutchouc etc. products. 7330. Mar. 16.

Carlsson. Regeneration of vulcanised rubber. 7248. Mar. 15.

Fessel. Manufacture of rubber. 7450. Mar. 17.

XVI.—Complete Specification

30,832 (1925). Owen. See XIX.

XVII.—Complete Specifications

31,505 (1925). Morgan. Extraction of juice from sugar cane. (267,234.)

31,575 (1925). Naugle. Refining raw sugar melts etc. (267,242.)

XVIII.—Application

Commercial Solvents Corp. Butyl-acetonic fermentation process. 7111. Mar. 14. (U.S., 3,426.)

XIX.—Application

Beus and Veen. Preserving food. 7037. Mar. 14.

XIX.—Complete Specifications

22,214 (1925). Matzka. Preserving fruit juices etc. (267,058.)

30,832 (1925). Owen. Dehydrating vegetable substances or organic products. (267,203.)

31,492 (1925). Kohman. Manufacture of bread. (244,480.)

22,983 (1926). Iscovesco and Adams. Vitamine-rich products. (267,410.)

XX.—Applications

Burgess and Morgan. Tellurium compounds for therapeutic etc. purposes. 7030. Mar. 14.

Commercial Solvents Corp. 7111. See XVIII.

Holzverkohlungs-Ind. A.-G. Concentrating volatile aliphatic acids. 7541. Mar. 18. (Ger., 17,526.)

I.-G. Farbenind. Production of aldehydes. 7061. Mar. 14. (Ger., 19,326.) Manufacture of condensation products. 7322. Mar. 16. (Ger., 16,326.)

Rupe. Manufacture of unsaturated aldehydes. 7460. Mar. 17. (Switz., 22,326.)

XX.—Complete Specifications

22,355 (1925). Carpmæl (Bayer & Co.). Manufacture of pharmaceutical products. (267,169.)

6167 (1927). Carpmæl (Bayer & Co.). Manufacture of quinoline derivatives. (267,457.)

*16,060 (1926). Eckermann. Decreasing the toxic action of cocaines. (267,463.)

XXI.—Application

Tarbin. Colour photography. 7489. Mar. 17. (Ger., 1,227.)

XXII.—Application

Luis. Explosives. 7573. Mar. 18.

XXIII.—Application

Du Pont de Nemours & Co. Disinfectants. 7595. Mar. 18. (U.S., 18,326.)

XXIII.—Complete Specifications

31,328 (1925). Cochran Corp. Production of base-exchange substances. (245,092.)

8916 (1926). A.-G. f. Stickstoffdünger. Purifying boiler feed-water. (250,574.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Argentina*: Paper (B.X. 3322). *Belgium*: Pig iron (291); steel castings, rolled steel (292); pharmaceutical goods (293). *Brazil*: Tinplate, galvanised iron sheets, iron and steel (320). *British India*: Tinplate (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Bulgaria*: Rubber, tinplate, iron, metallurgical coke (297). *Canada*: Quartz mining supplies (286). *France*: Soaps (299).

New Zealand: Cast iron (287). *Northern Ireland*: Artificial silk yarns (288). *Poland*: Tin, nickel, copper, mercury (316). *South Africa*: Leather belting, impregnated rubber belting (B.X. 3355). *Turkey*: Gas and oil engines, pumps, indiarubber goods, refrigerating machinery (317). *United States*: Colloidal clay, high-grade china clay, ball clay (B.X. 3347).

Milan Sample Fair

The eighth Milan Sample Fair will be open from April 12 to 27. About 6000 exhibitors are showing, the total area taken being 300,000 sq. metres. Fourteen of the most important nations have erected permanent pavilions.

News from Advertisements

A chemical engineer, experienced in the production of acetate silk, is wanted for abroad (p. viii).

A mineral analyst with British, Colonial and Chinese experience of buying ores desires responsible appointment (p. viii).

An artistic bungalow is offered for sale (p. viii).

PUBLICATIONS RECEIVED

A STANDARD MANUAL OF BREWING AND MALTING AND LABORATORY COMPANION. By J. Ross-Mackenzie, F.C.S., F.R.M.S. Pp. xxiii+412. London: Crosby Lockwood & Son, 1927. Price 45s. net.

FOURTH REPORT OF THE JOINT BENZOLE RESEARCH COMMITTEE OF THE NATIONAL BENZOLE ASSOCIATION AND THE UNIVERSITY OF LEEDS. Pp. 248. London: The National Benzole Association, Wellington House, Buckingham Gate, S.W.1, 1927.

THE MICROBIOLOG OF CELLULOSE, HEMICELLULOSES, PECTIN AND GUMS. By A. C. Thaysen and H. J. Bunker. Pp. 363. London: Oxford University Press, 1927. Price 25s. net.

GMEIN'S HANDBUCH DER ANORGANISCHEN CHEMIE. 8th new and revised edition. Lithium. System No. 20. Pp. xxiv+254. Published by the Deutsche Chemische Gesellschaft. Edited by R. J. Meyer and collaborators. Berlin: Verlag Chemie, G.m.b.H., 1927. Price, subscription 28.50 m., published 37.50 m.

SELENIUM. A LIST OF REFERENCES, 1817—1925. Compiled by Marion Foster Doty. Pp. 114. New York: The New York Public Library, 1927.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE. BUREAU OF MINES. MINERAL RESOURCES OF THE UNITED STATES, 1925. Washington: Government Printing Office, 1926—27:—Abrasive Materials. By F. J. Katz. Asbestos. By B. H. Stoddard. Clay and Gypsum. By J. Middleton. Chromite and Mercury (Quicksilver). By J. W. Furness. Lead and Zinc Pigments and Salts. By J. A. Stader and A. Stoll. Magnesium and its Compounds. By J. M. Hill. Mica. By W. M. Myers and B. H. Stoddard. Potash, Slate, and Stone. By A. T. Coons. Price 5 c. each.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE. BUREAU OF MINES. Washington: Government Printing Office, 1926:—Effects of the Corona Discharge on Petroleum. By J. J. Jakosky. Technical Paper 375. Pp. 21. Price 10 c. Electric Shot-firing in Mines, Quarries, and Tunnels. By L. C. Hsley and A. B. Hooker. Bulletin 240. Pp. ix+139. Price 35 c. Lead Poisoning in the Mining of Lead in Utah. By A. L. Murray. Technical Paper 389. Pp. 40. Price 10 c. Recovery of Molybdenite from the Ore. By H. A. Doerner. Technical Paper 399. Pp. 13. Price 5 c.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW
SERIES**

LONDON, APRIL 8, 1927

No. 14

EDITORIAL

The Oil and Colour Chemists

WE have become so accustomed to pleasant company and good cheer when the members of the chemical fraternity dine together that we have high expectations when a further dinner is held. Indeed, it might well be claimed that chemists were facultative Frothblowers long before that august body had been thought of. The dinner of the Oil and Colour Chemists was no exception amongst our pleasant memories, and we were once more blessed in that our expectations were not disappointed. There were some good speeches, there was music of a discrete, carminative kind, and the ailments were provided by the Hotel Cecil. There were one or two features which were peculiar to the evening. Sir Frank Heath, who, as our readers are aware, is severing his connexion with the Department of Scientific and Industrial Research, announced, in the course of an interesting speech, that the occasion was the last on which he would speak as the representative of the Department. The splendid work which Sir Frank Heath has done and his powers as an organiser and as an administrator are demonstrated by the Department itself. No words of ours could add anything to his reputation or to the gratitude which he has earned equally from science and from industry. The Society of Chemical Industry was, as one would expect, well represented, as the President, Mr. F. H. Carr, C.B.E., and two Past-Presidents, Dr. E. F. Armstrong, F.R.S., and Mr. W. J. U. Woolecock, C.B.E., were present as guests of the Association. Mr. Carr, in his speech, referred to the new Research Association of British Paint, Colour and Varnish Manufacturers, and pleaded earnestly for the long view to be taken in planning out the research programme, for fundamental researches, which alone could ensure the future and steady progress of industry. Dr. Armstrong paid a well-deserved tribute to the President of the Association, Mr. C. A. Klein, and in a punning allusion, said there was nothing small about him except his name. Prof. H. E. Armstrong, who was also a guest, spoke by special invitation of the President, and sang the praises of linseed oil and white lead for outside work. Previously in the evening his distin-

guished son, Dr. E. F. Armstrong, had sung the song of cellulose lacquers, although in not so definite a major mode, and had pointed out that nobody has yet discovered what linseed oil really is. We were completely puzzled by these remarks, and the pleasure of our evening, otherwise delightful and interesting, was threatened by "a depression over Iceland" which arose from our inability to provide a solution.

Spectrum Analysis

Mr. Twyman's paper on "Metallurgical spectrum analysis" is published at a time when our attention has been otherwise directed to optical research and achievements. The Newton celebrations have reminded the whole nation of the life of a man who made important discoveries in mathematics and astronomy, almost founded the science of optics, took an intelligent interest in chemistry, philosophy and religion, and reformed our coinage. As Mr. Twyman points out, Newton's discovery of the dispersion of light was the first step towards spectrum analysis; other steps were taken in this country by that singular man Wollaston, by Brewster and Talbot, and more recently by Fowler, all of whom have made notable advances in this science. Mr. Twyman is acknowledged as an expert on the subject, and his paper, read before the Birmingham and Midland Section a month ago, is an admirable account of the use of this method of analysis as a speedy method of detecting and estimating the impurities and components of alloys. The division of spectra into flame spectra, arc spectra, spark spectra, and so on is convenient in practice: theoretical investigations indicate that it is the outer electrons which have most to do with the production of spectra, that the flame and arc spectra are produced by the normal atom, that the spark spectrum is produced by atoms which have been deprived of one electron, and that other anomalous spectra can be emitted in suitable circumstances by atoms which have lost two or even three electrons. Within our recollection the study of spectrum analysis has made astonishing progress. It must be thirty years or more since Sir William Ramsay delighted us by showing us in his laboratory the recently

discovered spectrum of helium; since then the spectra of a few of the simpler elements have been resolved into the well-known series of Lyman, Balmer, Paschen, and Brackett, or the modifications of one or more of these suggested by Rydberg, Hicks and others. The practical side of spectrum analysis has hardly made so much progress as the theoretical side; Mr. Twyman's paper shows us how the practical side should be developed and can be developed.

The American Petroleum Industry

Petroleum production in the United States is steadily increasing every year, and notwithstanding the fact that some prophets thought that 1923 would prove the peak year of production, after which a decline would be noticeable, we find that, during 1926, three further important and highly productive new fields have been found in Smackover, Panhandle and Semmore. Quite a number of other small pools have also been found, with the result that not only was the high production of previous years maintained, but a record achievement in production of about 770,000,000 barrels has been realised. Other countries have also increased their production considerably, including Rumania and Russia, and in view of such high production in America, Prof. Ise's recently published book on the United States oil policy is of particular interest. The book itself is reviewed in another column, and one cannot help but agree with Prof. Ise's long-sighted view, that the profligate use or misuse of such a valuable product as petroleum should be deprecated. One, however, wonders whether sacrifices which we may make in our generation for generations to come may not after all retard progress considerably. Are we properly grateful to past generations for not having used up all the tallow in their candles to provide us with enough to light our way? or should we be accused of profligacy for not using candles for lighting to-day and using up valuable natural resources such as either coal or oil which are being used for the manufacture of electric light? Prof. Ise is of opinion that, as the United States has supplied the whole world with oil, they may find themselves in a difficult position later on, when perhaps they may have to go abroad for oil. Would it be so very dreadful if we suggested that in a generation or two oil itself may be placed in the same category as we now place the tallow candle of a generation or two ago? And supposing the United States should have to go abroad for its oil? Would not the United States, whose great prosperity is being accepted as a matter of course, be always in the position of being able to get what she wants when it comes to a question of competitive buying? Would she not be even then in a better position than the rest of the impoverished world? Prof. Ise suggests that the United States should have an equal share with other countries, perhaps more particularly with England and France, of any oil to be found elsewhere, and suggests that the United States Government should press for recognition of such a claim; but is the United States Government prepared to pay, both in life and treasure, for the protection and retention of potential fields found in other countries? This question of "the open door"

does not somehow coincide with their own "Monroe Doctrine," and we do not think that Government pressure or Government interference will be of great assistance to trade. American business men are as capable of taking care of themselves abroad as they are in their own country, and seeing the vast capitalistic resources which they control, Prof. Ise can quite safely leave it to them to see that future generations are not left in want. There is, however, another aspect, and that is, just as the last decade or two in the last century and the first quarter of the present century has seen such great scientific progress, so it may well be assumed that science will advance with as rapid strides during the next half century, and that fifty years hence we may regard oil as a very obsolete fuel, whether cheap or otherwise.

Applied Research

Dr. H. Moore, in his address to the British Non-ferrous Metals Research Association, deals with many subjects, including that ever-present one, the mating of pure science with utilitarian demands. We think his address is well worth study: with the greater part of it almost everyone must agree. It seems hard to believe that in metallurgy or chemistry anyone will now consider that research in applied science is inferior to research in pure science, but it is wise to give due emphasis to the point as Dr. Moore does. His advice on the procedure of applied research will, we think, be useful. We are sorry to read the advice that all information, whatever its source, should be examined critically, and that serious errors are to be found in scientific papers published in the most reputable periodicals, while text-books are almost notorious in this respect. We are sorry to read this because, although we have ourselves on sundry occasions encountered statements in reputable periodicals and text-books which we were unable to believe, we attributed this mainly to our own lack of faith, and it is disturbing to find that really competent judges, for instance, directors of research, also find it difficult to believe statements which you may find in many of those scientific treatises, without which no gentleman's library is complete. If you are buying a horse in Yorkshire, a lead-mine in Wales, or an overcoat in Houndsditch, you may disregard nine-tenths of what the vendor has to say: the remaining tenth will be found to be untrue. With due modification of the proportions, and excepting statements appearing in this JOURNAL, and those made by our own particular friends, we should advise those who undertake research on scores of simple problems we have heard of to adopt the same mental attitude; by all means read something of what is supposed to be known about the problem, but do not assume that a process is possible because it is described or is impossible because it conflicts with the views of every sane man. Ramsay would never have discovered helium or Mme. Curie radium had they not been unwilling to believe what everyone else did believe. And if the truth were known, it may well be that Perkin was told in his early days that his proposed method of making quinine was no good and would turn out to be a waste of time.

METALLURGICAL SPECTRUM ANALYSIS

By F. TWYMAN, F.R.S.

(Continued)

Solids, including powders.—The specimens for sparking are held in clips in an adjustable holder. This holder suffices for metals, alloys or conducting minerals. If the specimens consist of non-conducting powders (such as those of slags, precious stones, stony minerals, glasses, precipitates or residues from solutions), there should be added a small cup of platinum about 20 mm. diameter and 5 mm. deep, held in the lower clamp by a wire of the same metal, the cup being heated in the flame of a Meker burner. A stout platinum wire leads the spark from the upper clamp to the platinum cup, in which the powder or powdered mineral is mixed and fused with about four times its weight of sodium or lithium carbonate—these salts being chosen because of the simplicity of their spectra.

Liquids.—If the samples are in the form of solutions, the sparking tubes of Hartley or of Pollok may be

The set of photographs develops up like that shown in Fig. 4, in which the top spectrum is of tin supposed to be pure, the middle is a commercial tin under examination, and the bottom is of lead, the metal whose presence or absence is in question. It will be seen by the presence of the sensitive lines of wavelengths 2614, 2663, 2803 and 2833, not only that the commercial tin contains some lead, but also, as shown by line 2833, that a trace of lead is present in the supposedly pure metal. It is not, of course, necessary to adopt this precise arrangement of spectra, but it is one that is very frequently convenient.

If examinations for the presence of other metals require to be made on the same sample or if other samples are to be tested, the same plate can be used by racking the dark slide to a fresh position, and as many as six strips (that is, eighteen spectra in all), will easily go on a single plate.

In this way, and in other ways which I will not stop to describe, the entire metallic constituents in an alloy, mineral, ash, or whatnot, can be readily and quickly identified.

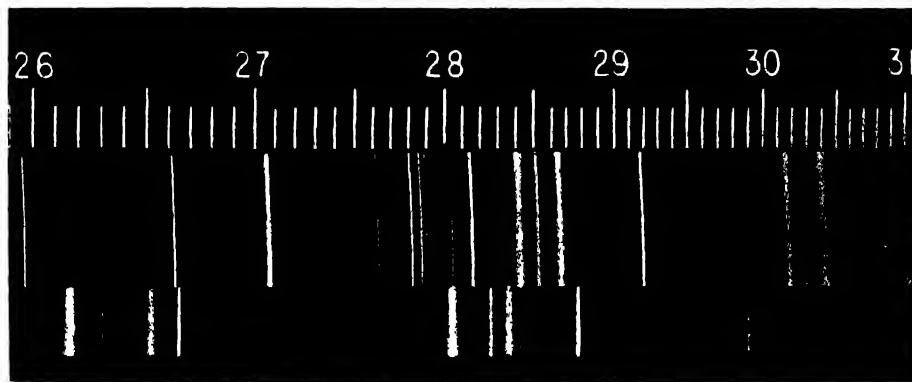


FIG. 4.

adopted (see "Wavelength Tables for Spectrum Analysis," by F. Twyman, Adam Hilger, Ltd.).

So much for how the sample is made to emit the light. Next I will describe very briefly the means of identifying the lines of the various elements.

COMPARISON SPECTRA

Here is a photograph (Fig. 4) in which the spectra of several samples are shown close together. These spectra are taken one after the other on the same plate without any readjustment of the spectrograph. If there are any constituents common to two or more of the samples the spectrum lines of those constituents will appear in the corresponding spectra. Spectra so arranged are called "comparison spectra."

To ascertain whether a substance contains a specified metal—Three spectra are taken, of which the first is that of any metal which is known to be present in considerable quantity, or if none such be known then one of the purest iron obtainable; the second that of the sample under test; while the third is that of the metal whose presence or absence is to be determined.

PART II.—QUANTITATIVE SPECTRUM ANALYSIS

Variation of intensity with content

We have seen how Hartley, with his co-workers, endeavoured to found a quantitative method of spectrum analysis on the observation of the amount of dilution to which a solution could be submitted before the disappearance of certain distinctive lines which he called "persistent" lines. The method has the disadvantage that a solution must be made up and the avoidance of the making-up of solutions is among the advantages of spectrum analysis.

Of recent years, therefore, attempts have been made in the laboratory of Adam Hilger, Ltd., and elsewhere, to found a method of quantitative analysis on observations of the varying intensities of the spectrum lines with the proportion of the corresponding ingredients. It is true attempts of the kind were made many years ago, and were not very successful. Recent attempts, however, have been more so.

If we take any range of percentages of particular impurities in a particular metal we shall find that there are certain lines which do not alter much in intensity, whilst

there are usually other lines which alter rapidly in intensity. Obviously, in attempting a quantitative determination of a substance which is present in approximately say, 10%, we should utilise for our observations not the lines which do not alter in intensity round about that percentage, but those which do. These are not generally the persistent lines or "raies sensibles" and, since there has been no large accumulation of data relative to these variable lines of a character similar to that accumulated by Hartley, de Gramont, and so forth for the persistent lines, each observer will usually, for the time being, find it necessary to accumulate the data for himself. A certain amount of such information has been collected in the laboratory of Adam Hilger, Ltd., and I will now give a brief account of some of the examples of quantitative analysis the routine of which has been worked out.

The instrument used by us is the quartz spectrograph, usually the size shown in Fig. 2. Either the arc or spark spectrum is used for this work, and in most cases the arc method is both simpler to use and more sensitive in detection.

A convenient form of arc is obtained by using two electrodes of the metal under examination, and maintaining an arc about $\frac{1}{16}$ in. in length by a current of about 3 amps. This can be obtained, using a D.C. supply of 220 volts and placing in series with the arc a lamp resistance having three or four 50-c p. carbon filament lamps in parallel. It is preferable to have both electrodes of the same material, as in that case no impurities except those in the material are introduced. If only one piece of a sample of metal is available, such as copper, it is advisable to use the sample as positive electrode and a rod of the purest copper obtainable as negative electrode. In the same way for analysing steel samples the negative electrode would be pure iron. This method has the disadvantage that the intensities of the impurity lines are less than would be the case if both electrodes were of the same material.

In the case of the spark, using an A.C. supply of 150 volts and transformer as described above, a satisfactory spark will be obtained (about $\frac{1}{16}$ in. in length) by placing 4 lamps in the lamp board, and thus is the procedure which has been regularly adopted.

The most suitable shape of spark electrodes is wedge-shaped, so that they can be mounted in the holders with the edges of the wedge parallel to, and in line with the axis of the collimator. This arrangement gives a steady image on the slit. Whatever the shape of the electrodes, however, it is advisable to mount them in the holders, so that the discharge takes place either in this manner, or from two points, so as to obtain an image on the slit which does not wander.

Where the sensitive lines used in analysis lie towards the ultraviolet end of the spectrum the ordinary condensed spark generally proves satisfactory, but when the lines occur towards the visible part of the spectrum trouble arises from the "air lines" (lines due to oxygen and nitrogen) which may mask the lines of the material, especially if these are faint. To remove these air lines from the spectrum a self-induction coil is placed in series with the spark.

This method of quantitative spectrographic analysis

is based on the appearance and variation of intensity of selected lines in the spectra of standard samples. As the percentage of impurity increases, other lines than the sensitive lines of de Gramont begin to appear, these lines showing an increase in intensity as the amount of impurity increases. These lines are readily identified by photographing a comparison spectrum of the impurity itself. It has been found, as explained above, that the actual "raie ultime," or "raie sensible," which appears when only traces of the impurity are present, is not always the best line to use in quantitative work. Any lines which appear with certain percentages of the impurity, and show a systematic variation of intensity can be used, and those are best which vary most rapidly with variation of percentage.

In the preparation of standard alloys containing definite percentages of each metal, the Ajax-Northrup induction furnace is recommended by the Bureau of Standards (B.S. Sci. Paper No. 444. "Practical Spectrographic Analysis"—Meggers, Kiess and Stinson.) Homogeneity of the alloys and minimum loss from volatilisation and freedom from contamination are then ensured. The purity of the metals used in the preparation of these synthetic alloys can, of course, be checked by spectrographic methods.

Having standard samples whose impurity contents are accurately known, their arc spectra are photographed in juxtaposition on a Hilger medium quartz spectrograph E3. The wavelength scale (which is photographed directly on to the plate) facilitates the identification of the sensitive lines in the spectra: but to make the identification still easier, a further spectrum can be photographed, namely, that of a sample of the metal for which estimations are to be carried out. In the various spectra these sensitive lines will decrease in intensity as the percentage of impurity is decreased, and in some cases will disappear. Hence, using these spectra as standards, spectra of any samples of a like composition can be compared with them and estimations made within the range of the standard samples. It sometimes happens that a sensitive line due to the impurity occurs fairly close to a line of the metal containing that impurity. In this case the estimation is considerably simplified, as the line due to the main bulk of the metal serves as an intensity standard, and any errors which may arise from differences in exposures and developing are eliminated.

This procedure has been clearly pointed out by W. Gerlach; it is identical with that used in the laboratories of Adam Hilger, Ltd., wherever possible.

Two lines of the impurity are not compared with one another, but one (or more) lines of the impurity B with one (or more) neighbouring lines of the substance containing it, as far as possible equal in intensity. A single ideal case will serve to illustrate this. Near a spectrum line λB of the impurity B occur three lines of the main substance A, $\lambda_1 A$, $\lambda_2 A$, and $\lambda_3 A$. Adopting these three lines as standards one finds that the intensity of the λB line

At 0.1% B is equal to $\lambda_1 A$
 „ 0.2% B „ $\lambda_2 A$
 „ 0.05% „ $\lambda_3 A$

Then in the analysis of the substance $A + x\% B$ the

quantity x is determined from the brightness of the B line relative to $A_1 A_2 A_3$. This method is already well developed, and gives results whose accuracy increases as the range between the standards decreases. Also it is independent of photographic effects."*

As a result of spectrographic investigations which have been carried out in the Hilger laboratories with various metals, it may be stated that one can distinguish between 0.001%, 0.01%, 0.1% and 1.0% of any metallic impurity by such comparisons of the intensities of the lines; while in favourable cases a very much higher accuracy is attained. The estimation is, of course, very rapid—one half hour will suffice for the whole procedure of photography, developing, and estimation; and the plate forms a permanent record of the whole metallic contents of a sample.

The tables of de Gramont are useful whether the arc or spark be used, since the lines which are persistent in the spectrum of the spark are persistent also in that of the arc. At the same time it should be observed that where one is dealing with a small quantity of metal of high melting point (such as iron or nickel) in a metal of low melting point (such as copper or aluminium) the arc is not so sensitive as a means of detection of impurity, the reason probably being that there is an insufficient quantity of the vapour volatilised in the arc, the temperature of which is low as a result of the low boiling point of the main bulk of the metal.

Specific Examples

Impurities in copper Bismuth is one of the most injurious elements that can be present in copper. It induces extreme brittleness in the copper, so much that not more than 0.005% of bismuth can be tolerated. According to W. Stahl (*Metall. u. Erz.*, 1925, **22**, pp. 421

2) as little as 0.02% Bi in copper renders copper hot-short, while 0.1% renders it cold-short, although the effect can be reduced to some extent by the addition of the requisite amount of antimony or arsenic. Bismuth occurs in the form of films between the copper crystals, and this is the reason of the brittleness.

Other impurities present in copper such as arsenic and iron seriously affect the electrical conductivity. Although the copper obtained by electrolytic refining is of exceedingly high purity, impurities are unavoidably introduced during subsequent remelting and casting.

When the amount of arsenic is small, it cannot be identified as a separate constituent under the microscope, but exists in what is called a solid solution. The consequence is in this particular case of arsenic in copper, that the mechanical properties of copper are not adversely affected until the amount of arsenic becomes considerable. On the other hand, the effect on the electrical conductivity is very great, because the presence of the arsenic atoms in the crystals themselves destroys the complete regularity of their structure and interferes with the passage of the electrons which carry the electric current." (Dr. Rosenhain, 5th Autumn Lecture to the Institute of Metals, September 1, 1926.)

The main difficulty in the chemical analysis of copper with respect to bismuth is that the method consists of

a very large number of manipulative processes, which necessarily reduce the chances of accuracy. The determination takes very considerable time, and in view of the small quantity which is usually present, and also in view of the fact that the methods are partly gravimetric, any great degree of accuracy is difficult to attain. In most instances it is desired to know rapidly what the percentage of bismuth in copper may be, so that rapid decisions regarding material can be reached, and the chemical methods are too tedious for this purpose to be achieved.

These chemical processes can be replaced by the comparatively simple spectrographic method, which is based on the intensity of the bismuth lines, wave-lengths

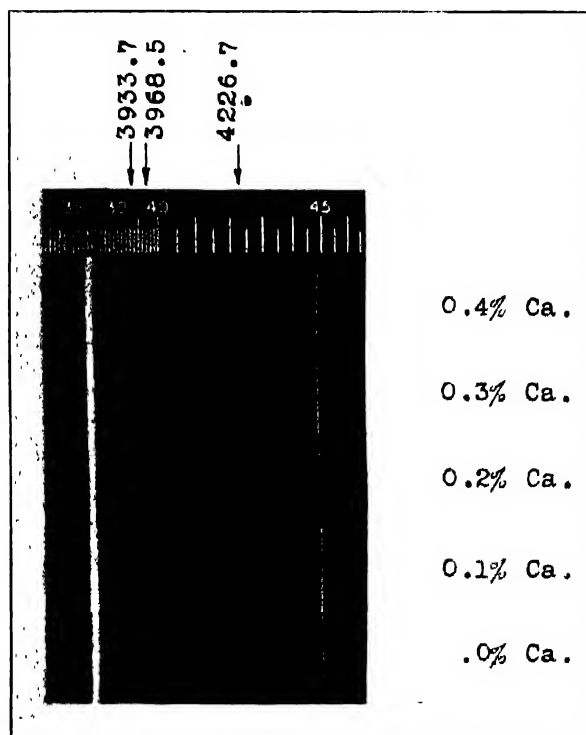


Fig. 5

3067.7 and 2898.0 Å, which appear in the arc spectra of copper samples containing bismuth.

The determination of calcium in magnesium. In the use of magnesium for light alloys it is customary to add calcium to retard the rapid oxidation of the molten surface during foundry operations. If much less than 0.1% be present, the calcium has but little of this desired effect, while if it is present in excess of 0.2% it is not only in excess of requirements but appears to be objectionable.

The accurate determination by chemical means of such small quantities of calcium is an extremely laborious process, and is also subject to uncertainty on account of the masking effect of the relatively large quantity of magnesium.

The quantitative spectrographic determination is, however, both rapid and reliable. A condensed spark

* Zur Frage der richtigen Ausführung und Deutung der Quantitativen Spektralanalyse, Zeits. f. anorg. und allg. Chemie. Band 142 Heft. 3 u. 4.

discharge is passed between two pieces of magnesium under test, a Hemsalech coil included in the circuit. Fig. 5 shows the increase in intensity of the calcium lines 3933.7, 3968.5 and 4226.7 Å as the percentage of calcium in the magnesium increases. This photograph was obtained on a Hulger E.3 spectrograph with 3 minutes' exposure for each spectrum.

The determination of aluminium in brass. Aluminium in brass increases the hardness of the material. Furthermore, brass containing aluminium is generally found difficult to forge. Beyond these facts, however, aluminium imparts a characteristically light colour to brass even when present in only small quantities, and this colour renders the brass unacceptable to many people.

Further examples of the quantitative spectrographic analysis of non-ferrous metals are given in "Practical Spectrographic Analysis" (Bureau of Standards Scientific Paper No. 444--Meggers, Kiess and Stimson); among them are:—

(a) *Analysis of tin used as fusible safety plugs for steamboat boilers*:—"The requirement that only minute quantities of the elements may be present in the metal used for plugs renders the chemical analysis difficult. When only small quantities of lead and zinc or bismuth and copper are present, they may both respond to the same chemical test for one of them, thus giving a wrong analysis. No such confusion is possible in the spectroscopic analysis, and from a study of the intensities of

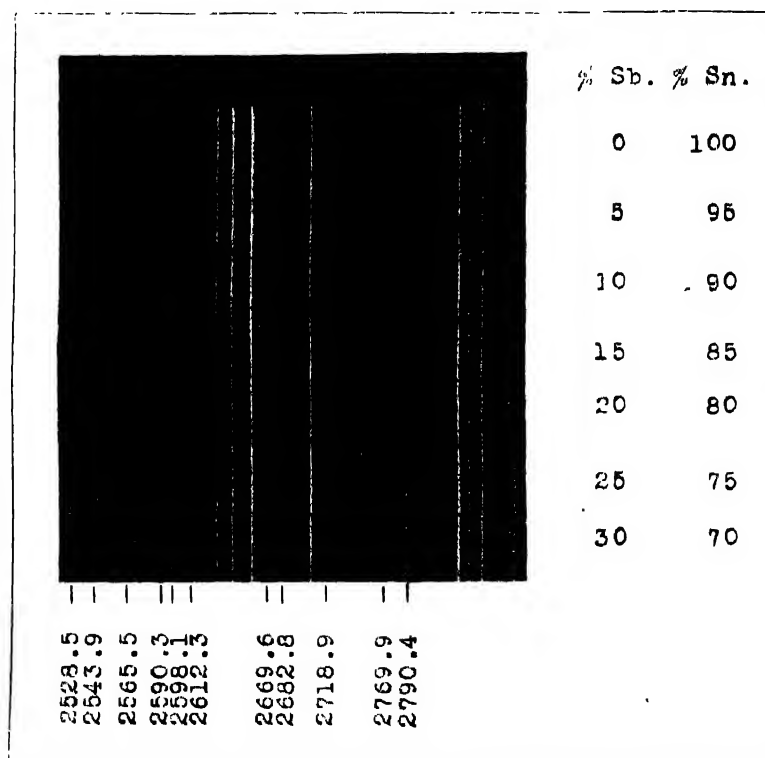


FIG. 6.

The difficulty in connexion with the determination of aluminium in brass, by chemical methods, is that it is a long and tedious process entailing a number of operations, whereas the spectrographic method is comparatively rapid.

Spark spectra of tin-antimony alloys.—Two minutes' exposure of the condensed spark discharge between small pieces of tin-antimony alloy samples is given. The increase in intensity of the sensitive antimony lines as the amount present increases to 30% in stages of 5% is shown in Fig. 6.

Determination of small quantities of impurities in lead.—The bismuth line 3067.7 Å and the copper doublet 3247.5 and 3274.0 Å can be used for the quantitative determination of small quantities of these metals.

the raies ultimes and other sensitive lines in the spectrum it is possible to determine very closely the amount of each present in the alloy."

(b) *Analysis of gold.*—"Chemical analysis for the determination of base metals in gold bullion, must of necessity be done by wet methods most carefully carried out on very large amounts of metal when only minute traces of the base metal are involved."

(c) *Analysis of platinum.*—"It is well known that certain physical properties of metals are extremely sensitive to traces of impurities which are not readily detected by chemical methods. This is of exceptional importance in the case of platinum which finds such wide use in precision measurements of temperature."

Spectra of various alloys illustrating the method are



FIG. 7.



reproduced and a detailed account of the technique and mode of procedure is given.

(3) STEEL ANALYSIS

The determination of chromium and manganese.—In obtaining the photographs reproduced, one minute's exposure of the arc between steel samples was given in each case, using a violet glass spectrograph, E. 43.

It is difficult to maintain a steady arc between ferro-chromium electrodes (containing 69.5% Cr) and thus the series of spectra of chromium steels reproduced in Fig. 7 has been obtained by using the sample as the positive electrode and a pure iron rod as negative electrode. In using pure iron as one electrode care has to be taken not to allow a bead of molten iron to adhere to the sample under investigation, otherwise the spectrum will be that of practically pure iron.

In the case of the series of spectra of manganese steels (reproduced in Fig. 8), both electrodes were of the same

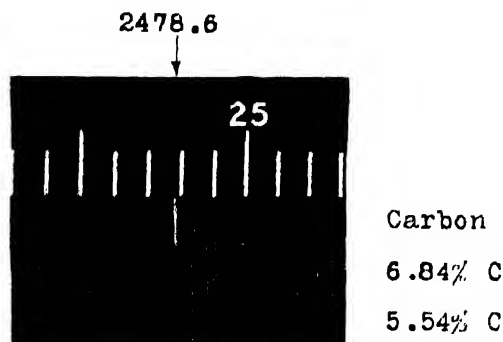


Fig. 9

sample, and greater variations in intensity were obtained in this way.

The lines of chromium and manganese which are found to be useful are as follows:

(a) Chromium. The group of lines 5208.4, 5206.1 and 5204.5 Å, shows an increase of intensity as the percentage of chromium increases, and it occurs in a region of the spectrum which is comparatively free from iron lines. These lines are given as sensitive lines by de Gramont.

(b) Manganese. The group of lines

4761	4754.1
4762.5	4783.5
4766.0	4823.6
4766.6	

gives the best variation of intensity with increasing percentage of manganese present in the steel. This group also occurs in a region of the spectrum comparatively free from iron lines. The lines 4823.6, 4783.5, and 4754.1 Å are given as sensitive lines in the spark spectrum by de Gramont, but the remaining lines are sensitive under these conditions to the same extent as the sensitive lines, although not classified as such.

The determination of carbon in steels.—Fig. 9 was obtained by photographing the spark spectra of carbon, and of ferro-manganese and ferro-chromium containing 6.84% and 5.54% carbon respectively. A distinct increase in intensity in the "raie ultime" 2478.6 Å of carbon is observed. A 5 minutes' exposure was given in each case, using the medium quartz spectrograph, E.3.

Some doubt has been expressed as to the utility of such spectrographic analysis of steels. There is no difficulty whatever in estimating manganese or chromium in steel by chemical methods with a high degree of accuracy and without doubt that the determination is correct. But the comparatively rough quantitative estimations by spectrogram are obtained with great rapidity, and information as to all the other metals present is given at the same time. The method is well adapted to the sorting out of steels and checking purposes.

A visual instrument has been designed for the purpose of rapidly estimating nickel and chromium in steels. This instrument enables the presence of nickel and of chromium in samples of steel (e.g., steel bars or steel scrap) to be detected immediately, even by an unskilled observer. Not only so, but a few days' experience with bars of known nickel or chromium content will enable the observer to state the approximate percentage present—as, for instance, 1%, 2%, or 4%.

The instrument has no adjustments, the observation of nickel and chromium respectively being provided for by two eye-pieces, in the one of which is seen the most distinctive nickel lines, and in the other the most distinctive chromium lines. These lines are seen and identified by a circle around each, and by their position in relation to the iron lines grouped immediately around them, and the instructions for use of the instrument contain a description whereby the observer unfamiliar with the spectrum may find the lines without difficulty.

The arc is struck by touching both rods simultaneously with a third rod of iron or carbon steel (insulated by pushing over one end of it a piece of ordinary rubber tube). Removal of this rod strikes the arc, and the observer at the spectroscope is able immediately to state whether or no the sample contains an important quantity of nickel or chromium. With the aid of three or four standard samples containing various percentages of nickel and chromium, he can soon accustom himself to state also the range of percentage within which the nickel or chromium content lies.

VISCOSE SILK CARTEL

According to a statement in the *Financial Times*, the Belgian artificial silk firm Tubize has reached an agreement with Courtaulds, Snia Viscosa and the Vereinigte Glanzstoff Factory Company, under which minimum prices will be fixed for sales to Germany, without, however, instituting a mutual commercial management. The Vereinigte Glanzstoff Company denies the reports that there have been discussions concerning the linking up of the Nederlandsche Kunst-Seide factory and the Glanzstoff-Bember group with the International Artsilk Convention.

THE NITROGEN INDUSTRY IN THE UNITED STATES

By H. WIGGLESWORTH

"The Atmospheric Nitrogen Industry," by Dr. Bruno Waeser, recently published in English from a translation made by Dr. E. Fylenman, Chief Chemist to J. F. Crowley & Partners, should attract unusual attention at this time, when the subject is so often referred to in connexion with commerce, agriculture and explosives.

Some responsibility for accuracy must fall on the author of such an important work, and it is to be regretted that many statements quoted must be due either to clerical errors or wholly false reports.

The writer of this article has been identified for over thirty years with the development of the American chemical industry, and cannot, therefore, refrain from commenting upon some of the misleading statements, more particularly those dealt with in Chapter XI, Part I, entitled "The development of the nitrogen industry in the U.S.A."

For example, on page 260, it is stated that in 1914 6,000,000 tons of chemicals were manufactured in the United States of the value of \$2,500,000. Does anyone know of any chemical product that can be mined or manufactured for 40 cents a ton? In 1917, it is stated that the tonnage was 46,000,000 tons of a value of \$57,000,000, or \$1.25 per ton, which is obviously preposterous.

On page 261 it is stated that potash fertiliser from Nebraska was sold in the United States at \$12.50 per ton. Where were such sales made? The freight alone from Nebraska to the consuming centres would almost amount to that figure.

On page 286 it is stated that the General Chemical Company acquired a considerable influence in the National Aniline & Chemical Company during the war, the latter company having been founded with German capital. This must surely be classed as a wild assumption, as the National Aniline & Chemical Company was built, and had for years been controlled by, the Schoellkopf family, the senior and head of which, as well as all his brothers, was born in America. Furthermore, it would have been seized by the Alien Property Custodian if it were even half-German.

It is further stated on this page: "In 1920 a formal amalgamation took place of the General Chemical Company, the Barrett Company, the Semet Solvay Chemical Company, and the National Aniline Company. The new company is said to have a capital of \$150,000,000." Is it then implied that the German influence continued?

Any financial house in Berlin, Frankfort, or other important German city would give the complete facts, and not the surmises that are quoted to guide the reader.

Page 282, with repetition in pages 300 and 485, states that the U.S.A. Government's nitrate plant No. 1 at Sheffield, Alabama, which was to have operated a Haber process, was a "complete failure." Quite contrary was the case.

The Haber process owned by the Badische Aniline & Soda Fabrik was developed on Haber's exposition

that the synthetic reaction equilibrium of ammonia made it uneconomic to attempt the manufacture of synthetic ammonia at pressures less than 200 atmospheres. Hoping to control this industry, they had successfully secured world-wide patents that allowed claims, giving them an apparent monopoly of pressures over 100 atmospheres.

The General Chemical Company, therefore, set out to determine whether pressures under 100 atmospheres could be employed economically, notwithstanding the Badische's contention. They had naturally followed closely the research dealing with combining nitrogen, and in 1912 had created a special laboratory for synthetic ammonia studies. By 1916 they had made such progress in the operation of a pilot unit that they concluded to appropriate about \$1,000,000 for a larger manufacturing unit, which was to be erected at one of their works in the vicinity of New York.

Before the apparatus had been delivered in 1917, by which time the United States had entered the World War, the Government solicited the privilege of erecting an ammonia unit of 10 tons daily capacity, to determine whether the process had reached a stage that would justify its adoption for war purposes. Subsequently two additional units were decided upon as the Government's confidence had grown while the working plans progressed.

The first unit was only just coming into operation at the time of the Armistice, and was not run for any length of time thereafter, as after many months' discussion it was found impossible to effect arrangements free from Government interference that would render success possible.

The No. 1 ammonia plant erected at Muscle Shoals was designed to operate at pressures below 100 atmospheres, and employed a catalyst never before used anywhere. It can hardly, therefore, be properly classified as a Haber process. Secondly, it did produce enough ammonia to satisfy the experts of its success. Only certain mechanical defects needed correction, and these the General Chemical Company undertook to carry out at their expense if given reasonable time to perfect the changes.

This is the explanation of the so-called "failure." The real facts, however, are that in the opinion of the experts of the General Chemical Company the process fully justified expectations, and this conclusion was accepted by their directors.

The Atmospheric Nitrogen Corporation was therefore formed in 1920 with the co-operation of the Solvay Process Company, as their broad interest in coke and ammonia was deemed of greater importance for future development than the selection of a site such as Muscle Shoals, where cheap power was the only factor.

As Director of Research and Development in the General Chemical Company until the end of 1921, and responsible for the success of the synthetic ammonia venture, I feel called upon to give the above facts, which are well known and easily verified.

The superb work of Mr. de Jahn and his assistants should be widely known. He has been the American pioneer in this field, and was responsible for the design and construction of the first plant built in America at

Syracuse. Never has a chemical plant worked more successfully from the first. The studies carried out under his direction, commencing in 1912, demonstrated conclusively that with pressures of less than 100 atmospheres it is possible to secure reactions carrying higher ammonia contents in the combined gas than was practised by the Badische Company. These important practical results are the more notable when considering former misgivings as to such high pressures at such high temperatures. His work has brought out unexpected and definite facts that are invaluable, particularly in connexion with hydrogen-nitrogen mixtures produced from coke or other fuels.

I believe there can be no dispute in the following facts: -

1. No plant has been erected before or since where hydrogen was produced from coke of a purity that made it possible to use the same catalyst year in and year out. To this day, Badische, Casale and Claude are known to change their catalyst every few months, and have had to work out a mechanical operation to simplify this very serious objection.

2. Notwithstanding Haber's contention that the synthetic equilibrium requires approximately 200 atmospheric pressures to be successful, the Badische, in actual operations, have found it advantageous, as already stated, to use high velocities, giving them less than one-half of the NH_3 contents in the gases leaving the converters than is the case at Syracuse, where lower pressures are employed. So the very theory, so far as conversion equilibria are concerned, has over a period of five and a-half years, shown that the Badische's original economic contentions were not justified.

3. It is now quite possible to control temperatures in single units having a capacity of 60,000 lb. synthetic ammonia or over in 24 hrs.

Dr. Waeser, in his preface, states that he has been able to deal with the literature up to the middle of March, 1921, up to which time, as is well known, Germany was the only factor in the production of synthetic ammonia.

The translator, however, says that Dr. Crowley deals with the considerable developments since the war. It is surprising, therefore, in 1926 to find such meagre references to the United States and France. Dr. Crowley lays stress on what he calls the most outstanding development of recent years - the progress of the Casale process, though that has dealt only with the combination of nitrogen and hydrogen, with little or no attention to the production of cheap hydrogen by the various processes, notwithstanding that hydrogen is the all-important element in the manufacture of synthetic ammonia.

Claude's work, also of the utmost importance, is hardly referred to, though Claude has not limited himself to the Badische pressures, but has gone enormously higher. The 1000 atmospheres he employs call for great engineering skill and indomitable courage. That he has splendidly overcome the difficulties incident to lubrication, joints and valves is well known. He therefore has the most compact and economical conversion apparatus.

It should not, however, be overlooked that high- or low-pressure synthesis concerns only about one-fifth or less of the operations and plant cost. The rest of the plant is concerned with the production of hydrogen and its purification and ammonia absorption. The advance in production of pure hydrogen is undoubtedly one of the most significant and important developments that has occurred.

There has not been a free exchange of costs under operating conditions that makes certain whether high pressures or low pressures will produce the cheapest ammonia with raw materials at the same cost. Casale has apparently concluded that Claude's high pressures are the safest to follow, for he has gradually increased his pressures, and has attempted to obtain some rights to his control of temperature by patent.

The fact that he has increased his pressures close to those employed by Claude has resulted in a suit for infringement on the Claude patent, brought by the Dupont Company, who are the sole licensees to the Claude process through their subsidiary, Lazote Inc., in U.S.

The contention that the United States farmer does not use nitrogen enough has only a theoretical justification. The farmer uses all the fertiliser he finds it profitable to use, so nitrogen must be supplied at a price that induces wider use. That goal will be reached gradually - as the advantages are proved under different conditions.

The high export duties charged by Chile have been a contributing factor towards the successful pursuit of the synthetic process of ammonia manufacture. Had there been no export duty, there might be no synthetic process in Germany, and perhaps the Great War would have been of short duration. The fact that Chile has imposed a heavy export tax has therefore fixed a temporary, economic limit in the use of nitrogen as a fertiliser.

The synthetic process is now forcing Chilean Government policies in this matter, and to some extent their action will determine the rapidity with which synthetic ammonia will be employed in the manufacture of fertilising materials.

The outstanding fact to-day is that Germany no longer has a monopoly in this field, since four giant financial groups are operating large plants with complete success and employing different mechanical systems. I refer, of course, to the Imperial Chemical Industries, Ltd., through their ownership of the Billingham plant, the Dupont Company owning Lazote Inc., and the earlier plant of the Allied Chemical Company of New York. They will progress even against the mighty Interessen Gemeinschaft of Germany. Each of these companies depends at present upon the manufacture of hydrogen from fuel of some sort, none of them having as yet seen fit to employ electrolytic hydrogen on a large scale, which is the source of hydrogen employed by Casale in the small plants using his process.

It is rumoured, however, that the Norsk Hydro are planning to erect a plant that will employ electrolytic hydrogen on a large scale in Norway, where they have the cheapest water power in the world, and therefore good reason for using it.

The synthetic process for the manufacture of ammonia is now therefore an accepted commercial fact in England, America and France, and Germany has no longer a monopoly in its production.

The following estimate from *Chemical and Metallurgical Engineering* gives the status of the air-nitrogen industry in America at June, 1926 :—

Company	Plant	Process	Capacity per day
Atmospheric Nitrogen Corp.	Syracuse, N.Y.	de Jahn	30
Lazote Inc.	Belle, W. Va.	Claude	20
Niagara Ammonia Co.	Niagara Falls, N.Y.	Casale	15
Mathieson Alkali Works	—	—	10
Pacific Ammonia Co.	Seattle, Wash.	F.N.R.L.	3
Koppers & Hasselacher	Niagara Falls, N.Y.	—	3
Belle Alkali Co.	Belle, W. Va.	—	1
Total			82

METHODS OF RESEARCH IN APPLIED SCIENCE*

By H. MOORE, D.Sc.†

The view that research in applied science is necessarily inferior to research in pure science is unsound. The one essential difference is in aim. In the one case the object is the extension of scientific knowledge with no practical application in view, in the other case the goal is definitely utilitarian. The more advanced types of research in applied science may be quite as fundamental as any work in pure science, demanding quite as much knowledge, skill, initiative, and originality.

Before he begins his research the investigator should make his mind perfectly clear as to the aim or object of the work, as distinct from its subject. It is only too easy to choose a subject of work and to embark on a programme of experiments, without any clear idea of where the work is intended to lead. The investigator should make sure that his ideas as to subject and aim are in complete accordance with those of the authority selecting the research, and that the object is one which can be sought with some hope of success. Frequently a distinction can be drawn between the immediate aims and the ultimate object, which, as the definitely practical one, should never be lost sight of, though the immediate aims may present greater attraction to the scientific mind. As work proceeds, a problem may assume a different aspect and some re-statement of the aim may be necessary. In any case, a research worker should see that throughout the progress of his work its main object remains the controlling factor in its development.

When the problem is one directly concerning manufacture, the views of the industry are important. It will sometimes be found that different makers of the same product state the facts of the case differently, do not agree in their statement of the problem, and have divergent views about its extent and importance. It is well worth while going into these points carefully with different technical representatives of the industry, and the investigator will be ill-advised to reject altogether the apparently irreconcilable accounts he is given. Above all, he should never take the line that he knows all about it and has come to teach the manufacturer his

job. At the beginning of a practical research the attitude of the investigator should be that of a learner, not a teacher.

When his mind is clear as to the object and scope of the research, the investigator should make himself familiar with all available information bearing on the problem. How and what to read is a big question, and only one or two points can be mentioned here. Purely metallurgical literature is not enough; there is much essential matter to be found in physical, chemical, engineering, and even trade publications. The indexes of periodicals such as the "Journal of the Institute of Metals" are most useful for tracing information, but are never complete and exhaustive. Abstracts should be regarded as indicating where information is to be found, and not as reliable sources of information. A really useful knowledge of French and German is far too rare among metallurgists.

I wish to stress the importance of unpublished information, particularly when manufacturing processes are in question. The technical staffs of works often have valuable data, which can be obtained at the cost of some effort, tact and patience, with great benefit to the progress of a research. Manufacturing processes should be studied at first hand and, in suitable cases, in several different works, where there are certain to be differences in details if not in main features. Workmen can give information not obtainable elsewhere, and chatting with them while seeing some manufacturing operation is often profitable. It will be seen that I contemplate a fairly free entry of the research worker into the works making the product he is studying. This close association of research with manufacture I consider extremely important. The collaboration should be on terms of openness, freedom and equality. All information, whatever its source, should be examined critically. Serious errors are to be found in scientific papers published in the most reputable periodicals, while textbooks are almost notorious in this respect. An excellent plan, when the first survey of previous work and information is completed, is to write it up in essay form. You can only be sure you have clearly understood what you have read or been told when you can reproduce it in your own words.

Before experimental work is begun every endeavour should be made to estimate the kind and amount of work demanded and, consequently, what personnel, equipment and material will be needed. These should be viewed in close relation to the resources likely to be available. It is possible in many cases to adjust the scale of a research to the resources available, and while not embarking on such a full programme as one would like, to make a really useful attack on the problem within fairly narrow limits of expenditure. Much economy of time, effort and material may be achieved by careful planning in advance. It is wasteful to carry an investigation to a point at which some special apparatus, material or information is wanted, and then to have to wait weeks or months while it is being obtained, if the need for the special facilities could have been foreseen. What is required is to see the research as a whole, to plan the various items of work to fit well together, keeping the ultimate aim constantly in mind, to see that

* From an address given to a conference of research workers of the British Non-ferrous Metals Research Association, Oriol College, Oxford, January 1927.

† Director of Metallurgical Research, Woolwich

nothing essential is omitted or needlessly delayed, and to ensure that everything necessary is within the resources available. Throughout, the investigator should endeavour to see as far ahead as possible. Economy in purchase and use of apparatus and material is well worth constant attention. Economy of time and work of scientific personnel is also an important element in success. These matters should be regarded in a business-like way. Finance is a vital matter to all Research Associations. It is their duty to carry on their work with the smallest expenditure consistent with efficiency, and then investigators should co-operate whole-heartedly.

Usually only the opening work of a research can be planned in detail at the beginning, the later work being in broad outline which is expanded into detail as the work proceeds. The detailed programme should keep well in advance of the experimental work. In the case of a research into some occurrence the cause of which is obscure it often pays to start at the same time several more or less competitive lines of work. For instance, when we began work at Woolwich on the cracking of lead cable sheathing there was little to guide us. We began, almost simultaneously, work on the examination of many samples of cracked sheathing and of lead in other forms which had cracked, the mechanical properties of lead at different temperatures, the effect of prolonged stress with and without simultaneous corrosive action, crystal growth and recrystallisation, the effect of impurities in lead, and the resistance of lead and some of its alloys to fatigue. Several of these different lines of work led to the view that the cracking was failure by fatigue, and that the fatigue resistance of lead could be greatly increased by small amounts of alloy elements. Work was then concentrated on a more detailed study of the fatigue of lead and its alloys and on the manufacture, heat treatment and properties of certain binary and ternary alloys which promised to be largely if not wholly immune from the cracking. Had we worked only on the supposed analogy with season cracking, which at first seemed the most likely to provide the explanation, we should have been much longer in arriving at the truth.

There are many temptations in the path of the research worker in applied science. One is to follow a line of scientific investigation which is full of interest in itself, but does not help the main investigation. New and unexplained peculiarities in microstructure, in equilibrium diagrams, and in physical properties obviously call for further work, but unless it will assist the Research Association it is not justifiable to include it. Another temptation is to devote one's energies to mere technique and its improvement. A special variety of this concentration on technique for its own sake is the construction of new apparatus, an occupation which has a dangerous fascination for all of us. Given sufficient funds, it is easy and pleasant to fill a laboratory with physical apparatus capable of doing remarkable things. It is also expensive in time and money, and not infrequently actually delays the progress of the research it was originally intended to assist. The advantages of simplicity, and the danger of subordinating the end to the means should never be forgotten.

The importance of business-like methods in scientific research is sometimes neglected, and the idea is met that the research worker is an inspired genius who must choose his own more or less erratic methods of working. Everybody does not work at his best in precisely the same way, but the trained scientific worker should excel in orderly and systematic habits. The details and results of experiments, the records of conferences, discussions, visits to works, works trials, information derived from literature and elsewhere, should be written up as soon as possible in a clear, accurate, concise, and accessible form. All records should be fully intelligible to others, and it is worth while, at least, aiming at legibility in notes. Man is not only mortal, but mobile, and never knows at what stage his work may have to be continued by somebody else. The value of dating everything that is written can hardly be over-estimated, and the habit is easily cultivated.

The progress of a research should be frequently reviewed. The investigator should watch for the emergence of new facts which may alter its aspect or render some projected work unnecessary. A research that proceeds precisely according to plan is inclined to be a dull affair, and if it gives nothing but what was expected at the outset it is certainly not of the highest type. What is most important is to note any results pointing in a different direction from what was anticipated. Fresh hypotheses may have to be formulated, and a subsidiary programme arranged to test them.

It is difficult to realise the meaning of experimental results while they remain as laboratory notes, and it is advisable to write up all work done, at fairly short intervals. This writing up frequently leads to fresh ideas and to the detection of unsuspected effects, which can be specially watched for in later experiments. While conclusions should be drawn, as far as they are justified, in these progress reports, early generalisations on insufficient data should be avoided, and undue speculation is to be discouraged. Hypotheses should be within verifiable limits. It is well to use with caution the idea most fashionable at the moment, and to beware of employing the latest advances in physics for the construction of highly speculative hypotheses to explain some ordinary experimental result or observation. The simplest explanation should always be sought.

Difficulty in discarding preconceived ideas disagreeing with experimental results, and the inability to devise some plan to account for discordant results, arise from the natural conservatism of the human mind and the failure to do the necessary hard thinking. Few people ever do any real thinking. Most of those who think at all only do it rarely. The constant facing of difficulties, worrying at a problem from all angles until it becomes clear, requires effort, but is essential to successful research. A conviction that an early guess at the solution of a problem must be right often has a greater hold over the investigator's mind than he realises, and is highly dangerous in research work. The investigator should always be ready to receive new ideas, not at their face value, but critically and fairly. Sound judgment, hard and clear thinking, and an open mind are the requisites for drawing right conclusions from unexpected

results, and for forecasting the future development of the work.

Ultimate success has not been reached in a practical research until manufacture has changed in some way in consequence of it. When the regular output of a manufactured product is better in quality or more abundant or cheaper in cost, as a result of research, success has really been achieved. The application of research results in manufacture depends on the investigator only partially, but to a greater extent than he commonly realises. If he keeps before him the importance of successful application he will appreciate many points that he would otherwise miss—the practical difficulties of applying his suggestions, the need for putting his results in a form to appeal to manufacturers, the advantages of co-operating with manufacturers and understanding their point of view. It is not early enough to consider these matters when his work is finished; sound views on the practical application of his research will and should influence the whole of his work, from his preliminary collection of information and statement of the problem to the end.

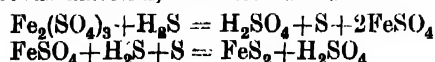
THE MINERALISATION OF AMMONITE SHELLS.

By C. O. HARVEY, B.Sc., A.R.C.S.

Ammonites, remarkable for the multiplicity of their species during Jurassic times, are commonly found in a state of mineralisation which has involved the replacement of the carbonate of lime of the shell by iron pyrites, a process which at first sight appears to be very difficult of explanation by simple chemical reactions.

Fossils in this state are found in abundance in the Lias shales of Hauxsker Cliffs and in other parts of Yorkshire, and examination of a number of specimens has shown that, whereas partially pyritified shells are commonly found to contain crystals of calcite, the massively-mineralised specimens frequently contain crystalline gypsum, an observation which suggests that, during mineralisation, calcium carbonate is converted into (and possibly removed in solution as) calcium sulphate.

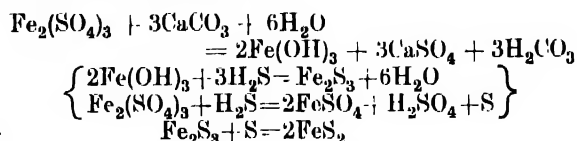
There is no lack of suggestions, some of them supported by experimental evidence, as to chemical reactions which may bring about the formation of iron pyrites and marcasite under natural conditions. Feld (*Z. angew. Chem.*, **24**, 97) states that, when sulphur and ferrous sulphide are formed together in a neutral or weakly acid medium and in the presence of reducing agents, combination to iron disulphide may gradually take place in the cold, the application of heat bringing about rapid completion of the reaction. He has also prepared iron disulphide by the action of hydrogen sulphide upon ferrous thiosulphate. Allen (*Mining Sci. Press*, 103, 113–114) states that pyrites and marcasite may be produced by the reduction of ferrous sulphate by carbonaceous material, and also as follows:—



The generation of hydrogen sulphide is commonly attributed to bacterial action upon ferrous sulphate and the proteins of decaying organic remains.

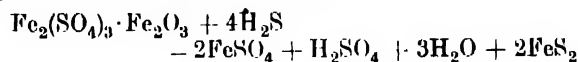
These theories do not explain the perfect replacement, particle by particle, of the calcium carbonate of ammonite shells by iron disulphide. Several theories accounting for this phenomenon appear to be possible, and attempts have been made to test their probability or otherwise experimentally.

Calcium carbonate may be replaced by ferric hydroxide (+ some basic ferric sulphate) by immersion in a solution of ferric sulphate, and, assuming the presence of excess of the ferric salt, the formation of iron disulphide may proceed as follows:—



No definite evidence supporting this theory has been obtained, though experiments have been carried out with shells, mixtures of ferric hydroxide and ferric sulphate contained in the pores of pipeclay tubes etc., and with equimolecular proportions of ferric sulphate and ferric hydroxide. The failure to obtain iron disulphide even upon heating in vacuo for several hours may possibly be due to the acidity developed during the reaction with hydrogen sulphide.

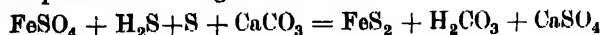
Two minerals, Raimondite and Illohanite (basic sulphates of iron) have been credited with formulae in which the ratio $\text{Fe}_2\text{O}_3 : \text{SO}_3 = 2 : 3$, and it seemed possible that such compounds might give rise to iron pyrites in one stage, as follows:—



Unfortunately, the existence of such compounds has been definitely disproved (Pickering, *J.C.S.*, **37**, 807. Cameron and Robinson, *J. Phys. Chem.*, 1907, **11**, 641. Posnjak and Merwin, *J. Amer. Chem. Soc.*, 1922, **44**, 1965. Applebey and Wilkes, *J.C.S.*, 1922, 337 T), and it was found that the addition of calcium carbonate to dilute solutions of ferric sulphate produced adsorption compounds approximating to the formula $2\text{Fe}_2\text{O}_3 \cdot \text{SO}_3$.

The last suggestion, which is thought to be the most probable explanation of the phenomenon, involves the reduction of very dilute solutions of ferric sulphate by hydrogen sulphide, the solution containing excess of hydrogen sulphide over that quantity required for the quantitative production of ferrous sulphide. Such solutions, containing ferrous sulphate, hydrogen sulphide, free sulphur, and sulphuric acid, will not deposit sulphide of iron in appreciable quantity unless some basic substance is present to neutralise the free acid, and the acid produced by the formation of these sulphides.

The occurrence of calcium carbonate, in the form of ammonite shells, in the vicinity will cause neutralisation locally, the shell being gradually replaced by ferrous sulphide, which, being slowly formed in the presence of colloidal sulphur and reducing agents, may readily change to the disulphide. It therefore seems possible that, under natural conditions, the replacement may take place in one stage as follows:—



Pure iron disulphide has been obtained experimentally in a manner analogous to the above suggested natural process by boiling the mixture resulting from the addition of a small quantity of calcium carbonate to excess of a solution of ferric chloride previously saturated with hydrogen sulphide. As was anticipated, when excess of calcium carbonate was added, the product was a mixture of ferrous sulphide, iron disulphide, and residual calcium carbonate.

CANADIAN INDUSTRIAL NOTES

The Canadian Fishing Co., Ltd., which has fourteen canneries in British Columbia, is erecting a large fish-reduction plant at Koprino Harbour, Quatsino Sound, N.W. Vancouver Island. The plant will have a daily capacity for the reduction of 125 tons of pilchards to fish oil, fertiliser, etc. This company has fish reduction plants at a number of its canneries to take care of salmon offal. At present there are fifteen fish reduction plants on the west coast of Vancouver Island, converting pilchards into fish oil etc.

The Distillers' Corporation of Montreal, Ltd., has merged with the Distillers' Company of Great Britain. The president of the Canadian subsidiary is Wm. H. Ross, chairman of the British company; vice-president, S. Broufman, Winnipeg. The Canadian company has an incorporated capital of \$2,500,000. The plant of the latter company is located at Ville la Salle, near Montreal, P.Q.

The salient features of the Shawinigan Water and Power Co.'s financial statement, recently presented at the annual meeting, were that the net revenue was the highest in the history of the company, being equal to 9.48% on the common stock at the end of the year, which was \$27,500,000. But the capital had been \$25,000,000 for ten months of the fiscal year, so the net average revenue would be over 10%. Reserves and surplus increased by over \$2,000,000 in the past year, and this account now stands at over \$8,850,000. The construction of the transmission line from Ile Malgoue to the city of Quebec was progressing favourably. Dealing with conditions, Mr. J. E. Aldred, president, expressed some concern about the ultimate supply of wood for pulp and paper mills, and entertained the opinion that, unless strong measures are taken to establish a policy of forest conservation, a time might come when no supplies would be available for the mills.

The Gatineau Power Co., a subsidiary of the Canadian International Pulp and Paper Co., has acquired two new electric power plants, the Bonhomme, on Blanche river, and that of the Papineauville Electric Co., on the Ottawa river. By the purchase of these two plants the Gatineau Power Co. has acquired important water rights on the Blanche, Ottawa and Nation rivers. The company now controls sources of available electrical energy amounting to nearly one million horse-power lying between Aylmer and Hawkesbury and Hull and Bitabee in the Ottawa district.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING, JULY 4 to 8, 1927

ACCOMMODATION

Members who intend being present at the Annual Meeting, and who have not yet booked their rooms, are strongly urged to do so without delay, as hotel accommodation in Edinburgh during July is being rapidly reserved.

No single bedrooms are now available in the North British Station Hotel—the Headquarters of the Society—and only a few double rooms (with two beds) are still available.

Single room accommodation for both men and women is still available in the University Hostels. Immediate application for such should be made to the Hon. Secretary of the Section—Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

A list of other hotels was published in *CHEMISTRY AND INDUSTRY* for February 4, 1927, p. 105.

RAILWAY FACILITIES

The Railway Companies of Great Britain (except the Metropolitan, the Metropolitan District, and London Electric Railway Companies) have agreed to issue tickets at the ordinary single fare and one-third for the double journey to persons travelling to Edinburgh to attend the meeting. Tickets will be available from Saturday, July 2, to Saturday, July 9.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

BRITISH CHEMICAL ABSTRACTS INDEX, 1926

In accordance with intimation previously made, the Index to the Abstracts for 1926 will cover both Pure and Applied Chemistry. Members of the Society of Chemical Industry who are also Fellows of the Chemical Society will receive only one copy of the combined Index.

The Index is in active preparation, and will be issued as soon as possible.

ANNUAL REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY—VOL. XI.

This volume of the Annual Reports (covering the year 1926) is now ready.

The price of the volume is 7s. 6d. to members of the Society and 12s. 6d. to non-members. Fellows of the Chemical Society, who are not members of the Society of Chemical Industry, can purchase the book at the price of 10s.

Orders for copies, accompanied by the appropriate remittance, should be sent to the General Secretary of the Society.

CHEMICAL SOCIETY'S LIBRARY

Members of the Society of Chemical Industry are reminded that they are entitled to consult the Library of the Chemical Society, Burlington House, Piccadilly, W.1, and to borrow books therefrom.

The Library is open daily from 10 a.m. to 9 p.m. Saturdays from 10 a.m. to 5 p.m. The Library is closed on Bank Holidays, the day following, and on other such occasions as the Council may direct.

DEATHS

Cawley, George (original member), of "Nippon," Cedar Road, Sutton, Surrey, Chemical Engineer. On March 3, 1927.

Rennie, Dr. E. H. (original member), of the University of Adelaide, South Australia, Professor of Chemistry. On January 8, 1927.

Turney, Sir John (elected 1887), of Trent Bridge Leather Works, Nottingham, Tanner. On March 17, 1927.

CHEMICAL ENGINEERING GROUP

Another paper entitled "Lubricating oils—Laboratory tests in relation to practical results," by A. G. Marshall and C. H. Barton, was read before a joint meeting of the Chemical Engineering Group of the Society of Chemical Industry and the Institution of Mechanical Engineers, which took place on April 1, at the Institution of Mechanical Engineers. Mr. F. H. Rogers, Chairman of the Group, presided.

The authors, in introducing their subject, pointed out that investigation into it had been carried on in two distinct ways:—by the theoretical or laboratory method in which attempts were made to determine the behaviour of an oil as a lubricant by testing its oiliness, coking, oxidation and other properties; and by the practical method, in which the lubricating properties were tested under actual conditions. After examining, in a Deeley machine, the "oiliness" of certain mineral oils and the effects of the addition of varying amounts of fatty oils, these oils were used to lubricate a specially designed piston testing machine driven by an electric motor with a swinging field which enabled a measure of the torque applied to be obtained, whilst the friction was measured by the rise in temperature of the jacket water. Further tests to see if temperature affected "oiliness" were made on an engine in which the cylinder was not water-jacketed, the temperature being registered by a pyrometer imbedded in the wall, as well as experiments on specially constructed bearings in which the abrasion was determined by loss in weight of the rubbing surfaces. As a result of all these experiments the authors state that an oiliness measurement cannot be relied upon as an indication of the general practical value of the oil, that oiliness has no influence on engines in any respect of friction or wear, and that substances added to give this oiliness can do more harm than good.

The carbonisation of the oil was then considered, the tests made on an air-cooled engine being compared with the forecasts obtained from laboratory tests. Other tests compared the behaviour of the lubricating oil on the crank case with that which would be predicted by laboratory tests, and the conclusion was drawn that although the formation of decomposition products in service is important in lubricating oil quality, the laboratory tests, at present, do not evaluate this factor correctly. Viscosity and its effect on the lubricating qualities of oils was investigated by the authors, who have

come to the conclusion that there is no justification for judging oil by its viscosity changes above 70° F.

A very large number of gentlemen desired to take part in the discussion which followed. Unfortunately time did not permit of all these gentlemen being heard, but they were asked to send in their contributions to the discussion to enable them to be published in the Transactions of the Chemical Engineering Group.

EDINBURGH AND EAST OF SCOTLAND SECTION

At the annual business meeting of the Edinburgh and East of Scotland Section, Mr. W. A. Williams in the chair, the following elections were made:—Chairman: Major R. Bruce, M.C., F.I.C.; Vice-Chairman: Dr. W. T. H. Williamson; Hon. Secretary and Treasurer: Mr. W. M. Ames, M.A., B.Sc., A.I.C. The vacancies on the Committee were filled by the election of Professor J. Read, Mr. W. A. Williams, Dr. W. O. Kermack, Dr. W. N. Stokoe, Mr. James Strathan, and Mr. James Sandilands.

GLASGOW SECTION

The annual business meeting was held on March 25, in Messrs. Ferguson and Forrester's Restaurant, Glasgow, with Mr. S. H. B. Langlands in the chair.

The reports of the hon. local secretary and treasurer were read and adopted. Attention was specially directed to the increased attendance at the meetings during the session, and to the fact that the student associates were joining the Society whenever they became ineligible for the associateship.

Mr. D. A. MacCallum presented his report as the representative of the Section on the Glasgow Chamber of Commerce, and it was agreed to continue the representation.

The following elections were made to fill vacancies on the local committee: Chairman, Mr. S. H. B. Langlands; Vice-Chairman, Mr. Douglas A. MacCallum; Hon. Local Secretary, Dr. J. A. Cranston; Members of Committee, Messrs. W. G. Hiscock, C. M. Keyworth, J. W. Mitchley, E. M. Melville and W. H. Nuttall; Chamber of Commerce Representative, Mr. D. A. MacCallum.

A vote of thanks was accorded to the retiring members of committee, and thereafter a joint smoking concert with the local section of the Institute of Chemistry was held, at which the Glasgow University Alchemists' Club, the Andersonian Chemical Society, and the Ardeer Chemical Club were present as guests.

MANCHESTER SECTION AND CHEMICAL ENGINEERING GROUP

A very well-attended meeting of the Manchester Section, the Chemical Engineering Group, and the North Western Section of the Institution of Mechanical Engineers was held in Manchester, on March 31, at which Dr. W. R. Ormandy further discussed the paper on "Lubrication," read on March 25 in London at the Joint Meeting of the Group and the Institution of Mechanical Engineers. In the discussion Mr. L. G. Radcliffe, Chairman of the Manchester Section, expressed the Section's sense of the importance of joint meetings of workers in different scientific and industrial fields.

MANCHESTER SECTION

The annual meeting was held at the Textile Institute on April 1, Mr. L. Guy Radcliffe, M.Sc.Tech., F.I.C., being in the chair. Messrs. M. F. S. Choute, J. R. Hannay, W. Hubball, H. Levinstein, D. M. Paul, and F. H. Terleski were elected members of the committee.

The hon. secretary, Mr. A. McCulloch, A.I.C., presented his report of the proceedings of the Section during the year. A new feature which had been introduced was the holding of a meeting in collaboration with the Fuel Section of the Society and with those societies which were directly co-operating with the Fuel Section. Concurrent with this meeting, on November 26 last, a National Coal Products, Chemical and Engineering Exhibition was open from November 16 to November 27. Although the period in which the exhibition was held coincided with the coal strike, which detracted very considerably from the success which would otherwise have attended this effort, the opinion of the Sectional Committee and of the exhibitors, as well as of those who attended the exhibition, was that it was distinctly successful. On May 6 a joint meeting was to be held with the Fellows of the Chemical Society resident in Manchester. This was a distinct innovation, and had been arranged primarily to further the good relations which already existed between the Chemical Society and the Society of Chemical Industry. It was hoped that, in some measure, it would give support to the scheme of collaboration between the societies, whereby Fellows of the Chemical Society might read papers at the meetings of the local sections of the Society of Chemical Industry. Nine papers had been read at the six meetings held during the Session. The membership of the Section was about 500.

The chairman announced that Prof. F. L. Pyman, who had been persuaded to fill the chairmanship of the Section for the ensuing session, had found himself compelled to withdraw from that position as he was about to take up an industrial post. For the same reason he had relinquished his positions as a Professor of Technological Chemistry at the Manchester University and the College of Technology.

The ordinary monthly meeting of the section was then held, and Dr. W. Rosenham, F.R.S., Superintendent of the Metallurgy Department of the National Physical Laboratory, gave a description of the work done at the laboratory.

Dr. Rosenham first described the origin of the National Physical Laboratory, and said that the purpose of the Laboratory was to aid the application of science, especially of physics in all its branches, to national and industrial needs. In spite of some early opposition, based upon unfounded fears and jealousies, it rapidly made its usefulness felt, and proved of great importance during the war. Even before the war, however, it had grown so large and important that the financial responsibility was more than the Royal Society could undertake, and the transfer of financial responsibility to the Government was suggested. This was carried out at the end of the war, and the Laboratory is now a part of the Department of Scientific and Industrial Research, although an Executive Committee appointed by the Royal Society still retains the scientific management. The Laboratory

now has seven departments, a scientific staff of over 130, and a total staff of over 500. Similar national laboratories exist in most of the more important countries of the world. The "Reichsanstalt," near Berlin, is one of the best-known, while the United States Bureau of Standards is probably the largest, but the National Physical Laboratory holds a foremost place among such institutions, and represents one of the finest organisations for scientific standardisation, testing and research in the world.

The lecturer then gave a brief sketch of some of the more striking activities of the Laboratory, dealing in turn with examples of the three great branches of work. In regard to standardisation, mention was made of the precision gauges used by engineers, of survey tapes, of weights, chemical glassware, and even of taximeters. Measurement down to the one millionth of an inch is now becoming a routine matter. Thermometers, including thousands of clinical thermometers and all types of precision thermometers and pyrometers, are standardised, whilst in another division of the Laboratory attention is given to X-rays and protective measures for those engaged in their use. Electrical meters and instruments of all kinds are standardised in great numbers, and much fundamental work has been done in the more accurate determination of the fundamental electrical units, the ampere and the volt. Means for testing insulating materials under electrical pressures up to one million volts are now being installed.

A long list of examples of the testing and research work of the Laboratory was given. Among these may be mentioned the recent work on the acoustics of buildings, whereby the behaviour of a hall can be predetermined by the use of small models and the photography of minute sound-ripples. Suitable adjustments can then be made to bring the hall to a satisfactory state for the hearing of speech or music. Interesting work on wireless waves was also mentioned, and in the latter part of the lecture the work on metals and alloys was briefly outlined. Recent achievements of the Laboratory relate to the production of gas-free metals by simple means, the production of new alloys capable of giving high strength at very high temperatures, and the production of a series of metals - iron, manganese, chromium, silicon and the rare metal beryllium - in a far higher state of purity than had previously been attained.

NOTTINGHAM SECTION

The seventh meeting was held on March 30, Dr. E. B. R. Prideaux in the chair. Prof. A. R. Ling delivered a lecture on "Accessory agents in biochemical and physiological reactions."

The lecturer referred to the important work done recently on hormones, vitamins and enzymes. These, he said, were carbon compounds, some of them containing nitrogen, phosphorus and sulphur, together with mineral matter. Hormones seemed invariably to contain nitrogen and sometimes sulphur. Vitamins, in so far as they had been investigated chemically, contained carbon and hydrogen. Enzymes, at one time thought to contain proteins as an indispensable constituent, had been obtained free from protein, yet no enzyme preparations had been obtained free from nitrogen.

Hormones appeared to be comparatively simple substances, and two of them at least had been obtained synthetically, whilst there is great hope that others might be made in the laboratory. Thus the chemist had—and still hopes to extend his success—opened up another source of supply for these substances which were present only in the minutest traces in living tissues. It was too early to speculate what the chemist might do in regard to producing vitamins *in vitro*, but here it would seem that by the application of certain forms of energy, e.g., ultra-violet light, to organisms and their foods, one at least of these obscure substances might be produced. Enzymes will probably defy the chemist in his efforts to produce them *in vitro*, and here again we must look to the physicist for help.

Hormones would appear to be definite chemical entities. Bayliss and Starling observed in 1901 the manner in which the pancreas is excited to activity and came to the conclusion that a chemical agent, belonging to a class of substances some of which were previously known, is concerned in bringing about this activity. Hormones were produced in one organ and carried by the blood stream to another on which their effect was manifested. Characterised by the property of serving as messengers, by which the activity of certain organs was co-ordinated with that of others, W. B. Hardy proposed the name hormone (I arouse to activity). The hormone of the suprarenal gland, adrenaline, was first obtained in a crystalline state by Takamine in 1901, and it was first synthesised by Stolz from catechol in 1903. The hormone of the thyroid gland (thyroxine) has been synthesised recently by Harington.

The hormone of the pituitary gland and of the endocrine gland of the pancreas, insulin, were also dealt with, and the work of Mr. F. H. Carr on the manufacture of the latter substance was described. It was then pointed out that adrenaline, thyroxine, and the hormone of the pituitary gland acted in the opposite direction to insulin, which promoted the storage of sugar as glycogen in the liver and depleted the blood sugar. In normal health, therefore, there was a balance between the first three named hormones and insulin.

The lecturer next dealt with vitamins, five of which now known were described. He mentioned the work of Drummond on the isolation from cod liver oil of vitamin D, and also the work of Rosenheim, Webster and Drummond on the production of this vitamin by irradiation of certain sterols with ultra violet light, which culminated in the discovery by Rosenheim and Webster that vitamin D, or at all events an anti-rachitic substance, could be obtained from ergosterol or an unsaturated sterol of similar constitution. This sterol could be made either from ergot or from a substance extracted from yeast by ether.

Enzymes are substances or mixtures of substances in the presence of which a reaction capable of proceeding slowly is accelerated. Prof. Ling described the work of Robison on ossification and dentition by an enzyme present in bone named phosphoric esterase which brought about the deposition of calcium phosphate by its action on calcium hexose-phosphate.

Attention was drawn to the fact that alcoholic fermentation of sugars has been shown by Harden to occur

through the medium of hexose-phosphate, and it was suggested that polysaccharides such as starch etc. were probably formed also through the medium of hexose-phosphates. The deposition of calcium phosphate has been found to require a hydrogen-ion concentration of p_H 9.0–9.2, whereas the formation of polysaccharides would probably take place at p_H 4.5–6.4.

The recent work on oxidation and reduction in the organism was next considered, and the synthesis of glutathione by Stewart and Tunnicliffe from glutamic acid was alluded to.

The author concluded by drawing attention to the great services rendered in this department of physiology by research work from the pure chemist, some of the substances for which previously they had to depend entirely on the living organism having been synthesised *in vitro* by organic chemists.

OTTAWA SECTION

Dr. Harold Hibbert, Professor of Industrial and Cellulose Chemistry, McGill University, addressed a joint luncheon meeting of the Ottawa Valley Graduates' Society of McGill, and the Ottawa sections of the Society of Chemical Industry and Canadian Engineering Institute, in the Chateau Laurier, Ottawa, on February 23, upon "Borderland science and its bearing on industry and civilisation." Dr. F. W. C. Mohr presided.

Dr. Hibbert defined borderland science as the intermediate and indefinite sphere lying between two or more branches of specific sciences. He maintained that development and advancement in many industries, and scientific achievements, could only be accomplished by the cultivation of borderland science, illustrating the progress which had followed in industry, therapy, preventive medicine, etc. by the scientific co-operation of the physicist, engineer, physiologist, pharmacologist, and bacteriologist with the chemist. The development of Canada, and civilisation in general, in the next fifty years depended on the progress attained in this sphere of scientific co-operation. The speaker presented numerous examples of successful developments in industry, engineering, medicine, and other branches of science entirely due to co-operation with the chemist. The prosperity of Canada depended on its natural resources and their intelligent development, and he suggested a number of lines by which this could be advanced. He was of the opinion that Canada would never truly develop until its agriculture was regarded and treated as a chemical industry.

At the regular meeting on March 17, with Mr. A. E. MacRae presiding, a paper was read by Mr. C. E. Watson on the subject "Driers, as applied to paints and varnishes." Investigation on the action of driers is of comparatively recent growth, but the results are promising, and are displacing rule of thumb methods in mixing paints and varnishes. Driers are substances which accelerate the atmospheric oxidation which takes place at the double bonds of the unsaturated glycerides of the drying oils. When linseed oil is blown, which may be considered as a speeded-up air drying, it shows practically no change in viscosity or film formation for the first 10 hrs., but after that period a progressive increase of

viscosity is apparent. Then peroxides are formed, and the increase of viscosity and film formation proceeds auto-catalytically. Insoluble colloidal phases are formed which tend to orientate at surfaces and so form the dried film.

Although many driers are known, considerations of utility and cost narrow the field to compounds of lead, manganese and cobalt. These vary in their solubility in oils, and also do not produce similar end results: thus it is found advantageous to use combinations of them. The best proportions have been found to vary within narrow limits and are small in amount, because of this, painters are very apt to put too much drier in their mixes, thinking they will speed up drying, but with quite opposite results.

These investigations brought out the fact that there were very many variables, but the findings of some six years have been averaged so that they will apply quite well to practically any of the drying oils as they come on the market.

CALENDAR OF FORTHCOMING EVENTS

- Apr. 8. **PHYSICAL SOCIETY**, Imperial College of Science, South Kensington, S.W., at 5 p.m. (1) "A carbon dioxide measuring instrument based on sound-velocity measurement," by E. Griffiths. (2) "The scattering of X-rays and the J' phenomenon," by B. L. Worsnop. (3) "The characteristics of thermionic rectifiers," by Prof. C. L. Fortescue.
- Apr. 8. **SOCIETY OF DYERS AND COLOURISTS, Manchester Section**, Literary and Philosophical Society, 36, George Street, Manchester, at 7 p.m. Annual Meeting. (1) "Photographic effects on cellulose acetate," by A. J. Hall and R. A. Hill. (2) "Note on the effect of light on coloured cotton fabric," by Miss Hibbert. (3) "The dyeing of cotton containing neps," by J. G. Lawrie. (4) "A new aim for the Society," by R. V. Taylor. (5) "Some notes on an emulsifying medium," by G. M. Williams.
- Apr. 8. **SOCIETY OF CHEMICAL INDUSTRY, Chemical Engineering Group**. The meeting arranged for this date has been postponed.
- Apr. 8. **INSTITUTE OF METALS, Sheffield Local Section**, The University, St. George's Square, Sheffield, at 7.30 p.m. "Refined silver for electro-plating anodes," by E. A. Smith.
- Apr. 11. **INSTITUTION OF ELECTRICAL ENGINEERS**, Savoy Place, Victoria Embankment, London, W.C.2, at 7 p.m. "The maintenance of small electric power plants." Discussion opened by T. Hodge.
- Apr. 11. **CERAMIC SOCIETY**, North Staffordshire Technical College, Stoke-on-Trent, at 7.30 p.m. Annual Meeting.
- April 11. **INSTITUTE OF BREWING, London Section**, Engineers' Club, 39, Coventry Street, W.C., at 7.45 p.m. "Methods of refrigeration in the brewery and their practical application to beer chilling," by J. McOustra.
- Apr. 12. **INSTITUTION OF PETROLEUM TECHNOLOGISTS**, House of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m. "Jet and jetonised material," by E. H. Cunningham Craig.
- Apr. 13. **ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY**, Northampton Polytechnic Institute, St. John Street, Clerkenwell, London, E.C.1, at 8.15 p.m. "Strains in electrodeposited metals," by R. H. T. Barklie.

OIL AND COLOUR CHEMISTS' ASSOCIATION

The ninth annual dinner of the Oil and Colour Chemists' Association was held at the Hotel Cecil, London, on March 30. Mr. C. A. Klein, the President, was in the Chair.

Dr. E. F. Armstrong, F.R.S., proposing "The Oil and Colour Chemists' Association," said that although it was discovered 500 years ago that linseed oil would carry a pigment and make a paint, nobody had yet discovered what linseed oil really is. Personally, he had urged university friends to investigate the structure and chemistry of linseed oil, but had never yet succeeded in finding a university professor who was willing to do it. There was thus considerable work awaiting the Research Association, although in the list of problems to be tackled he did not see much mention of linseed oil. After referring to the value of the work of the Department of Scientific and Industrial Research, Dr. Armstrong said that chemistry, and particularly organic chemistry on its industrial side, had taken on an entirely new lease of life; progress was making rapid strides, and in no branch of organic chemistry was the progress so rapid as in the oil and colour branch. It was a toss up whether the application of paint and colour to surfaces would not enter upon an entirely new development, for the use of the new cellulose lacquers and artificial resins might very well, within a few years, entirely change our ideas as to protection against corrosion and as regards decoration. The Association had made progress during the past year largely owing to the co-operation of the Society of Chemical Industry, the Federation of Paint Manufacturers, the Institute of British Decorators and the Institution of the Rubber Industry, and two other very important factors in the work of the Association were the progress made by the British Engineering Standards Association with regard to standardisation of paint materials, and the start made by the Research Association. When we realised that 20 years ago the vehicles, gums, resins and solvents, on which the industry is entirely dependent were natural products, with the enormous variations which ordinarily occur, it was obvious that the progress of the industry lay largely in the study of the vagaries of these products, because there was little knowledge of the fundamental principles involved. To-day the problems of the industry were being investigated in two ways, first, the detailed investigation of the fundamental properties of the raw materials, as instanced by the work of Dr. Morrell on linseed oil and drying oils, and the work of Eyre on flax, in regard to the control of natural products, and secondly, the synthetic chemist was endeavouring to produce alternatives and not merely substitutes in the narrow meaning of the word. Personally, he considered that the future of the oil and colour industry lies very largely in the application of synthetic organic chemistry to many of the problems. Mention had been made of cellulose lacquers. The consumption of this material in the United States in 1925 was said to be 11,000,000 gallons, a fact which should cause us to think in this country. As to paint products generally, however, he made no apology for any of the English products. We can and do produce products of excellent quality, but if we are to maintain that supreme position we must apply more and more science.

Sir Alexander Gibb, President of the Institution of Chemical Engineers, responding to the toast of "The Guests," proposed by Dr. J. J. Fox, said his Institution was always at the service of the Oil and Colour Chemists' Association.

Mr. F. H. Carr, C.B.E., President of the Society of Chemical Industry, who also responded to the toast, said chemistry as a whole is very complex, and the progress of applied chemistry is dependent upon the inter-connexion between the various sections. Therefore the Society of Chemical Industry did not desire the oil and colour, or any other department of applied chemistry, to become disconnected from the Society, because the progress of applied chemistry depends on all branches learning from each other. Societies such as these constituted the university in which their post-graduate training continued throughout their lives, and it was the object of the Society of Chemical Industry to promote that knowledge and to create that thought which constitutes the force by which industry alone can evolve, and the industry of this country would have to evolve to something very much greater than it is at present if the nation is to take its proper place in the world in generations to come. It was not asked that the other associations should lose their individuality in any sense; on the other hand, it did not desire to see wasted effort and unnecessary overlapping in publications on matters in which they were all concerned. Referring to the Research Association of British Paint, Colour and Varnish Manufacturers, he expressed the profoundest hope that the longest possible view would be taken, and that the researches would be as fundamental as could possibly be afforded. Success or failure depended upon taking a view which would not leave them disappointed if they did not get results in one year or two years, or even five years.

Prof. H. E. Armstrong, who was specially asked by the President to speak, congratulated the Association on the progress it had made since its first annual dinner, and referred to the President as a far too modest man who had rendered immense service to the industry. Personally he had been fighting the battle of white lead for a good many years, and would go so far as to say that whatever they might have heard about cellulose varnish, in the end, for outside work, white lead and linseed oil will carry the day. The public generally had never yet been properly informed on this subject, and it was very important that it should be more protected than it is in this matter.

Sir Frank Heath, Department of Scientific and Industrial Research, proposing the final toast of the evening, "The Research Association of British Paint, Colour and Varnish Manufacturers," said there was a certain sadness attaching to this occasion, because it would be the last time that he would have the opportunity of speaking as the representative of the Department of Scientific and Industrial Research. The success of that Department, however, was due entirely to the fact that its policy was directed by a body of scientific men, and he hoped this would always be the case.

Mr. S. K. Thornley, Chairman of the Council of the Research Association of British Paint, Colour and Varnish Manufacturers, replied to the toast, and acknowledged

the great assistance that had been given to the Research Association by the Department of Scientific and Industrial Research and also by a large number of scientific men who had come forward and helped with advice and assistance. He specially mentioned Dr. Fox, Dr. Lowrie, Dr. H. H. Morgan, Dr. Morrell, and Mr. Klein in this connexion. He expressed the hope the time would come when some of the nice things said with regard to the Oil and Colour Chemists' Association would be said of the Research Association. At the moment it had not got to that stage. The Research Association wanted more members, although as compared with most other associations formed in the same way he thought it was getting along very well. There was an assured income of about £5500 per annum, but in the early stages there were bound to be very heavy overhead charges. Perhaps out of the first £4000 subscribed, half would be required for rents, rates, taxes and equipment, leaving only £2000 for salaries of staff. After these items were met, however, every £1000 would be spent in getting the best men and the best brains possible, and that was why it was so very important to increase the income of the Research Association. It had been stated that the Research Association was not being supported by the colour makers. That, however, was wrong, because the figures showed that the actual subscriptions received from the three classes of members, viz., colour makers, paint makers and varnish makers, were almost identical. Again, it had been stated that the Research Association was making a mistake in not stating what it was going to do. It was suggested that if a definite programme was laid down, there would be a lot more members join. That, however, he felt would be fundamentally wrong, because it was absolutely essential that the people who joined the Association and found the money should have some say as to the nature of the work to be done and the direction in which research should be prosecuted. He could not conceive the work of the Association being done on any other lines. It was suggested, apparently, that if the Association stated it was going to investigate cellulose paints, more members would be obtained. It might be that one or two would join, but such a statement would not bring in a single colour maker, because they might say it would take five years to investigate cellulose paints and that there would be no time to deal with colour. It was a fact that there were some manufacturers who had not joined the Association. In some cases he believed he knew their reasons, and in other cases the firms had their own research staffs and felt that they did not need the Research Association. These few firms were large and prosperous firms, and he wished to put it to them most strongly that, even if it were true that they do not need the Research Association, they should support the Association in the best interests of the trade, regardless of their own interests.

BAUXITE IN FRANCE

A Bill has been put forward with the object of reserving the French national production of bauxite so that the ever-growing needs of the French aluminium industry may be filled.

OBITUARY

DR. F. B. POWER

Dr. Frederick Belding Power, Ph.D., LL.D., who died of heart failure, on March 30, at Washington, D.C., U.S.A., will best be remembered by British pharmacists as Director of the Wellcome Chemical Research Laboratories, a position he held from the founding of the Institution in 1896 until 1914. By early training a pharmacist, Dr. Power retained his interest in pharmacy throughout his life-work in England, Germany and America, and his death removes a figure of international influence in pharmaceutical and chemical research.

Born on March 4, 1853, at Hudson, New York, Dr. Power commenced his association with pharmacy at an early age. Five years later he was working as a practical pharmacist in Chicago. From Chicago he moved to Philadelphia and was connected with the business of the late Professor Edward Parrish, a notable pharmacist and lecturer of those days, whose name is linked inseparably with the compound syrup of phosphates commonly known as Parrish's Food. In 1871 he graduated in pharmacy at Philadelphia and was awarded the prize in chemistry. In 1876 we find him in residence at the University of Strasburg, where he took his degree in 1880, after acting as assistant to the famous Professor Flueckiger during 1879. Returning to America in 1881, he became Professor of Analytical Chemistry at the Philadelphia College of Pharmacy. Two years later he was called upon to establish the school of pharmacy at the University of Wisconsin, where he occupied the chair of Pharmaceutical Chemistry and Materia Medica.

In 1896, at the invitation of Mr. Henry S. Wellcome, Dr. Power came to England as first Director of the Wellcome Chemical Research Laboratories. In this way a close personal friendship dating from boyhood was renewed. Mr. Wellcome and Dr. Power were classmates at the Philadelphia College of Pharmacy, at which time neither could have foreseen that they would later be associated in research work for years. Under his direction no less than 168 scientific papers from the Wellcome Chemical Research Laboratories were communicated to learned societies, and during this period Dr. Power gained a wide reputation as a research chemist particularly in the field of plant chemistry, which he made peculiarly his own. One of his most important researches was his investigation of the constituents of chamomilla and hydnocarpus seeds, which ultimately formed the foundation on which has been built up the modern treatment of leprosy.

In 1911 Dr. Power returned to America, where he was appointed Director of the Phytochemical Laboratory of the Bureau of Chemistry at Washington, D.C., a post he held until his death.

Dr. Power's scientific work made him the recipient of many honours. In 1908 the University of Wisconsin conferred upon him the honorary degree of Doctor of Laws, and in 1913 he was awarded the Hanbury Gold Medal. In appreciation of this honour he was presented by his colleagues and associates with an illuminated address. In 1921 Mr. Wellcome, founder of the research institution bearing his name, presented Dr. Power with a gold medal bearing the doctor's profile

portrait in relief and commemorative of his distinguished services to science. Dr. Power was an honorary member of many scientific societies and institutions, and in America was recognised as one of the leading pharmacognosists. He was a Fellow of the Chemical Society of London and a Member of the corresponding Societies in America and Berlin. Corresponding Member of the Royal Society of Pharmacy of Brussels; Honorary Member of the Philadelphia College of Pharmacy; Vice-President of the Society of Chemical Industry, 1904-6, and he served on the Council and Publications Committee of this Society. He was awarded the Ebert Prize in 1877, 1892, and 1920.

Dr. Power served on the Committee of the United States Pharmacopoeia, and in 1920 was elected Vice-President of the United States Convention. One of the last honours that was bestowed on him was his appointment, by the President of the United States, as a member of the National Research Council on the Committee of Federal Relations.

PERSONAL AND OTHER ITEMS

Lord Gamford has been elected president of the Federation of British Industries in succession to Sir Max Muspratt.

Mr. Henry Mond has been elected to a seat on the board of Barclays Bank, Limited.

Professor F. L. Pyman, Ph.D., D.Sc., F.R.S., has resigned his chair of technological chemistry in the University of Manchester and the College of Technology, as he has been appointed head of the research laboratory of Boots Pure Drug Company.

Dr. J. W. Mellor, D.Sc., Principal of the Pottery Department of the North Staffordshire Technical College, conducted under the auspices of the City and County Councils, was entertained at luncheon by the Council of the North Staffordshire Chamber of Commerce on Wednesday last week, in recognition of his nomination as a Fellow of the Royal Society. Sir Francis Joseph, who presided, observed that Dr. Mellor had brought to his work an original mind and an immense power of application. He was the Secretary of the Ceramic Society and a Director of the British Refractories Research Association, but his chief claim on the goodwill of science was due to his authoritative and standard work—a "Treatise on Inorganic Chemistry." Business men, Sir Francis Joseph added, were paying increasing attention to the value of scientific research as an adjunct to their businesses, and North Staffordshire owed much to men who had laboured on the technical side of the pottery industry.

Dr. A. M. Smith, B.Sc., has been appointed lecturer in agricultural chemistry in the University of Manchester and Adviser under the Ministry of Agriculture Advisory Scheme.

Dr. John E. Teeple announces his intention to retire from his post as Vice-President and Director of the American Potash & Chemical Corporation. He will continue his connexion with the organisation as consulting chemical engineer.

Mr. M. C. Whitaker has announced his intention to retire from his post as President of the U.S. Industrial Chemical Co., and Vice-President of the U.S. Industrial Alcohol Co. The retirement will take effect at the Annual Meeting of the Corporations in April. He will continue his connexion with the organisation as a Director and as Consulting Chemical Engineer.

We regret to announce that Prof. D. A. Gilchrist, who retired a few weeks ago from the chair of agriculture at Armstrong College, Newcastle, died suddenly on April 4, at the age of 67. Prof. Gilchrist's detailed work on the use of phosphatic fertilisers at the famous Cocker Park has greatly influenced agricultural science, and the loss of his services to agricultural education and development will be deeply felt.

The late Mr. J. F. Moseley, J.P., senior director of David Moseley & Sons, Ltd., the Manchester firm of rubber manufacturers, left £226,028, with net personalty £207,175.

The late Mr. W. J. Emery, colour manufacturer, of Stoke-on-Trent, left £6,501, with net personalty £4,289.

Artificial Silk Exhibition

The second annual exhibition of British artificial silk goods was opened at Holland Park Hall on April 4 by Sir Burton Chadwick, M.P., Parliamentary Secretary to the Board of Trade, who said that the chief impression left upon his mind, after going round the exhibition, was the great beauty of British workmanship. Proposing the toast of "The British Artificial Silk Industry" at a luncheon at the Hotel Cecil, he said that the artificial silk industry was one of the outstanding industrial developments of the age, and formed one of the brightest constellations in our industrial firmament of the future. From the wide view he was able to take from the Board of Trade department of British trade generally, he could say that the artificial silk industry stood in the forefront both in production and in quality, and it could stand up to all competitors. At the exhibition that morning orders amounting to at least £10,000 had been received. He was told that British artificial silks led the world. Their foreign competitors might produce low-grade and cheap quality yarns, but they had not so far attained the uniformity of product nor the quality that distinguished British yarns. Dr. E. F. Armstrong proposed the toast of "The Dyers and Finishers," and said that the achievement with regard to artificial silk was only the forerunner of many great achievements, and he asked them to give all the encouragement they could to research work. Mr. H. Sutcliffe Smith acknowledged the toast.

Mercury from Coal Tar

Dr F. W. Aston contributes a letter to *Nature* of April 2, in which he deals with the isotopic constitution of mercury derived from coal tar. Mr. W. Kirby, of the South Metropolitan Gas Co., had furnished a sample of the mercury, which appears in the lightest of the fractions distilled, and occurs to the extent of about one part in seven millions of undistilled tar. Dr. Aston obtained a number of mass spectra, in which the groups of isotopic lines were indistinguishable from those of ordinary mercury.

Hydrogenation of Coal

The Joint Standing Committee for Research of the University of Birmingham, in a report on last session, deals with researches in progress in the Mining Laboratory, particularly in relation to hydrogenation, spontaneous combustion, and the research for the control of atmospheric conditions in hot and deep mines.

Regarding hydrogenation of coal, it is pointed out that progress has been made in the investigation into the conversion of coal into oil. A considerable amount of work has been carried out to obtain information regarding the type of coal most suitable for treatment in this way, i.e., the type which will give the highest oil yield. Specimens of coal ranging from lignite to anthracite, and including cannel coals from different sources, have been tested in detail with valuable results. Comparative tests have been carried out in the high-pressure autoclave using nitrogen in place of hydrogen, and also by carbonisation under atmospheric pressure. These experiments have shown that the carbonaceous material which yields the greatest amount of tar and oil by carbonisation at low temperatures does not necessarily give the largest yield by hydrogenation.

The large amount of product—definitely a product of hydrogenation—formed during the tests on some coals and the possibility of the conversion of this into oil by further hydrogenation points to the necessity for more detailed investigation of the physical and chemical nature of this product. Other experiments carried out during the past year have included the treatment of bright coal (clarain) from the Warwickshire thick coal in the form of an exceedingly fine powder suspended in water (material ground in colloid mill) at various temperatures up to 360° C. and pressures up to 245 atmospheres. The work includes hydrogenation tests on the various portions into which coal may be separated by the solvent action of pyridine and chloroform (α , β and γ compounds) and by means of phenol. The residue obtained after extraction with phenol of Warwickshire thick coal, vitrain (slate seam), has been tested in the high-pressure autoclave, viz., the standard hydrogenation procedure, with instructive results.

Third Census of Production (1924)

COAL

The following data are extracted from the "Preliminary Reports," of the Third Census of Production (1924):—During the year 1924 the total quantity of coal mined amounted to 265,429,000 tons, valued at £250,306,000, compared with 266,459,000 tons in 1907, valued at £119,507,000. In addition, 16,000 tons of coal was raised in collieries which were mainly in process of development during the year, and the selling value of this output was £12,000. Other products, including iron ore, iron pyrites, fireclay, other minerals raised, brought the total value to be added in 1924 to £1,140,000. Exports of coal in 1924 amounted to 79,340,000 tons, which includes 17,689,000 tons shipped for the use of steamers engaged in the foreign trade in 1924, compared with 82,220,000 tons exported in 1907, which figure included 18,519,000 tons shipped for the same purpose in that year. Exclusive of 8,000

tons of imported coal retained in the United Kingdom, 186,089,000 tons was retained in Great Britain during 1924, as against 184,340,000 tons in 1907. The net output of the coal mines covered by the above statement amounted in value to £209,820,000, which represents a net output per person employed of £175 in 1924, and £127 in 1907. The number of persons employed in the industry was 1,175,733 in 1924, and 837,785 in 1907. The total capacity of the engines engaged in the industry during 1924 was returned as 3,341,460 h.p., compared with 2,293,256 h.p. in 1907. The capacity of electric generators at collieries was 778,363 kw. in 1924.

COKE AND BY-PRODUCTS

In 1924, 12,803,000 tons of coke were produced, valued at £16,859,000, being 4% greater and 57½% higher in value than the amount produced in 1907, which totalled 12,322,000 tons, valued at £10,304,000. Tar products in 1924 amounted to 500,000 tons, valued at £1,430,000, and the total value of the whole year's output, including the various by-products, was £24,389,000. By-products included sulphate of ammonia (21·1% N.), 185,000 tons (£2,257,000); anthracene (as 40% paste), 66,000 cwt (£23,000); benzol (50% liquid), 37,900,000 gall. (£1,819,000); carboic acid (60%), 28,000 cwt. (£19,000); crude naphtha, 1,812,000 gall. (£87,000); naphthalene, 191,000 cwt (£54,000); pitch, 151,000 tons (£423,000); tar oil, creosote oil and other heavy coal-tar oils, 17,132,000 gall. and 1,669,000 cwt. (£507,000); toluol (90%), 320,000 gall. and 29,000 cwt. (£25,000); other distillation products were valued at £160,000; waste heat, including gas sold, valued at £465,000; electricity sold was valued at £117,000, and all other products at £144,000. The yield of coke per ton of coal carbonised was, in 1907, 12 cwt., but increased in 1924 to practically 13½ cwt. In 1907 18% of the coke ovens in use were by-product ovens and 78·5% were beehive ovens, whilst in 1924 the figures are reported as 75% by product ovens and 21% beehive ovens. During 1924 the quantity of coke exported was one-seventh of the quantity made in that year, and its average value f.o.b. was 32s. 6d. per ton. The net output of the works was £5,001,000, and the net output per person employed was £270 in 1924, as against £273 in 1907. In 1924 the total number of persons employed in the trade was 18,548, compared with 10,958 in 1907. The total capacity of engines at the works was returned as 76,733 h.p., and the capacity of the electric generators in the industry in 1924 was 37,264 kw.

The contrast between the movement in the value of coke and that in the value of coal is related to the greatly increased importance of the by-products obtained in the distillation of coal. In 1907 the value of the by-products represented only 7% of the gross output of coke ovens; in 1912 they represented 18%, and in 1924 31% of the gross output. In 1907 a ton of foundry coke had an average sale value at the works of 16s. 9d., and the by-products obtained per ton of coke were worth, on the average, 1s. 3d., making a total of 18s. In 1924 a ton of foundry coke had an average value of 26s. 4d., and the by-products obtained per ton of coke were worth 11s. 9d., making a total of 38s. 1d., or an increase of 111½%.

In the Report on the First Census the tar produced for sale amounted to 0·6% in weight of the coal carbonised; in 1912 it amounted to about 1½%, and in 1924 it was over 2½% of the corresponding weight. The value per ton of the tar sold in 1924 was nearly 3½ times that shown in the 1907 records. Whereas the sale of tar in 1907 added little more than 1% to the proceeds of the sale of coke, in 1912 the addition was 8½%.

From the point of view of sale value, sulphate of ammonia was the most important of the by-products both in 1907 and in 1924. In the former year it added 4·4% to the value realised from the coke made; in 1924 the addition was 13·4%. The weight of sulphate of ammonia produced was, in 1907, about one-sixth of 1% of the weight of the coal used; in 1924 it was 1% of the weight of the coal. The value per ton recorded for sulphate of ammonia disposed of by coke works in 1907 was about £11 5s., and in 1924 about £12 4s.

In order of importance benzol ranks next to sulphate of ammonia, and the output reported at coke ovens in 1907 was little more than one-ninth of a gallon per ton of coal carbonised. In 1912 the average yield was four times that of 1907, and in 1924 the average was about 2 gallons per ton of coal, or between four and five times that of 1912. The average value was 5d. per gallon in 1907 and 1s. per gallon in 1924.

The output of tar oil, creosote and other heavy tar oils in 1907 was about 5 gallons per 100 tons of coal carbonised; in 1912 it was not far from four times this amount, and in 1924 it was about 90 gallons per 100 tons of coal. In 1907 the average value of these oils was under 3d. per gallon, and in 1924 about 7d. per gallon.

With a somewhat smaller amount of coal carbonised in 1924 than in 1907 the pitch recovered was thirty times as much, and the value of 24s. per ton of 1907 is replaced by an average value of 56s. per ton in 1924.

In contrasting the yield of coke and of the leading by-products of coal distillation in 1924 with that obtained in 1907 the possible differences in the average quality of the coal carbonised must not be ignored. It is obvious, however, that the main feature calling for attention is the alteration in practice, indicated both by the difference in the type of oven used and by the greater recovery of products which were mainly wasted in 1907.

MANUFACTURED FUEL

During the year 1924 the quantity of manufactured fuel produced amounted to 1,271,000 tons, valued at £1,774,000, and in 1907 the amount totalled 1,670,000, valued at £1,205,000. Exports were 1,067,000 tons, valued at £1,549,000, representing about 84% of the total quantity manufactured in the year. In 1907 exports amounted to 1,481,000 tons, valued at £1,092,000, being 89% of the quantity made in that year. Only a very small quantity of manufactured fuel was imported in either year. The net output of the factories in the trade was £401,000, and the net output per person employed was £239 in 1924, and £174 in 1907. The number of persons employed in 1924 and 1907 respectively was 1,675 and 1,537. The total capacity of engines during 1924 was 8,442 h.p., against 5,344 h.p. in 1907. The capacity of electric generators for the same periods respectively was 1,983 kw., and 239 kw.

REVIEW

THE UNITED STATES OIL POLICY. By Prof. J. ISE, Ph.D., LL.B. Pp. x + 547. New Haven: Yale University Press; London: H. Milford, Oxford University Press, 1926. Price 35s. net.

One would naturally expect that a serious book such as "The United States Oil Policy," written by Prof. John Ise, would be well worth perusing, and in that one is not disappointed. If there were nothing else in that book but the history of petroleum in the United States, from the early days of 1859 up to date, these chapters alone would be worth the production of the book, but the chapters on "Waste of oil," and "Waste of capital and energy," are outstanding features, and should really form a monumental lesson to the exploiters not only of oil, but of any other natural resources.

The book is replete with interesting details. Chapters are devoted to the discussion of the various laws governing the disposition and leasing of the Public and Indian oil lands, and all the chapters are plentifully annotated with references.

Professor Ise is, however, professionally engaged in lecturing on economics in the University of Kansas, and the whole book has, of course, been written from the politico-economic point of view. The purpose for which it has been written is the curtailment of waste of oil in the present generation for the sake of conservation of oil for future generations. With that laudable sentiment one cannot, of course, quarrel, but it is a very mute question whether Government interference in restriction of trade can ever be the panacea. However private ownership may have erred in the past, private enterprise, with all its muddling from the point of view of the politico-economist, can never equal the "trust"-like immobility of a Government Department. One need only recollect that the State Government attempted in 1914 to curtail the exploitation of the Cushing field by a shut-down order. That order became abortive in results, and the politico-economist found that ordinary economic laws are more powerful, and that artificial price structures are stupid and untenable.

If a Government could prevent drilling altogether, there might be some chance of conserving the oil not broached, but to shut down a field which has already been pierced by the drill is very risky and of doubtful utility, as the loss of gas pressure, the amount wasted by seepage to other strata, and water flooding from both below and above the surface may be doing more incalculable damage than overproduction.

The Swan Song of Prof. Ise throughout the book is that oil is being sold too cheaply, and that over-production is the reason of the oil being sold at a cheaper price than oil is actually worth. The late Lord Bearstead lately expressed the whole question of prices and supply and demand by saying that "an article is worth what it will fetch." However much Prof. Ise may bemoan the cheapness of oil, he must not forget that the almost phenomenally speedy development of the United States industrially was in no immeasurable degree due to that cheap oil, and were it not for cheap fuel at the commencement of an industry the industry could not have grown with such rapidity.

In that respect, therefore, one cannot agree that

"cheapness of oil was unfortunate." Cheap liquid fuel has enabled the United States to develop its railway systems and has enabled it to carry railway tracks over arid wastes where probably no other fuel existed or was obtainable. To the existence of cheap fuel is due that development of motor transportation in the United States which the author himself says "was the most rapid and spectacular economic development in all history." The development of the motor industry has meant phenomenal development of subsidiary and supplemental industries, since the motor industry requires as raw materials steel, copper, aluminium, leather, upholstery fabrics, rubber, glass, etc. Cheap fuel, which enabled the motor industry to develop like that, is probably the principal cause of highway improvements, the boasted efficiency of the American business man, and there is no doubt that that same cheap fuel has caused a considerable revolution and change in the economic life of the citizens of the U.S.A.

Natural resources are not the only riches of a country, and if by means of the use of some of the natural resources a country can conserve the greatest of all riches, and that the man-power, the utilisation of such inanimate natural resources should be an off-set against any "waste" of such a commodity, and Prof. Ise's objection as "waste" to the uses of powerful motor cars by "Fat-bellied Bankers" and for the joy rides of the Bourgeoisie, are mere academic complaints.

A further waste of oil which Prof. Ise draws attention to is the waste of fuel which is being burned under boilers in ships. Here too, this "waste" is the interregnum stage of development. Industrially, there can be no question that oil fuel on board ship represented a stage of higher development as compared with the old low-pressure coal-fired boiler, and the scientist, striving for efficiency, has realised that fuel oil can be more economically used, and with greater efficiency in an internal combustion engine, whilst the use of oil in internal combustion engines, which, so far as we have gone at present, is the most economical use of oil, is developing rapidly, and more and more ships are fitted with this latest development in prime movers. We would have never reached this stage if it had not been for "cheap" fuel.

One has seen it stated so often that when prices rule high, governed as they probably are by economic laws of supply and demand, people complain of profiteering, and when the same laws cause a fall in prices people say that this is proof that prices had no business to have been up. If one is to condemn profligacy then despondency should merit the same condemnation, and, judging by the prophecies of the various authorities, the United States is in no imminent danger of having to depend upon outside sources for a great number of years.

On the whole Prof. Ise is to be congratulated on a very studious and painstaking work.

COMPANY NEWS

BRUNNER, MOND AND CO., LTD.

The Rt. Hon. Sir Alfred Mond, Bt., M.P., presiding over the annual meeting held on March 29, stated that the reduced gross profit shown in the accounts was due to the facts, first, that the balance sheet was for a nine

months' period, and, secondly, to the loss from the long-continued coal strike. The coal strike had meant a difference of £500,000 to the company in increased cost of fuel and decreased trade. In this connexion, the company raised its prices slightly in agreement with its customers, but it carried the greater part of the burden in continuing its works on imported coal. It did this because it regarded it as its duty, both to the industries of the country and to its customers, to continue production even under such very unfavourable circumstances. There was an increased revenue from investments which partly compensated for the reduction in trading profits. Also, in spite of the bad year, £150,000 had been placed to depreciation, against £200,000 for the previous year. The new works at Wallerscote, the completion of which had been delayed by the strike, were now operating successfully. Dividends were declared for the nine months ended December 31, 1926, as follows. To the holders of preference shares at the rate of $7\frac{1}{2}\%$ per annum, less income tax and less the interim dividend paid in December last, and to the holders of preference shares at the rate of $7\frac{1}{2}\%$ per annum, less income tax and less the interim dividend paid in December last.

BRITISH ALUMINIUM CO., LTD.

The seventeenth ordinary general meeting, held on March 31, was presided over by Major R. W. Cooper, who said that Mr. A. W. Tait, the chairman of the company, was absent through ill-health, and the vice-chairman, Colonel S. H. Pollen, was abroad. The net profit for 1926 was £438,776, against £550,434 for 1925, the increased costs of operation arising from the general strike and the coal strike accounting for the reduced amount. In certain directions there were satisfactory developments in the demand for the company's products, one being the use of aluminium for electrical conductors, with the result that the electrical industry was becoming one of the more important outlets for the metal. The total weight of aluminium sold for such purposes last year exceeded that of any previous year, and was double that of 1925. Other favourable developments were the use of aluminium for marine work, and the increasing use of alloys for pistons and cylinder heads of motor engines. Further, the properties of aluminium for cooking and other domestic utensils were more widely recognised than ever. Extended uses of the metal and its alloys demanded unremitting attention to metallurgical research and experiment, and the present high standard of the metal must be maintained by continual watchfulness and skill on the scientific, as well as on the productive, side of the industry. Further additions had been made to buildings and plant, the chief expenditure being on extensions of the Burretsland alumina factory and at the rolling mills.

STEWARTS AND LLOYDS, LTD.

The thirty-seventh ordinary general meeting, held on March 31, was presided over by the chairman, Mr. A. C. MacDiarmid. Towards the end of 1925 the iron and steel trade of the country appeared to be emerging from the long and difficult period through which it had been passing since the collapse of the post-war boom, but the hopes entertained at the last meeting were shattered by the general strike and the coal stoppage. During the period May to December

the company's collieries, ore fields, blast furnaces, steel works and some of its tube works were almost entirely shut down. The directors decided that, in spite of the difficulties, the right policy was to carry on the production side of the business as far as was feasible, and the company was successful in keeping a number of its principal tube plants working fairly regularly during the whole period. The direct loss inflicted upon the company by the strike was estimated at £300,000. Despite these difficulties, the volume of tubes made and sold during 1926 was within a few tons of the turnover of 1925, the record year for production. Intensive and successful work was being carried on with the object of developing and opening up existing and new markets and sources of demand. The works were now fairly well employed, the sales for the first part of this year exceeding previous returns for a similar period. The appropriation of the profits made during the year was on conservative lines, and the carry-forward was increased by £11,000. The company had acquired for a small sum a quarter share in a company called the Nascent Carbon Metal Co., formed to acquire and develop the patents of Mr. H. Edwin Coley. Mr. Coley had discovered a method of extracting certain metals from their ores at a greatly reduced cost, and the company had erected a plant on a commercial scale at its Coombs Wood works, the results obtained proving that the discovery may be one of great value. A scheme had been instituted enabling the staff and workmen to purchase and hold, on easy terms, deferred shares of the company, the number of shares now held, or in course of being subscribed for, amounting to 48,427, divided among 2,180 subscribers.

UNITED GLASS BOTTLE MANUFACTURERS, LTD.

The net profits for 1926 totalled £39,709 (against £100,552 for 1925), and with £11,353 brought in and £17,103 provision for taxation etc. not now required, there was an available balance of £98,165. After again providing £15,000 as special depreciation in respect of capital reorganisation and placing £3,557 to the staff benevolent fund, the directors have provided for the year's preference dividend, and propose to carry forward the increased balance of £43,622. Mr. G. E. Alexander, O.B.E., for many years managing director of the company, has been elected to occupy the dual position of chairman and managing director.

BRITISH OIL AND CAKE MILLS, LTD.

A trading profit is recorded for 1926 of £251,518, which, with £38,144 interest, £374,506 dividends on investments, and transfer fees, makes a total of £664,496. After making all charges, the net balance is £218,037, compared with £188,422 for 1925. With £113,750 transferred from preferential dividend reserve and £33,619 brought in, there is available £365,406. A dividend of 10%, less tax, is proposed on the preferred ordinary shares ($2\frac{1}{2}\%$ for 1925), and £33,633 will be carried forward.

ANGLO-PERSIAN OIL CO., LTD.

At 5% actual, the interim dividend for the year to March 31, 1927, is the same as that for the preceding year, but is payable on the capital increased by the 50% capitalised bonus distributed in November last.

DUNLOP RUBBER CO., LTD.

The profits for 1926, after providing for depreciation, amounted to £2,711,418 (against £3,207,611 for 1925), and were struck after allowing for the dividend on the preference shares of No. 2 D.R. Cotton Mills absorbing £97,500. A dividend has been recommended of 20%, being an increase of 5% over the previous year. It is proposed to place £500,000 to reserve, leaving £665,000 to be carried forward, compared with £593,091 brought in. The trading was adversely affected by the coal strike, the increased expenditure on coal and power alone exceeding £100,000.

ASSOCIATED PORTLAND CEMENT MANUFACTURERS, LTD.

The twenty-eighth ordinary general meeting was held on April 1, Mr P. Malcolm Stewart, chairman, presiding. After briefly reviewing the company's widespread interests, the chairman said that since the meeting in 1925 when emphasis was placed on the necessity for improving the earning capacity of the fixed assets by modernising the largest works, they had created at Bevan probably the finest cement works in Europe, with a present annual capacity of 375,000 tons, and with cement shipping facilities second to none in the world. In addition, the chamber kilns at the Crown works had been replaced by a rotary kiln plant, and both the Bevan and Crown factories were running smoothly and producing cement of excellent quality at a low cost of manufacture. With the completion of the reconstruction now commenced, of the Swancombe works, the company will have an annual productive capacity exceeding 1,250,000 tons from efficient rotary kiln plant. Despite the dislocation of business brought about by the coal stoppage, the company's sales organisation was successful in selling in the home market a larger tonnage of cement than ever previously accomplished. It was evident that the extensive propaganda undertaken by the company during the last few years in showing the advantages of concrete for constructional purposes was bearing fruit. Regarding the prospects for the current year, the demand was well up to expectations for the spring period, and the factories were on full time.

TAR RESIDUALS, LTD.

This company, which has just been registered, consists of an amalgamation of the tar products business of Messrs Simon Carves, Ltd., 20, Mount Street, Manchester, with Messrs. Walter Waugh & Co., Ltd., of London, and Messrs. Walter H. Brown & Co., Ltd., of London. The new business will be carried on in the same manner and under the same management as the old, three directors of each company constituting the board. The London office of Tar Residuals, Ltd., will be at 4, Lloyd's Avenue, and the Manchester office at 20, Mount Street.

RIO TINTO CO., LTD.

This big copper and sulphur mining concern will maintain the dividend at 50%, for the year, by making a final payment of 30s. per share on the ordinary capital of £1,875,000. The gross profit for 1926 was £1,400,789, the net profit being £1,041,046 (excluding £150,000 transferred from taxation suspense account), compared with £1,457,627 and £1,027,190, respectively, for 1925. After placing £500,000 to reserve, making that fund £1,000,000, the sum of £153,449 will be carried forward.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; **Powder,** £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime—£7 19s. per ton, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; **Contract,** £8 10s. per ton d/d., 4 ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; **Granulated,** £19 per ton; **Powder,** £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5 12s. 6d.—£5 17s. 6d. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; **Pyridinised Industrial,** 2s. 7d.—3s. per gal.; **Mineralised,** 3s. 6d.—3s. 10d. per gal., 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. **Potass. Bichromate.**—4½d. per lb. **Potass. Chlorate.**—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac.—£45—£50 per ton. **Chloride of ammonia** £37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. **Sod. Bicarbonate (refined).**—£10 10s. per ton, carr. paid. **Sod. Bichromate.**—3½d. per lb. **Sod. Bisulphite Powder 60/62%.**—£17 per ton, home market, 1-cwt. iron drums included. **Sod. Chlorate.**—2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.r. London, casks free. **Sod. Sulphate (Glauber's Salt).**—£3 12s. 6d. per ton. **Sod. Sulphide conc. solid 60/65.**—Spot £13 5s. per ton, contracts £13 carr. paid. **Sod. Sulphide cryst.**—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. **Sod. Sulphite, Pea Cryst.**—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6d.—1s. 5½d. per lb., according to quality.
Crimson.—1s. 3d.—1s. 7½d. per lb., according to quality.
Arsenic, Sulphide, Yellow.—2s. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£46—£55 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 2d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithophone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity
Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride.—4d. per lb., carboys extra.

Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.

Thiocarbanilide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep.—5s. 3d. per lb.

Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.

Charcoal.—£7—£10 per ton, according to grade and locality.

Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.

Red Liquor.—9d.—1s. 16° Tw. per gal.

Wood Creosote.—1s. 9d. per gal., unrefined.

Wood Naphtha.—Miscible, 4s. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.

Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.

Brown Sugar of Lead.—£41—£42 per ton.

TAR PRODUCTS

Acid Carbohc.—Crystals, 7½d. per lb. Crude 60's, 1s. 8d. 1s. 9½d. per gal.

Acid Cresylic, 99/100.—2s. 4½d.—2s. 6½d. per gal. Steady, 97/99.—2s.—2s. 2d. per gal. Pale, 95%, 1s. 10d. 2s. 2d. per gal. Dark, 1s. 9d.—2s. per gal.

Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.

Benzole.—Crude 65's, 1s. 2½d.—1s. 3½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s.—2s. 1d. per gal., ex works in tank wagons

Toluole.—90%, 2s. 1d. to 2s. 2d. per gal. Firm. Pure, 2s. 3d.—2s. 4d. per gal.

Xylol.—2s. 1d.—2s. 2d. per gal. Pure, 3s. per gal.

Creosote.—Cresylic 20/24%,—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.

Naphtha.—Crude, 9d.—9½d. per gal., according to quality. Solvent 90/160, 1s. 8d.—2s. 1d. per gal. Solvent 95/160, 1s. 8d.—1s. 9d. per gal. Solvent 90/190, 1s. 4d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.

Naphthalene.—Crystals.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.

Pitch, medium soft.—90s.—95s. per ton, f.o.b. according to district. Nominal.

Pyridine.—90/140.—9s. 6d.—10s. per gal. Nominal. 90/180—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—8s. per lb.

Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.

Acid H.—3s. 3d. per lb. 100% basis d/d.

Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.

Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.

Aniline Salts.—7d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.

Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—4d. per lb. Fair enquiry.

m-Cresol 98/100%.—2s. 8½d. per lb. Only limited enquiry.

p-Cresol 32/34° C.—2s. 8½d. per lb. Only limited enquiry.

Dichloraniline.—2s. 3d. per lb.

Dimethylaniline.—2s. per lb. d/d. Drums extra.

Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.

Dinitrochlorbenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

α-Naphthol.—2s. per lb. d/d.

β-Naphthol.—11d.—1s. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb. d/d.

β-Naphthylamine.—3s. per lb. d/d.

p-Nitraniline.—1s. 9d. per lb. d/d.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb. d/d.

R. Salt.—2s. 2d. per lb. 100% basis d/d.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—7½d. per lb., naked at works.

p-Toluidine.—2s. 2d. per lb. ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Firm and brisk.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.

Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 4½d.—1s. 5d. per lb. Less 5%. Firm.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. 1s. 3½d.—1s. 5d. per lb. Technical 11½d.—1s. per lb. Both in good demand.

Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.

Acid, Tartaric.—1s. 2d. per lb. Less 5%. Firm market.

Amidol.—9s. per lb. d/d.

Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb. Powder 1s. 3d. per lb.

Atropine Sulphate.—11s. per oz. for English make.

Barbitone.—6s. 6d. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth

Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—

8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—

8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb.

Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Sub-

chloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—

7s. 9d.—8s. per lb. Extra and reduced prices for

smaller and larger quantities respectively; Lique-

Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—

1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.
Bromides.—Ammonium.—2s. 4d.—2s. 6d. per lb. Potassium.—2s. 4d.—2s. 6d. per lb. Sodium.—2s. 2d.—2d. 4d. per lb. All spot.

Calcium Lactate.—1s. 3½d.—1s. 4½d. per lb.
Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.
Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
Croosote Carbonate.—6s. per lb.
Ether meth.—1s. 1d.—1s. 1½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.
Guaiacol Carbonate.—5s. per lb.
Hexamine.—2s. 4d.—2s. 6d. per lb.
Homatropine Hydrobromide.—30s. per oz.
Hydraetine Hydrochlor.—English make offered, 120s. per oz.
Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.
Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—22s. per cwt., 112 lb. lots.
Magnesium Carbonate.—Light Commercial £33 per ton net.
Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net.
Synthetic, 11s.—12s. 6d. per lb., according to quantity.
Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.
Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.
Methyl Sulphonal.—11s. per lb.

Metol.—11s. per lb. British make.
Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.
Phenacetin.—3s. per lb.
Phenazone.—4s. 6d. per lb.
Phenolphthalein.—6s.—6s. 3d. per lb.
Potass. Bitartrate.—99/100% (Cream of Tartar) 96s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
Potass. Ferriyanide.—1s. 9d. per lb. in cwt. lots.
Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.
Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Rosorcin.—4s. per lb. spot.
Saccharin.—55s. per lb. Very limited enquiry.
Safol.—2s. 4d. per lb.
Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
Sod. Ferrocyanide.—4d. per lb., carr. paid.
Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.
Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net, according to quantity.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—7s. 6d. per lb.
Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.
Thymol, Puriss.—11s. 6d.—12s. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
Aubepine (ex Anethole).—10s. 6d. per lb.
Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
Cinnamic Aldehyde.—Natural, 17s. per lb.
Coumarin.—10s. 6d. per lb.
Citronellol.—14s. 6d. per lb.
Citral.—8s. 3d. per lb.
Ethyl Cinnamate.—10s. per lb.
Ethyl Phthalate.—3s. per lb.
Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. per lb.—(ex Shui Oil) 14s. 6d. per lb.
Methyl Anthranilate.—8s. 6d. per lb.
Methyl Benzoate.—4s. 6d. per lb.
Musk Ketone.—35s. per lb.
Musk Xylol.—8s. 6d. per lb.
Nerolin.—3s. 9d. per lb.
Phenyl Ethyl Acetate.—12s. per lb.
Phenyl Ethyl Alcohol.—10s. 6d. per lb.
Rhodinol.—27s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb. Good demand.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—12s. per lb.
Camphor.—67s. 6d. per cwt. Cananga, Java, 30s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure—6s. per lb.
Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—10s. 6d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. per lb. Peppermint.—Wayne County, 19s. 3d. per lb. Japanese, 8s. 6d. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than May 28th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on April 14th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Baxter, Bruce, and Cox, Ltd. Method of subdivision of colloid or plastic materials. 8378. Mar. 26.
Bentley, Coates, and Riley & Sons. Manufacture and treatment of colloidal materials. 7975. Mar. 23.

British Furnaces, Ltd. (Surface Combustion Co.). Furnaces etc. 7940, 7942, 8072-4. Mar. 22 and 23.

Calder. 7889. See XXIII.

L.-G. Farbenind. Drying agent for gases. 8303. Mar. 25. (Ger., 7.6.26.)

Parker, and Vickers, Ltd. Rotary drying and cooling cylinders. 8032. Mar. 23.

Smith (Surface Combustion Co.) Furnaces etc. 7940 and 7942. Mar. 22.

I.—Complete Specifications

4389 (1926). McGowan and Hunter. Emulsifying apparatus. (267,681.)

8844 (1926). Ljungstrom. Furnaces. (267,723.)

12,153 (1926). Soc. L'Air Liquide. Apparatus for bringing liquids and gases into contact. (262,042.)

19,251 (1926). Crossman. See II.

28,538 (1926). Simpson. Mixing-machine. (267,840.)

29,253 (1926). Union A.-G. für Metallind. Centrifugal separators. (262,096.)

31,439 (1926). Alexander. Apparatus for purifying liquids centrifugally. (267,858.)

II. Applications

Bamber. Gas-producers. 8174. Mar. 24.

Barker (Cunningham) Mechanically-operated gasanalysers. 8196. Mar. 24.

Burmah Oil Co., Ltd. (Allan and Moore). Wax sweating and crystallising apparatus. 8358. Mar. 26.

Calder. 7889. See XXIII.

Easton and Henneage. Fuels for gas-producer plants. 8271. Mar. 25.

Fairweather (Amer. Coalfield Corp.). Fuel. 7905. Mar. 22.

Groné. Converting heavy hydrocarbons into light hydrocarbons. 7750. Mar. 21.

Humphreys & Glasgow, Ltd. Purification of gas. 8376. Mar. 26. (U.S., 24.6.26.)

Johnson (L.-G. Farbenind.) Production of fuel gases. 7920. Mar. 22.

Jones. Fuel for internal combustion engines etc. 8027. Mar. 23.

Koppers Co. Manufacture of coal products. 8268. Mar. 25. (U.S., 25.3.26.)

Misch. Generating gas. 7776. Mar. 21.

Northrup. Conversion of heavy petroleum oils into lighter oils. 7742. Mar. 21.

Stanciliffe. Apparatus for distilling and cracking oils. 8121. Mar. 24.

Sutcliffe. Apparatus for distillation of coal etc. 8386. Mar. 26.

II. Complete Specifications

4747 (1926). L.-G. Farbenind. Manufacture of articles from molten carbon. (254,679.)

9244 (1926). Travers and Clark. Manufacture of gas (267,724.)

12,461 (1926). Allgem. Ges. f. Chem. Ind. Refining mineral oils with liquid sulphur dioxide. (267,071.)

18,114 (1926). Soc. Luxembourgeoise des Hydrocarbures, and Brimeyer. Cracking oils and tars. (267,776.)

19,251 (1926). Crossman. Drying-apparatus for briquettes etc. (267,784.)

*26,226 (1926). Still. Coke ovens. (267,881.)

*5567 (1927). Smeets-Solvay Co. By-product coke ovens. 267,906.)

*7474 (1927). Stransky and Hansgig. Cracking hydrocarbon oils or their distillates. (267,958.)

*7475 (1927). Stransky and Hansgig. Refining low-boiling distillates of hydrocarbon oils. (267,959.)

III.—Complete Specification

18,114 (1926). Soc. Luxembourgeoise des Hydrocarbures, and Brimeyer. See II.

IV.—Applications

L.-G. Farbenind. Substituted aromatic sulphonic acids. 8146. Mar. 24. (Ger., 7.4.26.) Manufacture of alkylated etc. arylsulphonic acids. 8285. Mar. 25. (Ger., 27.3.26.)

Johnson (L.-G. Farbenind.). Production of vat dyestuffs. 8138. Mar. 24.

IV.—Complete Specifications

4843 (1926). Soc. Chem. Ind. in Basle. Manufacture of intermediate products and dyestuffs of the anthraquinone and anthracene series. (249,480.)

12,143 (1926). L.-G. Farbenind. Manufacture of condensation products of the anthraquinone series. (252,029.)

*7322 (1927). L.-G. Farbenind. Manufacture of condensation products from aromatic hydrocarbons etc. (267,940.)

V.—Applications

Brandwood. Application of artificial silk coatings to yarns. 8214. Mar. 25.

Rimman. Producing cellulose etc. from straw, esparto, etc. 8029. Mar. 23. (Sweden, 7.4.26.)

Silberad. Manufacture of artificial filaments. 7989. Mar. 23.

Soc. Chem. Ind. in Basle. Manufacture of artificial threads. 8147. Mar. 24. (Switz., 24.3.26.)

Soc. Chim. Usines du Rhône. Apparatus for manufacture of cellulose acetate. 8170. Mar. 24. (Fr., 10.5.26.)

V.—Complete Specifications

28,990 (1925). Eichenbrun. Production of artificial silk, filaments, etc. (213,350.)

31,689 (1925). British Enka Artificial Silk Co. Manufacture and use of artificial silk etc. (244,496.)

4113 (1926). Pellerin. Manufacture of a cellulose product having the appearance of wool. (263,727.)

VI.—Applications

Clavel. Weighting natural silk. 8148. Mar. 24.

Durand & Huguenn. A.-G. Dyeing animal fibres. 7939. Mar. 22. (Ger., 22.3.26.)

Hadfield and Hadfield. Treating textile yarns etc. 7713. Mar. 21.

L.-G. Farbenind. Dyeing mixed textile goods. 7938. Mar. 22. (Ger., 22.3.26.)

Soc. Anon. Etabl. Petitdhier. Colour printing on fabrics. 8270. Mar. 25. (Fr., 7.5.26.)

VI.—Complete Specifications

1528 (1926). L.-G. Farbenind. Obtaining fast discharges on fast dyes. (246,183.)

5382 (1926). Johnson (L.-G. Farbenind.). Dyeing and printing cellulose esters. (267,695.)

*7060 (1927). L.-G. Farbenind. Treatment of fibres etc. (267,924.)

*7458 (1927). Durand & Huguenn. Products for dyeing or printing. (267,952.)

*7938 (1927). L.-G. Farbenind. Dyeing mixed textile goods. (267,985.)

*7939 (1927). Durand & Huguenn. Dyeing animal fibres. (267,986.)

VII.—Applications

Andreas. 8254. See IX.

Carpmael (L.-G. Farbenind.). Absorbing ammonia etc. from gases. 7786. Mar. 21.

Holzverkohlungs-Industrie A.-G. Concentrating raw pyro-ligneous acid. 8300. Mar. 25. (Ger., 25.5.26.)

VII.—Complete Specifications

8381 (1926). Toniolo. Manufacture of nitric acid (267,721.)

12,638 (1926). L.-G. Farbenind. Utilising residue obtained in reduction of molten crude phosphates. (252,367.)

*20,797 (1926). Petersen. Manufacture of sulphuric acid. (267,885.)

*5571 (1927). Bachmann. Producing active silicic acid. (267,907.)

*6107 (1927). Dupire. *See* XI.

*7657 (1927). Mulliez Frères et Cie. *See* IX.

VIII.—Application

Hartford-Empire Co. Glass furnaces. 7888 and 7890. Mar. 22. (U.S., 6.4.26 and 3.8.26.)

VIII.—Complete Specifications

23,731 (1926). Gen. Electric Co., Ltd. Readily fusible glasses and enamels. (267,815.)

32,848 (1926). Bicheroux. Manufacturing raw plate glass. (263,847.)

IX.—Applications

Andreas. Burning cement, lime, etc. 8254. Mar. 25. (Ger., 31.3.26.)

Gunn. Preserving wood etc. 8234. Mar. 25.

Parker, and Vickers, Ltd. Rotary cement kilns. 8034. Mar. 23.

IX.—Complete Specifications

22,842 (1925). Universal Rubber Pavoirs, Ltd., and Brown. Bituminous mixtures for roads. (267,317.)

29,113 (1925). Bubla. Apparatus for impregnating wood. (267,579.)

*7393-4 (1927). Ackermann, and Scheidhauer & Giesing A.-G. Manufacture of bricks. (267,949.)

*7057 (1927). Mulliez Frères et Cie. Manufacture of lime or cement products and the like. (267,971.)

X.—Applications

Brownson, and Kynoch, Ltd. Annealing metal. 8262. Mar. 25.

Coley. Reduction of ores etc. 7898. Mar. 22.

I.-G. Farbenind. Refining iron. 8354. Mar. 26. (Ger., 1.4.26.)

Ireland. Iron alloy. 8065. Mar. 23.

Kelly. Silver alloys. 8305. Mar. 25.

Smith (Naam. Vennoots. Elementenfabr. Utrecht Battery Co.). Coating metals etc. with dissimilar metals etc. 8298. Mar. 25.

Stimson. Treatment of ores. 7831. Mar. 22.

X.—Complete Specifications

23,145 (1925). Greff. Smelting oolitic ores and slimes. (240,165.)

29,436 (1925). Molybdenum Corp. of America. Compositions for alloying molybdenum with other metals. (245,422.)

33,008 (1925). Bracy. Furnaces for roasting sulphide and other ores. (248,711.)

4776 (1926). Kuehnrich. Heat-treatment of alloy steels. (267,687.)

9089 (1926). Krupp Grusonwerk. Working-up ores etc. containing volatilisable metals. (252,679.)

10,220 (1926). British Thomson-Houston Co. Protecting metals against oxidation at high temperatures. (250,975.)

14,335 (1926). Metallbank u. Metallurgische Ges. Desulphurising fine iron pyrites. (254,691.)

18,515 (1926). Krupp Grusonwerk. Extraction of lead and zinc from ores etc. (256,601.)

*7532 (1927). Piwowarsky and Oberhoffer. Production of technical alloys of diverse structural condition and properties. (267,964.)

*7665 (1927). Corsalli. Melting metals. (267,972.)

*7315 (1927). Piwowarsky and Oberhoffer. Production of high-grade iron or steel. (267,939.)

XI.—Application

Metter. Lead accumulators. 8176. Mar. 24. (Ger., 20.3.26.)

XI.—Complete Specifications

31,494 (1925). Leitner. Electric accumulators. (267,588.)

31,250 (1926). Internat. General Electric Co., Inc. Electric furnaces. (262,796.)

*6107 (1927). Dupire. Apparatus for electrolysing alkali chlorides etc. (267,912.)

XII.—Application

Soc. Anon. Anc. Etabl. Pellerin. Apparatus for melting fatty substances. 8082. Mar. 24. (Fr., 22.4.26.)

XII.—Complete Specification

*7164 (1927). Sorensen. Treating crystallised margarine mass. (267,928.)

XIII.—Complete Specifications

32,304 (1925). Whatmough. Manufacture of carbon black pigments. (267,625.)

32,456 (1925). Bloxam (I.-G. Farbenind.). Manufacture of writing-inks. (267,033.)

11,107 (1926). Marks (Bakehte Corp.). Potentially reactive liquid coating-compositions. (267,736.)

19,501 (1926). Marks (Irwin and Monk). Titanium pigments. (267,788.)

*5171 (1927). Kunstharzfabr. Pollak. Manufacture of phenol-formaldehyde condensation products. (267,901.)

XIV.—Applications

Chem. Fabr. Kalk, and Oehme. Vulcanisation of rubber. 7700. Mar. 21. (Ger., 21.6.26.)

Hayes, Klein, McKay, Szegvári, and Trobridge. Production of rubber articles from aqueous dispersions of vegetable resins. 8399. Mar. 26.

XIV.—Complete Specifications

21,798 (1926). Carpmacel (I.-G. Farbenind.). Removal of liquid polymers from synthetic rubber. (267,808.)

22,526 (1926). Naugatuck Chem. Co. Vulcanisation accelerators. (259,933.)

XV.—Applications

Arnot. Manufacture of adhesives. 8375. Mar. 26.

Baxter, Bruce, and Cox, Ltd. 8378. *See* I.

Ehrenreich. Treatment of shark skins etc. 8190 I. Mar. 24. (Belg., 24 and 25.1.27.) Preparatory treatment of fish skins. 8192. Mar. 24. (Belg., 26.1.27.) Process for obtaining glue. 8193. Mar. 24. (Belg., 31.1.27.)

Roberts. Leather manufacture. 7788. Mar. 21.

Weber. Mineral tanning etc. 7783. Mar. 21.

XIX.—Application

Peyton. Preservation of meat. 8381. Mar. 26.

XIX.—Complete Specification

*7164 (1927). Sorensen. *See* XII.

XX.—Applications

Carpmacel (I.-G. Farbenind.). Obtaining perfumes. 7784-5. Mar. 21. Manufacture of elastic preparations of pharmaceutical products. 8299. Mar. 25.

May & Baker, Ltd., and Newbery. Manufacture of oxyacetic acid derivatives of arylarsenic compounds. 8017. Mar. 23.

XX.—Complete Specifications

15,398 (1926). Johnson (I.-G. Farbenind.). Manufacture of concentrated solutions of formaldehyde or paraformaldehyde. (267,768.)

21,196 (1926). Consort. f. Elektrochem. Ind. Manufacture of acetals. (257,622.)

26,407 (1926). Soc. Chem. Ind. in Basle. Manufacture of aldehyde condensation products. (260,288.)

*1766 (1927). Naef et Cie. Increasing the yield in civetone from civet. (267,893.)

*7061 (1927). I.-G. Farbenind. Production of aldehydes. (267,925.)

*7460 (1927). Rupe. Manufacture of unsaturated aldehydes. (267,954.)

XXI.—Applications

Bawtree. Photographic image. 8391. Mar. 26.

Chem. Fabr. van der Grinten, and Grinten. Manufacture of photographic sensitive layers. 8071. Mar. 23. (Holland, 11.12.26.)

XXIII.—Application

Calder. Treating water, oil, etc. 7789. Mar. 22.

XXIII.—Complete Specifications

*24,731 (1926). California Fruit Growers' Exchange. Insecticides and fungicides. (267,878.)

*7595 (1927). Du Pont de Nemours & Co. Disinfectants. (267,968.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number. *Brazil*: Tinplate, galvanised iron sheets, structural iron and steel (339). *British India*: Steel rails, electro copper wire bars (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Structural Steel* (Directors of the South Indian Railway Company, 91, Petty France, Westminster, S.W.1). *Czechoslovakia*: Lead and antimony (A.X. 4459). *Egypt*: Liquid asphalt (B.X. 3375). *France*: Tinplate,terne plates (328). *Holland*: Galvanised hollow-ware and sheets (333). *New Zealand*: Aluminium hardware (321). *South Africa*: Copper pipes (A.X. 4474). Charcoal iron or anti-corrosive steel boiler tubes (A.X. 4471); Hides (B.X. 3390); Cast-iron pipes (A.X. 4470 and A.X. 4467).

Safeguarding of Key Industries

The Board of Trade give notice that representations have been made to them under Section 10 (5) of the Finance Act, 1926, regarding the following articles: Dial (acid di-allyl barbituric); Elbon (cinnamoyl para-oxyphenylurea); Integrators (planimeter type); R Lead acetate; Liponodin (ethyl di-iodo brassidate); Phytin (calcium magnesium inositol hexaphosphate); Planimeters.

Section 10 (5) of the Finance Act, 1926, is as follows:

"The Treasury may by order exempt from the duty imposed by section one of the Safeguarding of Industries Act, 1921, as amended by this Act, for such period as may be specified in the order, any article in respect of which the Board of Trade are satisfied on a representation made by a consumer of that article that the article is not made in any part of His Majesty's Dominions in quantities which are substantial having regard to the consumption of that article for the time being in the United Kingdom, and that there is no reasonable probability that the article will within a reasonable period be made in His Majesty's Dominions in such substantial quantities."

Any person desiring to communicate with the Board of Trade with respect to these applications should write to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, within two months from the date of this notice. (March 30, 1927.)

Merchandise Marks Act, 1926. (Applications for Marking of Goods: Reference to Standing Committee)

In accordance with the provisions of Sub-section 4 of Section 2 of the Merchandise Marks Act, 1926, the Board of Trade announce that in pursuance of appli-

cations received by them for the making of Orders in Council to require imported goods of certain classes and descriptions to bear an indication of origin, they have made a reference to the Standing Committee appointed by the Board under the Act in respect of the following classes and descriptions of goods:—(1) (a) The following descriptions of steel:—Plates, rails, joists, angles, channels, sectional material of all descriptions, castings, forgings, rounds, squares, flats, hexagons, hoops, hot and cold rolled strip. (b) The following descriptions of wrought iron:—Bars, hoops, sections, plates and sheets. (2) Silk and cotton woven labels; and (3) Gold and silver leaf. The Standing Committee will begin their inquiry with regard to the classes and descriptions of goods specified above at 2 p.m., on Monday, April 25, in Room 74A (First Floor), New Public Offices, Great George Street, London, S.W.1. Further meetings of the Committee will be held at the same place on April 26 and 27. The Secretary of the Committee is Mr. E. W. Reardon, New Public Offices, Great George Street, S.W.1.

News from Advertisements

The General Hospital, Birmingham, invites applications for the newly-created post of biochemist (p. viii).

A special course of eight lectures upon high-pressure gas research is announced by the Imperial College of Science and Technology, London (p. viii).

The University of St. Andrews draws attention to the Scholarships and Bursaries open to competition in June, 1927 (p. viii).

PUBLICATIONS RECEIVED

ESSAYS ON THE ART AND PRINCIPLES OF CHEMISTRY, INCLUDING THE FIRST MESSEL MEMORIAL LECTURE. By H. E. Armstrong. Pp. xxxi + 276. London: Ernest Benn, Ltd., 1927. Price 15s. net.

DIRECTORY OF MEMBERS OF THE ASSOCIATION OF TAR DISTILLERS. Pp. 15. London: The Association of Tar Distillers, 166, Piccadilly, W.1. 1927.

KUNSTSEIDE. By Dr. O. Faust. Sonderausgabe aus der Kolloidchemischen Technologie, edited by Dr. R. E. Liesegang. Pp. 61. Dresden and Leipzig: Th. Steinkopff, 1927. Price 3 r.m.

GOTTFLOP'S TECHNOLOGY OF RUBBER. Authorised English Edition, translated and revised from the German Edition of 1925, by J. L. Rosenbaum, M.Sc., M.J.Chem.E. Pp. xvi + 350. London: MacLaren and Sons, Ltd., 1927. Price 42s.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF MINES. MINERAL RESOURCES OF THE UNITED STATES. 1925. Washington: Government Printing Office, 1926-27; Barite and Barium Products in 1925. By A. Stoll and R. M. Santmyer. Lime in 1925, and Salt, Bromine, and Calcium Chloride in 1925. By A. T. Coons. Secondary Metals in 1925. By J. P. Dunlop. Tin in 1925. By J. W. Furness. Price 5 c. each.

FORTSCHRITTE IN DER KAUTSCHUK-TECHNOLOGIE. By Dr. F. Kirchhof. Part XIII. Technische Fortschrittsberichte. Fortschritte der Chem. Technologie in Einzeldarstellungen, edited by Prof. B. Rassow. Pp. xi + 201. Dresden and Leipzig: Th. Steinkopff, 1927. Price, paper 12 m., bound 13.50 m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, APRIL 15, 1927

No. 15

EDITORIAL

China

CHINA is so great a country and our trade with it so varied that the present chaotic conditions fill the more timid of us with disappointment and alarm. When, however, we consider the essential facts, there are found sundry features which help to restore our equanimity. China is a country which is comparable in size with Europe rather than with Britain; it has a population of about four hundred and fifty millions of people, including some twenty thousand, or less, foreigners congregated in comparatively few places. The foreigners have come into contact with very few of the Chinese, probably not more than a fraction of 1% of them. On the whole, the Chinese who have come into contact with the foreigners have been friendly, trusting, and trusted. There has been no ill-will, no suspicion; on the other hand, there are probably four hundred and forty millions of Chinese who know nothing of the foreigners, care little about them, and are comparatively easily incited to dislike them. A small proportion of these—a very small proportion—is now completely out of hand. The civil wars which have distracted China during recent years have, fortunately, not involved the whole number of men of military age; it is doubtful if at the present time one-tenth of 1% of the population is under arms. Much has been written and said about the efforts made by the foreigners to protect the settlement at Shanghai, a property about the size of Hyde Park. Whether these efforts are wise, necessary, futile or provocative, is not the concern of this JOURNAL. We are justified in calling attention to the fact that only a small proportion of the population has departed from its customary industry, and only an insignificant acreage, a mere field in a continent, is troubled by the armed forces of the foreigner. In these circumstances we are not surprised to learn that the trade of China has so far remained steady, that the factories, on the whole, maintain their normal output, and that no great diminution in exports and imports is yet manifest.

The American Institute of Chemistry

So there is to be an American Institute of Chemistry, but not, let us hasten to explain, with the scope and functions of the British Institute. The idea, sponsored by the American Chemical Society, appears broadly to consist in affording American chemists an annual grand opportunity of combining pleasure and profit under the most agreeable of conditions. The first session is to be held this year at the Pennsylvania State College, the funds being provided by the latter and the Chemical Foundation. The North Western University will hold itself responsible for the second annual session of the Institute, and there appears to be little doubt that the Institute will be backed in succeeding years. During each session a series of morning and evening lectures and demonstrations is to be arranged, whilst the afternoons will be given over to recreation. It is truly said by our contemporary, the *Journal of Industrial and Engineering Chemistry*, that in these days of extreme specialisation many chemists find no opportunity of keeping abreast of modern developments, and that lectures given by those best qualified to speak will be of great benefit. We claim no right to interfere in the family matters of the American Chemical Society, especially as we are confident that the plan has been evolved with a full knowledge of American temperament, but we conceive that a similar organisation would find little favour in this country. We take our pleasures sadly, maybe, but we do take them, and as the Englishman's home is his castle, so is his holiday his very own. Now that April is here, both poet and chemist revel in the glory of England, and during the few days' break at Eastertide, just as during the summer holiday, we shall go pleasure hunting with ne'er a thought of chemistry. Our American friends are not entirely to take a busman's holiday all the same, for in the agreeable climate of the Pennsylvania hills much enjoyment will be possible to the angler, the motorist, the "hiker" and to all manner of men.

At the same time we cannot think that the average chemist—we have writ much of the average chemist these latter days, but we hope we are not overworking the term—would take kindly to a holiday “with just enough serious work thrown in to keep the time from dragging.” Have we, after all, spoken critically of the American Institute of Chemistry? The temperament of the American is quite different from that of his English cousin, who could never bring himself happily to instal a dictaphone in his bedroom, but there is much else behind our remarks. Chemical organisations in this country have much to learn from the American Chemical Society, which, representing nearly 20,000 chemists, speaks with authority in matters national. Our efforts for many years must be in the direction of bringing about consolidation within the ranks of British chemists. American chemists have the American Chemical Society and may smile contentedly upon the new Institute. We have not yet got Chemistry House.

The Utility of the Electron

One evening recently an enterprising gentleman walked into the editorial sanctum—why it is called a sanctum, we do not know—and placed a polished case upon the editorial table. After a few words of explanation, the young gentleman proceeded to turn a few knobs and, behold, to our surprise, a voice issued from the case and informed us that it was Daventry calling, to be replaced after a few minutes by the guttural warning “Achtung,” evidently from Berlin, and, a little later, by a Parisian who told us what it was that we “came from hearing.” We had previously conceived wireless reception as an operation usually carried on amidst a tangle of wires, but the Rees-Mace Manufacturing Company, who were responsible for the demonstration which had charmed our ears, place everything that is required in a neat case which can be carried about with ease. An inspection of the interior of the apparatus suggested that some nice problems had been solved in the disposition of the components and reminded us that broadcasting owes more to chemistry than it has yet acknowledged. Pure copper wires and other products of the metallurgist, insulating materials such as ebonite, bakelite and so on, colloidal compositions of high electrical resistance, special magnetic materials, and, of course, the thermionic valve, all these are primarily due to the applications of chemistry. The thermionic valve or “tube,” as it is known in the United States, presents interesting possibilities for the measurement of the conductivity of electrolytes, for electrometric titrations, the analysis of gases and similar physico-chemical applications. We do not know if such applications of the valve are common practice; perhaps one of our readers will write and tell us about them. It is an amazing thing to be able, by means of a small box without external connexions of any kind, to hear people speaking and pleasant music from great distances. It has been described as unprofitable to gain the whole world and lose one's own soul. But the offer of access to a goodly part of Europe, simply by expending thirty-five guineas on a Rees-Mace set, is a very strong temptation.

NITROCELLULOSE LACQUERS AND ENAMELS

By HARVEY S. GARLICK

By the treatment of cellulose-containing material with nitric acid in the presence of sulphuric acid, a substance containing from 10 to 13% of nitrogen can be obtained. That containing from 11.2 to 12.4% nitrogen is characterised by high solubility in numerous organic solvents, and is known as pyroxylin. It forms the basis for most of the so-called “cellulose” lacquers and enamels now appearing on the market. Gun cotton is a nitrocellulose of from 12.4 to 13.0% nitrogen content, and is much less soluble. Nitrocellulose containing 10.2 to 11.2% nitrogen is also less soluble than pyroxylin, but is, however, soluble in anhydrous ethyl alcohol.

A solution of nitrocellulose on evaporation leaves a hard, transparent and lustrous film, which, however, is somewhat brittle, though by the incorporation of certain “plasticisers” this difficulty is overcome. The film so obtained does not possess the high sheen of a spirit or oil varnish, but this defect may be remedied by dissolving in the nitrocellulose solution one or more gums or resins. Such a solution yields a film which is equal in finish to that obtained from the highest class of spirit or oil varnish, but is much harder and more resistant to water and wear. Clear transparent solutions of nitrocellulose are called lacquers. By the incorporation of finely-ground pigments, opaque enamels are made which are now rivalling, and in many cases replacing, the older paints and enamels made up in an oil medium.

The foundations of this industry were laid in 1881, when Stevens introduced amyl acetate as a solvent for nitrocellulose. Previous solvents, such as ether-alcohol mixtures and wood spirit, gave, on evaporation, distorted and often cloudy films. By the use of amyl acetate these initial difficulties were overcome, but the rapid growth of the industry led to a shortage of this solvent, and search was made for other and cheaper solvents. Further mention will be made of these later.

The nitrocellulose manufactured until a very short time ago was such that only a few ounces could be dissolved in a gallon of solvent if the solution was not to be too viscous for use. Films from such solutions were very thin, and to obtain a reasonable protective coating a considerable number of applications was necessary. This led to their use only as tarnish preventatives on silver and brass. Research has led, however, to the production, within the last few years, of “low-viscosity cottons,” that is, of nitrocellulose which will dissolve in large quantities and still give solutions fluid enough to apply.

The great advantage possessed by the nitrocellulose products is the rapidity with which they dry, each coat taking, on an average, about half an hour. Once the solvent has evaporated, a stable film remains, as there is no chemical action to set in such as occurs with the older paints employing drying oils and turpentine. Apart from this, it has been demonstrated that far fewer applications are necessary. A high-grade automobile is reputed to be given some twenty or more coats of enamel before reaching a satisfactory condition. A maximum of six coats of a nitrocellulose enamel would produce a

finish the equal of the other in gloss, and superior in resistance to weathering, scratching, or action of petrol. It will also be found that washing and cleaning actually increase the lustre.

Nitrocellulose products are being used by the automobile industry and by furniture makers, both for wood and metal, whilst a third field is now being cultivated in interior decoration and home use.

INGREDIENTS

Nitrocellulose

Cotton fibre, too short to use for spinning or other mill waste, carefully cleaned, is the raw material for the production of nitrocellulose. This is treated with mixed nitric and sulphuric acids under carefully controlled conditions, the properties of the resultant product being particularly dependant on acid concentration and the time and temperature of reaction.

The nitrated cotton, still resembling the original material in appearance, is thoroughly washed till free from all acid, pulped, lightly centrifuged or pressed, and the remaining water removed by displacement with alcohol. The nitrocellulose is usually marketed containing 30% of alcohol, but there is a tendency for the actual lacquer manufacturers to order their material already dissolved in a specified solvent.

Until comparatively recently the nitrocellulose manufactured was that known as "high viscosity cotton"; that is to say, only a small amount could be dissolved without producing a solution too viscous to use. Recent research has shown that treatment with certain compounds or heating under pressure will remove this objection, and solutions are now made containing as much as 30 oz. of nitrocellulose per gallon, as compared with a maximum of 6 oz. of the older type of product. This permits films of good thickness to be deposited at each application.

It is usual to judge the solubility of nitrocellulose by its viscosity in a specified solvent. Acetone is the solvent usually chosen as standard, although solutions in this liquid are apt to give viscosities much lower than those obtained in commercial practice.

Several means of determining viscosities are available, but the simplest and most widely used is the falling sphere method. In this method the viscosity is judged by the time taken for a standard steel ball to fall through a definite column of the solution. Commercial nitrocelluloses vary in viscosity between fairly wide limits, depending entirely upon the conditions of their manufacture. High-grade enamels and wood lacquers require a nitrocellulose of the lowest viscosity. For cheaper products a higher viscosity material suffices, whilst a bronzing liquid must contain a nitrocellulose of high viscosity in order to keep the bronze powder in suspension.

Solvents and diluents

A nitrocellulose film is formed simply by deposition from solution as the solvent evaporates. No oxidation or polymerisation has to take place in order that it may be produced. The time taken to obtain such a film, therefore, depends upon the rate of evaporation of the solution. Thus, in general, the lower the boiling point

the more quickly the surface coated will be in a condition for use. This is not strictly true, because rate of evaporation does not depend only upon the boiling-point of a liquid, although the boiling-point can usually fairly accurately be taken as an indication thereof.

Although it would seem advantageous to use as low boiling a solvent as possible, difficulties are introduced here, because, owing to rapid evaporation, the temperature of the surrounding atmosphere is lowered to such an extent that the dew-point is reached, and moisture is deposited upon the film. This causes "blushing"—that is, precipitation of the nitrocellulose, with the consequent formation of a film lacking in hardness and adherence. To a low-boiling solvent is therefore added a high-boiling solvent to slow down the rate of evaporation sufficiently to prevent the occurrence of blushing.

Solvents for nitrocellulose are comparatively expensive, and it is practically impossible under the varied conditions of use to attempt to recover them. They are therefore almost invariably diluted with certain non-solvents. A diluent must be perfectly miscible with the solvents employed, and must not cause precipitation of the nitrocellulose, either on addition or at any stage during the evaporation of the solution. Only three non-solvents have found any extensive use in the industry—namely, benzene, toluene, and light petroleum spirit. Low-boiling solvents are diluted with benzene and high-boiling solvents with toluene. If a low-boiling solvent were diluted with a high-boiling non-solvent, the former would evaporate more quickly and "solvent blush" would occur—that is, precipitation of nitrocellulose through excess of non-solvent.

No one solvent has been found ideal in its boiling-point, rate of evaporation, solvent power and so on; it is therefore almost invariably the rule to use a mixture of liquids. Experience has shown that the smoother the distillation curve of such a mixture the better the film obtained therefrom. A light, suitably cut petroleum spirit is therefore an excellent non-solvent to use in order to obtain the correct boiling range. Technical solvents, however, usually contain at least traces of water, or are liable to absorb water, and when using a petroleum spirit great care has to be exercised in order not to obtain a turbidity.

One other point that should be mentioned is that in any series of liquids that may be solvents—such as ketones or esters—the lowest members are always the best solvents. Increase in molecular weight decreases the solvent power.

Since nitrocellulose does not form a true solution, it is impossible to obtain any saturation point by which to compare various solvents. Addition of more nitrocellulose merely increases the viscosity of a solution. It is therefore usual to compare the solvent power of liquids by dissolving in 100 c.c. of each 5 grams of the same nitrocellulose, at a temperature of 20° or 25° C., and noting the amount of a particular non-solvent required just to produce precipitation.

Of the many liquids proposed as nitrocellulose solvents, those used to any great extent by the industry are ethyl, butyl and amyl acetates, acetone, methyl ethyl ketone, wood spirit, and ethyl lactate. Butyl propionate,

diacetone alcohol, and hexalin acetate are also used, but to a smaller extent. Alcohols also always find a place in lacquer formulæ. Whilst not true solvents, since the pure substances only cause gelatinisation of nitrocellulose, the alcohols cannot be classed as inert diluents, since the presence of small quantities of other bodies will convert them into powerful solvents.

Methyl alcohol in the form of wood spirit was one of the solvents first used for nitrocellulose lacquers, and it owed its solvent properties to its content of acetone and other impurities. Ethyl alcohol, as already mentioned, is used for dehydrating nitrocellulose, which is often marketed containing 30% of this body. Anhydrous ethyl alcohol has recently been experimented with in the United States in conjunction with a nitrocellulose of slightly lower nitrogen content. Excellent results are reported to have been obtained. Several solvent mixtures are also on the market there, consisting of anhydrous ethyl alcohol plus a small percentage of an ester. Butyl alcohol is now produced in large quantities by a fermentation process, and has largely replaced amyl alcohol in lacquers. It is an excellent blending agent, and forms a constant boiling mixture with water distilling at 92° C. Fusel oil or pure amyl alcohol is also often included in lacquer formulae. The presence of a higher boiling alcohol promotes the formation of a nitrocellulose solution of good flowing properties, giving a smooth and lustrous film. The alcohols, too, are the best solvents for many of the gums and resins used, and are often included for that reason.

One remarkable feature about the nitrocellulose lacquer industry is the fact that the search for suitable solvents and plasticisers has led to the commercial production of numerous compounds previously regarded as purely laboratory curiosities.

Some of the cheaper lacquers employ scrap celluloid as the nitrocellulose base in solutions containing acetone as the principal solvent. Such lacquers do not produce as satisfactory films as those obtained when a high-class low-viscosity nitrocellulose is used. The reason is the variability of the raw material. This always contains camphor also, which slowly volatilises from the dry film and leaves it porous. Solutions containing large amounts of acetone also tend to give matte surfaces, and are more prone to absorb moisture than is desirable. The best films are obtained by the use of anhydrous materials.

Plasticisers

A film of nitrocellulose alone is inclined to be brittle, and when subjected to strain is apt to arch away from its support. This defect is overcome by the addition of a "plasticiser" to the lacquer. The film thus obtained is flexible and adhesive.

The first compound used of any importance in this respect was camphor. It was fairly effective, but in time it evaporated from the film and left it porous and brittle. Castor oil and linseed oils—both raw and boiled—replaced camphor, and still find considerable use, more especially in the cheaper lacquers and enamels. Castor oil is almost invariably a constituent of leather dopes, and aeroplane dopes usually contain it too.

Linseed oil is not popular as a plasticiser, owing to its

drying qualities, whilst the smell and property of tending to make the film too soft are against castor oil. High-class lacquers and enamels utilise for this purpose high-boiling solvents, almost always an ester, the most useful of which are triphenyl and tricresyl phosphates, butyl stearate, butyl tartarate, dibutyl phthalate, and triacetin. Benzyl alcohol is also occasionally used, more especially in this country.

Gums and resins

Practically all nitrocellulose lacquers and enamels now made contain some resin. The reason is twofold. The resin increases the gloss and adhesion of the coating, and secondly, since the addition of resin to the nitrocellulose solution does not appreciably raise the viscosity, it allows the production of a solution of greater total solid content.

The gums and resins used are often not completely soluble in the solvents of the lacquers. It is usual, therefore, to dissolve as much as possible in a particular liquid, separating the clear liquor, and either adding that to the nitrocellulose solution, or else evaporating to obtain the resin and redissolving that with the nitrocellulose.

The gums and resins utilised are usually those used in the spirit varnish trade, but in order to obtain a transparent film, hard and durable, and of high and permanent gloss, it is invariably necessary to use a mixture of two or more. The most widely-used resins are shellac, mastic, dammar, copal and sandarac. Synthetic resins, such as ester gum—made by esterifying rosin with glycerin and albertol—a product of the bakelite type—have also found favour.

Pigments and dyes

Of the innumerable pigments and dyes available, only those of the highest tone and maximum covering power have been used. Pigments must be extremely finely ground in order that they may remain in suspension. Some lacquers contain low-viscosity nitrocellulose, in order to obtain the maximum total solid content, blended with a small quantity of higher viscosity nitrocellulose in order to obtain sufficient body to support the pigment and keep it in suspension.

Application

Until quite recently the only method in use for the application of nitrocellulose lacquers and enamels was spraying. Recent improvements, however, have led to the production of these materials in a condition perfectly suitable for brushing. The solvents used in this case must be such that, whilst sufficient time is allowed for the brush marks to smooth out, they must not be so rapid in their action of dissolving nitrocellulose that they cut through previously applied coats.

Whilst the consumption of nitrocellulose lacquers and enamels in this country is still small compared with that in the United States, there is no reason, now they have obtained a good footing, why they should not as rapidly increase in popularity. Such being the case, enormous quantities of solvents will be required, and will lead to the growth of a new branch of the chemical industry in this country.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

ANNUAL GENERAL MEETING, JULY 4 to 8, 1927

In accordance with the provisions of By-law 68, notice is hereby given that the Annual General Meeting of the Society of Chemical Industry will be held in the Debating Hall, The Union, University of Edinburgh, on Tuesday, July 5, 1927, at 10 a.m.

A preliminary programme appeared on page 265 of CHEMISTRY AND INDUSTRY, for March 25, 1927, but a more detailed programme will be issued shortly.

In accordance with the provisions of By-law 23, notice is hereby given that the following members of Council retire from their respective offices at the forthcoming Annual General Meeting:—

Mr. Francis H. Carr, C.B.E., *President*; Dr. E. Frankland Armstrong, F.R.S., Professor J. W. Hinchley, Professor J. C. Philip, F.R.S., and Sir Richard Threlfall, K.B.E., F.R.S., *Vice-Presidents*; Mr. W. A. S. Calder, Mr. W. H. Coleman, Dr. William Cullen, and Mr. J. Arthur Reavell, *Ordinary Members*.

Mr. Francis H. Carr, C.B.E., has been nominated for re-election to the office of President under By-law 19, Mr. E. V. Evans, Mr. C. S. Garland, Dr. H. Levinstein, and The Right Hon. Sir Alfred Mond, Bart., M.P., have been nominated Vice-Presidents under By-law 20.

Dr. E. W. Smith has been elected Hon. Treasurer, and Dr. E. Frankland Armstrong has been elected Hon. Foreign Secretary.

Members are requested to nominate on or before May 13 next fit and proper persons to fill the four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the General Secretary of the Society.

By-law 22.—An ordinary Member of Council shall be nominated by five or more members upon Form B in the Schedule, a copy of which form shall be furnished by the General Secretary upon the written or verbal request of any member; but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form.

A nomination shall be declared invalid by the Council if:—

(a) The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

(b) The nomination is not made on the authorised printed form, or substantially not in the manner directed thereon.

(c) The nomination form is signed by less than five members not disqualified or not ineligible to nominate as provided by the By-laws.

(d) The nomination form is not received before or upon the day appointed therefor.

(e) The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the General Secretary, and shall not be submitted for election.

J. P. LONGSTAFF,
General Secretary

Members Elected April 8, 1927

- Baker, Reginald, 71, First Avenue, Manor Park, London, E.12. Pupil Gas Engineer.
 Buning, Dr. Harm L., Bensine-Installatie K.N.P.M., Postbus 644, Rotterdam. Assistant Manager.
 Burman, Axel S., K. Patentverket, Valhallavägen, 136, Stockholm. Byrådirektor.
 Challenger, Dr. Frederick, Chemistry Dept., The University, Manchester. Lecturer.
 Daish, Arthur J., The Gas Works, Monkbridge, York. Chemist.
 Ewing, Homer H., 54, New Broad Street, London, E.C.2. Chemical Engineer.
 Hochstadter, Irving, 227, Front Street, New York City, N.Y., U.S.A. Chemical Engineer.
 Hyde, A. T., c/o Messrs. Walter Baker & Co., Ltd., Dorchester, Mass., U.S.A.
 Laing, John B., Railway Hotel, Haddington, N.B. Brewery Chemist.
 Myers, T. Henry, The Croft, Stainton Road, Marton, Yorks. Fuel Chemist.
 Nicholls, Frederick, Redheugh Gasworks, Gateshead-on-Tyne. Chemist.
 Pieper, Ernest J., Armstrong Cork & Insulation Co., Argo Laboratory, Gloucester, N.J., U.S.A. Chemist.
 Preston, Richard St. J., Riverside, Kinlochleven, Argyll. Physical and Electro Chemist.
 Schwartz, Andrew K., South Texas Cotton Oil Co., Houston, Texas, U.S.A. Chemical Engineer.
 Shortt, Arthur, St. Andrews, Clayton Road, Newcastle-on-Tyne. Industrial Chemist.
 Speakman, John B., Dept. of Textile Industries, The University, Leeds. Lecturer.
 Wigg, Edward W., 14, Woodland Road, Chelmsford, Essex. Engineer.

EDINBURGH AND EAST OF SCOTLAND SECTION

The Honorary Secretary, in his report, states that during the session six ordinary meetings were held jointly with the Local Section of the Institute of Chemistry. Papers were read by the President of the Society, Mr. F. H. Carr, C.B.E., on "Vitamins in their relation to industry"; by Mr. A. M. Cameron, B.Sc., on "Fire risks in industry"; by Dr. C. H. Lander on "The importance of fuel research in the coal problem"; by Mr. B. D. W. Luff on "The use of the microscope in qualitative analysis"; by Mr. J. Adam Watson on "Some chemical aspects of geology"; and by Mr. W. A. Williams on "Costs in industry." The meetings had been well attended, the average number being 50, the two Societies contributing towards the attendance.

The joint Scottish meeting arranged to take place in St. Andrews at the end of May last year had to be indefinitely postponed owing to the general strike. In view of the fact that the annual meeting is to be held in Edinburgh in July next, it was decided not to arrange a joint Scottish meeting this session, but it is hoped that such a meeting will take place next year.

Through the courtesy of Messrs. Scottish Oils, Ltd., an interesting afternoon was spent in a visit to the Grange-mouth Oil Refinery on April 20 last.

As there appeared to be very little desire on the part of members for the social evening which it was proposed

to hold in November, the committee decided to give up the project.

The total membership for 1926 was 148: 4 were transferred to other sections, 9 resigned, and there were 2 deaths, leaving 133, to which should be added 5 transferred from other sections and 4 new members, making a total membership of 142. The section had lost two members through death—Mr. P. J. Anderson, Librarian to the University of Aberdeen, and Mr. Allin Cottrell. Mr. Cottrell was a member of Committee, and was ever ready and willing to give his able services to promote the welfare of the Section and the Society as a whole.

The number of associates on the register was less than last year owing to several obtaining appointments outside the area of the section. A small sub-committee had been formed to keep in touch with associates and to bring the activities of the section before the notice of students in Edinburgh.

Mr. W. A. Williams, who has been chairman of the section for the last two years, retires from the chairmanship at the end of the present session. The section owes a great deal to Mr. Williams for his unfailing interest in its welfare and for his able participation in all its activities.

CALENDAR OF FORTHCOMING EVENTS

Apr. 21. INSTITUTION OF MINING AND METALLURGY, Burlington House, Piccadilly, W.1. Annual Meeting.

Apr. 22 FARADAY SOCIETY. *Oxford Meeting*. University and 23. Museum, Oxford. General discussion on "The theory of strong electrolytes." On April 22, from 3.30 to 5.0 p.m., and 5.45 to 7.15 p.m., Part I. "Mobilities of ions," will be given, including the following papers:—(1) Introductory paper. Report on conductivity of strong electrolytes in dilute solutions, by P. Debye. Communicated by E. Hückel. (2) Report on a revision of the conductivity theory, by L. Onsager. (3) Refractometric evidence for the existence of undissociated molecules and complex ions in solutions of strong electrolytes, by K. Fajans. (4) Electrolytic transference of water, true transference numbers, ionic mobilities and water sheaths of the ions, by H. Remy. (5) Ionic mobilities in non-aqueous solvents, by H. Ulich. (6) The mobilities of the elementary ions in methyl alcohol, by H. Hartley and H. R. Raikes. (7) Notes on the Debye-Hückel theory, by H. Hartley and R. P. Bell. (8) The ionisation of some typical strong electrolytes, by D. A. MacInnes. (9) A thermodynamical study of the system lead chloride-potassium chloride-water at 25° C., by A. J. Allmand and L. J. Burrage. (10) Note on the occurrence of points of inflexion in the concentration-vapour pressure curve of aqueous solutions of certain electrolytes, by A. J. Allmand. On April 23, from 9.30 to 11 a.m., and 11.30 to 1 p.m., and 2.15 to 3.45 p.m., Part II.—"Activity," will be held when the following papers will be given:—(1) Introductory paper. On the activity of electrolysis, by J. N. Brønsted. (2) Strong electrolytes in relation to statistical theory, in particular the phase integrals of Gibbs, by R. H. Fowler. (3) Note on the theory of Debye and Hückel, by D. L. Chapman. (4) Anomalies in the theory of solutions of strong electrolytes, by N. Bjerrum. (5) Mixed solutions of electrolytes and non-electrolytes, by G. Scatchard. (6) On the

thermodynamic properties of a few concentrated salt solutions, by H. S. Harned. (7) The activity of zinc chloride in concentrated solution, by F. Foxton and W. J. Shutt. (8) Influence of salts on solubility in non-aqueous solvents, by C. A. Kraus. (9) The use of amalgam electrodes for determining activities in methyl alcohol, by J. H. Wolfenden, C. P. Wright, N. L. Ross-Kane, and P. S. Buckley. (10) The significance of the activity coefficient, by Merle Randall. (11) Methods of calculation of activity coefficient, by Merle Randall. (12) Electrochemical properties of non-aqueous solution of strong electrolytes, by J. R. Partington. (13) The definition and characteristics of strong electrolytes, by T. M. Lowry. (14) The activity of hydrogen ion in mixed solvents as a function of environment, by H. Millet.

Apr. 25. INSTITUTION OF MECHANICAL ENGINEERS. *Graduates' Section*, London. Storey's Gate, St. James's Park, S.W.1, at 7 p.m. "Parcel and package conveying plant," by H. W. Cadman.

Apr. 25. SOCIETY OF CHEMICAL INDUSTRY. *Chemical Engineering Group*. Additional Meeting at the American Film Co., Ltd., 89-91, Wardour Street, London, W.1, at 8 p.m. "Permanent moulding machines for cast iron," by Prof. J. W. Hinchley, illustrated by a film showing the process. Informal Dinner at 6.30 p.m., at the Restaurant Au Petit Riche, 44, Old Compton Street, W.1.

INSTITUTION OF MINING AND METALLURGY

The annual dinner of the Institution of Mining and Metallurgy was held on April 6 in the Hotel Victoria, Sir Thomas H. Holland presiding. The chief guest was Mr. Amery, Secretary of State for Dominion Affairs and the Colonies, who proposed the toast of "The Mineral and Metal Industries of the Empire." He said that the whole fabric of civilisation had grown up in the main on the two great pillars of agriculture and metallurgy. Nothing had been a more dominant factor than the utilisation of metals, both for the conquest of man over nature, and over his fellow man. It was possible that the great new discoveries of gold might have a very stimulating effect in bringing about the recovery of the world from the depression which followed the Great War. We were under the obligation of paying to the United States 6,700 tons of gold, which we should probably have to pay in work, in British goods, and service spent to acquire the gold to be paid back. The problem of the American debt was, therefore, much more one for the prospector and the mining engineer than for the financier. Sir Robert Horne, M.P., president of the Empire Mining and Metallurgical Congress in Canada this year, replied. He said that judging from the response which was coming from the various Dominions and Colonies, he had the greatest hope of a meeting in Montreal in August such as had rarely been seen in the history of the world, and he believed that they would be able to do something which would be of the greatest possible value. He hoped that they would all do their utmost to encourage the investigations which were being made at the present time for the better use of coal. If a method could be discovered by which all the constituents of coal could be most usefully employed, it would enormously add to the wealth of

this country. No investigation was of any use unless they could show that the result of the expenditure upon it would yield a revenue upon the capital invested.

The toast of "Our Guests," proposed by Dr. William Cullen, was responded to by Sir Alfred Mond, M.P., who said he agreed that the world required a new gold inflation. The prosperity of the world had always been in ratio to the discovery of new goldfields. Limitations of trade went together with limitations of credit. People wondered at the prosperity of America. How much of that prosperity was due to the fact that by a most ingenious elaboration dead credits had been mobilised and harnessed to the wheels of industry? That enabled them to produce a condition of prosperity which was likely to remain a leading factor. We wanted new methods in industry and new methods in finance. Unless some of our industries destroyed antiquated and obsolete machinery, and introduced more advanced methods of research, they could not expect to survive the modern competition of Germany and America. Speaking of the great chemical merger with which he was associated, he said that this had been made because it was realised that if the chemical industry was to survive in the front rank, as they intended it should, it could only be done by the pooling of brains, finance, technical knowledge, and research. In a few months they were obtaining results from the merger which he did not think would have been obtained in years. Lord Meston proposed the health of "The President of the Institution," which the chairman acknowledged.

PERSONAL AND OTHER ITEMS

Dr. W. E. Garner has been appointed to succeed Prof. J. W. McBain as professor of physical chemistry in the University of Bristol.

Dr. M. W. Travers has been appointed reader in applied physical chemistry and an honorary professor in the University of Bristol.

The degree of D.Sc. of London University has been conferred upon Mr. W. H. J. Vernon for a thesis entitled "The Atmospheric Corrosion of Metals (Second Experimental Report to the Atmospheric Corrosion Research Committee)."

Prof. H. Freundlich has been appointed deputy director of the Kaiser Wilhelm Institute for physical and electro-chemistry.

The trustees of the John Simon Guggenheim Memorial Foundation have announced the awards of fellowships for 1927-28 to, *inter alios*, Dr. R. B. Harvey, for research into low-temperature effects on plants, principally at Cambridge (Dr. Harvey has discovered that ethylene will hasten the ripening of fruit and vegetables), Dr. L. V. Heilbrunn, for research into the colloid chemistry of protoplasm, and to Dr. J. W. Woodrow, for research on the phosphorescent, chemi-luminescent, and photo-electric properties of cod liver oil and other substances which either have anti-rachitic properties or can be activated by ultra-violet irradiation, principally with Prof. Sir E. Rutherford at Cambridge and Prof. J. E. S. Townsend at Oxford.

Mr. John Parke Jackson, who has been connected with the Salt Union for 27 years, has been appointed

an additional member of the board. He is head of the coastwise and Continental sales department and foreign representative of the Union.

Messrs. Fuerst Brothers & Co., Ltd., announce that their Chairman, Mr. J. Fuerst, is retiring after 43 years' connexion with the company and its predecessors, Fuerst Brothers, of which he was one of the founders in 1884. His two sons, G. M. and H. R. Fuerst, are the remaining directors, and will carry on the company's business of chemical, oil and drug merchants as before.

The Consolidated Gold Fields of South Africa, Ltd., Gold Medal and Premium have been awarded by the Institution of Mining and Metallurgy to Dr. S. W. Smith, for his paper, entitled "Liquation in molten alloys and its possible geological significance."

The late Mr. T. Murdoch, J.P., chairman of the Employers' Federation of Bleachers, left £139,520, with net personalty £111,121.

The Pottery Inquiry

The Committee appointed to inquire into the application made by the British Pottery Manufacturers' Federation for the imposition of a Safeguarding duty on imported tableware of translucent pottery, has recommended that a duty of 28s. per cwt., on the net weight, should be imposed for a period not exceeding 5 years, on translucent and vitrified pottery used in connexion with the service of food and drink. The Committee consisted of three members, two of whom recommended that the application should be granted. The Committee concluded that nothing in the nature of "ring" prices exists in the industry; that the present unemployment in the industry is due to the importation of foreign china; and that, though some economies could be effected by co-operative working, the industry is carried on with reasonable efficiency and economy.

Light Leather Goods Inquiry

The Committee appointed to inquire into applications made by the National Leather Goods and Saddlery Manufacturers' Association for the imposition of a duty upon light leather bags and other receptacles, including bags and receptacles of materials made to resemble leather, and by the British Fittings Manufacturers' Association for the imposition of a duty upon metal frames, locks, and clasps for bags and other receptacles, has concluded that a case for a duty has not been made out.

The Sugar Industry

At a meeting of the Empire Sugar Section of the British Empire Producers' Organization, which represents the entire sugar-producing industry of the British Empire, it was unanimously decided to constitute the section into a federation. The objects of the federation are "to promote the interests of the sugar industry of the Empire and to collect information in regard to all matters relating to methods of production, transport, and marketing; to carry out a programme of propaganda and publicity with a view to increasing the production, sale, and consumption of Empire sugar; and to obtain such treatment for Empire-produced sugar as will secure stability and generally to take such action as may be considered desirable in the interests of the Empire sugar industry."

Sale of Chilean Nitrate

It is announced that free selling of Chilean nitrate will be permissible from April 14, 1927, but no nitrate sold under the free system may leave Chile before June 16, 1927. Therefore, nitrate sold under the free system will not be available in Europe until the middle of July, and so prices for the present season cannot be affected.

Municipal Coal-mining in Germany

The Frankfurt Gas Company and the Municipality of Cologne have purchased 11 coalfields from the Rheinische Stahlwerke A.-G. This is considered as a countermove to the proposed scheme of the Rhenish-Westphalian coal syndicate for the supply of heat and power for the whole of Germany from the Ruhr. The largest shareholder in the Rheinische Stahlwerke is the I.-G. Farbenindustrie, which has hitherto viewed the Ruhr power scheme with apprehension. The move is significant, as the Rheinische Stahlwerke is itself the third largest participator in the Rhenish-Westphalian coal syndicate.

Third Census of Production (Seed-crushing Trade)

In the following statement, particulars are given in respect of the quantity and value of the main classes of products manufactured during the year 1924 by firms engaged in the seed-crushing industry. The figures cover factories and workshops in Great Britain :-

Products	Sold or added to stock		
	Total Make In Year of Return	Quantities	Selling Value £
UNREFINED OILS	Tons	Tons	£
Cocunut	45,200	16,800	738,000
Cotton Seed	87,400	29,800	1,208,000
Ground Nut	29,100	18,500	850,000
Linseed	124,800	118,700	4,707,000
Palm Kernel	119,400	105,000	4,277,000
Rape Seed	25,500	15,800	616,000
Sesame	2,800	2,800	121,000
Soya Bean	16,300	4,600	176,000
Sunflower	6,400	6,200	279,000
Other Unrefined Oils	15,800	4,200	176,000
Total Unrefined Oils	472,700	322,400	13,268,000
REFINED OILS			
Cocunut		28,500	1,461,000
Cotton Seed		74,700	3,400,000
Ground Nut		11,500	619,000
Linseed			
Boiled ..		4,000	213,000
Refined ..		1,300	65,000
Palm		4,200	193,000
Palm Kernel		21,800	1,021,000
Rape Seed		9,600	447,000
Soya Bean		17,900	797,000
Other Refined Oils		12,600	716,000
Total Refined Oils		187,000	8,062,000
OIL-SEED CAKE AND MEAL			
Cotton Seed		413,000	3,253,000
Ground Nut		45,400	412,000
Linseed		271,000	3,163,000
Rape Seed		34,400	204,000
Soya Bean		80,900	835,000
Palm Kernel		116,400	796,000
Cocunut		79,200	254,000
Compound and Other Oil Seed cake and Meal (including Animal Feeding Stuffs unspecified)		463,500	4,485,000
Total Oil-Seed Cake and Meal		1,451,400	13,402,000
OTHER PRODUCTS			
Aid Oils			153,000
Black Grease			82,000
All Other Products			477,000
Total Value of Goods Made			£36,341,000

The quantities shown under the heading "Total Make in Year of Return" represent, without duplication, the total amount of each specified class of unrefined oil expressed during the year 1924, whether the oil was

subsequently refined by the firm by whom it was expressed, or was sold by that firm in an unrefined state. After taking into account the exports and imports of crude oil, it is practically certain that all the crude oil made in the United Kingdom and not refined by the original crushers was sold to manufacturers of soap, margarine, paints, etc., except in the case of cottonseed oil. With regard to the latter, either there was refined in 1924 an exceptionally large quantity of crude oil remaining in stock from previous years, or there was a duplication between the crude and the refined oil amounting in value to £1,000,000, or a little more. Further, the 463,500 tons of "Compound and Other Oil-Seed Cake" may include some cake bought (for mixing) from other makers and also included as output of the makers from whom it was bought, and to the extent to which this has occurred, duplication is involved. An additional 29,500 tons of cake and meal, shown on returns made by manufacturers of soap and candles, should be added to the 1,454,000 tons, shown above as produced in seed-crushing establishments in 1924.

During 1907 the output of oil, oil cakes and sundries totalled 1,371,000 tons, valued at £12,940,000, and other products totalled in value £21,000. Particulars of the quantity of the output for any class of seed oil or cake separately were not available in 1907. The total make of vegetable oils, unrefined in 1907, was 250,000 tons, compared with 472,700 tons in 1924, and of oil-seed cakes and meals the figures were 1,146,000 tons in 1907, against 1,454,400 tons in 1924. The development in crushing varieties of oil seeds and kernels not generally handled in this country before the war is clearly shown by these figures. Exports of unrefined oils in 1924 were 56,900 tons, of refined oils 25,500 tons, and of oil-seed cakes and meals 95,200 tons. The total quantity of oil-seed cakes and meals imported and retained for use was 24.8% of the total quantity manufactured in the United Kingdom, which was 1,454,400 tons, and the quantity of exports amounted to 6.5% of that quantity. The corresponding proportions for the year 1907 were about 30% and 2%, respectively. The net output of the factories employed in the industry was, in 1924, £3,832,000, the total estimated cost of materials used amounting to £32,512,000. The net output per person employed was £273 in 1924, and £180 in 1907. The average number of persons employed during the year was 14,027, compared with 7696 in 1907. The total capacity of engines at seed-crushing factories during 1924 amounted to 50,529 h.p., against 26,492 h.p. in 1907. In addition, in 1924, factories were also equipped with electric motors, driven by purchased electricity, aggregating 22,987 h.p. Electric motors aggregating 17,977 h.p. were returned in 1924 as driven by electricity generated in the firms' own works. About 7% of these motors were shown as in reserve or idle.

Castorseed Crop of British India, 1926-27

From information received from provinces and states which contain practically the whole area under castorseed in India, the total area reported is 1,372,000 acres, compared with 1,401,000 acres last year, a decrease of 2%. The yield is estimated at 132,000 tons, as against 144,000 tons last year, a decrease of 8%. The condition of the crop is, on the whole, reported to be fair.

REVIEW

THE SCIENTIFIC PRINCIPLES OF PETROLEUM TECHNOLOGY. By Dr. LEO GURWITSCH, translated and revised by HAROLD MOORE, M.Sc. Tech. Pp. xvi + 470. London: Chapman & Hall, Ltd., 1926. Price 25s. net.

Mr. Moore's translation of Dr. Gurwitsch's well-known treatise will be welcomed by English chemists interested in the physics and chemistry of petroleum. It is, perhaps, regrettable that the title chosen is quite misleading and gives one no correct idea of the nature of the book. Dr. Gurwitsch deals with few scientific principles and still less with petroleum technology, though his translator has inserted some sections more directly concerned with the industrial aspect of the subject. It is as an organic chemist that Dr. Gurwitsch approaches his subject, and as a treatise on the chemistry of petroleum and its components, this volume should be read by all chemists who are interested in this particularly complex mixture of organic chemicals.

The author makes no attempt to imitate that massive compilation "Das Erdöl," but he has collected a very large proportion of all the work that has ever been published on the physical behaviour and the chemical reactions of the constituents of the various fractions of petroleum. Works of this nature are too apt to consist of an uncritically assembled conglomerate of other peoples' statements, but this is an agreeable exception; the author is sufficiently an expert to be able to review, and where necessary to criticise, the opinions and results he quotes.

The book is divided into five principal sections:—(1) The constituents of petroleum and the action of various reagents on the products. (2) The physical properties of the constituents of petroleum. (3) The distillation of petroleum. (4) The refining of petroleum distillates. (5) The physical and chemical properties of the products.

The first section is the largest, and is concerned mainly with the identity of the compounds constituting petroleum and with the effect of various chemical reagents upon them. The hydrocarbons naturally receive the greatest amount of attention, whilst the oxygen compounds, which have been studied to a greater degree in Russia than elsewhere, are also fully described. Russian oil is not notably sulphurous, and the three-page section on sulphur compounds is decidedly inadequate, certainly not up to date. Much important work on the isolation and properties of these compounds has been published since Mabery's isolation of the "thiophanes" (which the translator describes as "hydrated" thiophens).

The section on the physical properties of petroleum (including a good chapter on surface tension and emulsions) is well written and full of interesting and useful information. The section on distillation consists largely of a survey of cracking and the effect of experimental conditions on the nature of the product; this survey is made from the chemical and not the technical or commercial aspect, though the more well known of the modern processes are briefly described. The concluding section deals with the chemistry and physics of refining,

the chemistry being mainly an account, very exhaustive and informative, of the action of sulphuric acid under all variations of experimental conditions on the various commercial fractions of petroleum. The chapter on adsorption and its application to the selective removal of specific types of petroleum components bears the mark of an authority on this subject.

Dr. Gurwitsch's book is undoubtedly the best treatise on the chemistry of petroleum in existence, and it should be in the library of every chemist who specialises in this material.

F. B. THOLE

PARLIAMENTARY NEWS

White Lead Paint

Answering Mr. Rhys Davies, Earl Winterton said that a letter had been communicated to the Government of India from the Federation of British Industries, suggesting that as the British Government had now decided to regulate, instead of prohibit, the use of white lead in paint, the Bombay Government should cancel its prohibitive instructions. In March, 1926, the Government of India drew the attention of local Governments to the proposals of the British Government, but the present attitude of the Bombay Government on the matter was not yet known. As regards the Convention generally, the difficulty the Government of India felt in putting it into operation was that it was impossible for any Government to control the hundreds of thousands of small painters who had been working in the past. It was therefore suggested by the Government of India that there should be a modification of the original Convention.—March 28.

British Industries Fair

In reply to Mr. Williams, Sir Burton Chadwick said that the space let to exhibitors amounted approximately to 176,000 sq. ft., and the rent paid was £22,000. A contribution of £3,000 per annum was made from the fair funds to cover both the services of the Exhibitions Divisions of the Department and all overhead charges. The whole of the correspondence connected with applications from would-be exhibitors was dealt with by special staff engaged for the fair, and paid for out of fair funds, general inquiries only being dealt with in the general registry of the Department. The whole cost of the staff employed in connexion with the fair was recovered from receipts from exhibitors, and involved no charge to the taxpayer.—March 28.

Food Preservatives

Replying to Mr. Campbell, Mr. Chamberlain said that he did not propose to issue to local authorities a suggestion that they should warn consumers that certain foods should not be expected to keep so long, owing to the absence of preservatives. In making the Regulations, however, the circumstances of the ordinary household, and the fact that most of the principal foods affected were already being sold without preservative by some traders, had been remembered.—March 31.

Fuel Research

The Duchess of Atholl informed Lieut.-Colonel Watts-Morgan that one of the duties of the Intelligence Section of the Fuel Research Division of the Department of Scientific and Industrial Research was to keep in touch

with the more important developments of fuel research in other countries, and a great deal of useful information had been obtained.—April 4.

Replying to various questions, the Duchess of Atholl stated that the net amount spent by the Department of Scientific and Industrial Research on fuel research in 1925–26 was £76,547, and during 1926–27 about £88,000. The products obtained from a ton of coal by the latest experimental treatment varied according to the process adopted and the coal used. It was impossible to give reliable commercial values for the by products until they had been available for purchase in large quantities over an extended period. During 1926 the coal used for experimental purposes by the Fuel Research Board amounted to 1541 tons of nuts, 2501 tons of run of mine, and 518 tons of smalls. The run of mine consisted of large and small in about equal proportions. It was sometimes used as received, and sometimes screened, according to the investigation in progress. The Prime Minister was not prepared to direct that a definite sum should be set aside for the purpose of research into the uses of oil for power production, since in these matters the Lord President was advised from time to time by his Advisory Council for Scientific and Industrial Research.—April 5.

In a written answer to Mr. Walsh, Colonel Lane Fox stated that the colliery owners had a national research association, and many of them were associated with the research work of the Institution of Mining Engineers. Locally, there was a Lancashire and Cheshire Coal Research Association, and in this and other coalfields some of the colliery owners, individually and through their associations, co-operated in research work carried on at the universities and by the local institutions of mining engineers. He had no information as to the amount spent.—April 6.

Lord E. Percy informed Mr. Lawson that coal for the experimental work of the Fuel Research Board had been drawn from the following coalfields in Great Britain :

• Northumberland and Durham, Lancashire, Yorkshire, Nottinghamshire and Derbyshire, North Staffordshire, South Staffordshire, Leicestershire, South Wales, Kent, Lanarkshire, Stirling, and Linlithgow. Arrangements were being made for a test on some Somerset coal to be carried out shortly. April 7.

Experimental Lactose Factory, Haslington

Mr. Guinness informed Mr. Lansbury that the total cost of the experimental factory at Haslington, which was established to investigate the problem of the utilisation of whey, was £43,600, including maintenance charges of £12,700 during the period 1918–26; it was sold by public tender for £3000 as from March 1, 1926. The cost of the experiment to the exchequer was therefore £40,600. An account of the work done at the factory, and of the solution which was obtained of the problem before it, had been published by the Ministry of Agriculture.—April 6

COMPANY NEWS LEVER BROS., LTD.

The net profit for 1926 amounted to £4,899,966, after providing for depreciation and allowing £463,465 for

debenture interest, compared with £5,501,556 for 1925. The preference and preferred dividends absorbed £3,895,528, and the balance of £4437 has been placed to reserve, as against an allocation of £661,343. Notwithstanding the depressing effect upon trade of the industrial disturbances during 1926, the total sales of soap were more than maintained. Steady progress was being made with the construction of the dock at Bromborough Port on the River Mersey, and with the development of the properties of the Huileries du Congo Belge. Three new soap factories, in Dublin, Buenos Aires and Sydney, N.S.W. respectively, were in course of erection, and were expected to be completed this year.

BRITISH DYESTUFFS CORPORATION, LTD.

The eighth ordinary general meeting was held on April 6, and was presided over by Lord Colwyn, deputy-chairman, in the absence, through indisposition, of the chairman, Lord Ashfield. In his prepared speech, which was read by Lord Colwyn, Lord Ashfield said he was conscious that he was addressing himself to a larger audience than was represented by the present shareholders of the company—namely, to those persons whose interests had now been merged with those of shareholders in other allied businesses in Imperial Chemical Industries, Ltd. The trading profits for the nine months, before providing for depreciation on plant and machinery, amounted to £82,931, which with the balance brought forward from the previous year, made an available sum of £160,939, from which £45,000 had been set aside for depreciation, leaving a net balance of £115,939. Even for a period of only nine months, this was not a satisfactory result by comparison with the previous year. When he last addressed the shareholders, we were at the beginning of what proved to be one of the most disastrous industrial disputes ever experienced in this country, and when he now reflected upon its length and extent, he wondered that the trade of the country was not more adversely affected. He wished that a better result could have been shown as a result of their trading activities, but he did not feel called upon to make any elaborate apology for the somewhat meagre amount realised under such circumstances, particularly in view of the fact that, though costs of production were materially higher, prices of dyestuffs have shown a continuous decline throughout the period. Every endeavour had been made, with some success, to increase efficiency and reduce expenditure, and he thought they could now claim that to-day they offered in their technical and commercial departments a service to the consumers of their dyestuffs in the textile and other industries which left little or nothing to be desired, and he also believed that their prices have been reduced to the lowest possible level under present circumstances. As regards payment of a dividend, it was possible that had no merger with other chemical undertakings occurred, the net balance of £115,939 mentioned above would have been carried forward and not distributed, but it was necessary to consider the interest of the shareholders connected with the Corporation prior to the amalgamation, and to have regard to the policy adopted by the other companies with which it had joined interests. Also, the Corporation had very ample resources in cash and investments and

it was not so necessary to carry forward a large balance; finally, the directors did not wish to go back from the start made last year by paying a dividend, and accordingly a dividend was declared of $2\frac{1}{2}\%$ per annum (less tax) for the nine months to December '31, 1926. As regards the merger in Imperial Chemical Industries, Ltd., the directors were gratified by the emphatic manner in which their decision to enter this important merger had been endorsed. Out of a total of 4,775,580 shares, only 47,818 shares had not been exchanged, many of which were held by persons resident abroad or by persons who could not be traced. The formation of Imperial Chemical Industries, Ltd., represented a determination to co-ordinate and develop the chemical resources of this country in a much more effective manner than has been possible in the past. It represented a new stage of industrial development within our Empire, whilst it fully recognised the obligations it carries not only to its shareholders, but also to consumers of its products and to the staff and workpeople it employs. The new company possesses a world-wide organisation and an unrivalled capacity for production in nearly all branches of the chemical industry, whilst its resources both in funds and personnel will enable it to enter into new fields of research in a manner which has hitherto been impossible to any single firm. The address was concluded by a short review of the earlier history of the Corporation since its formation in 1919 under the encouragement of the Board of Trade and of the principal colour-consuming industries, with the object of extending and concentrating the manufacture of synthetic dyestuffs in this country. It was no small scientific and commercial achievement that in spite of the handicaps under which the Corporation has laboured it has been able to develop from a small foundation a highly organised dyestuffs industry capable of giving an effective service to the colour users of this country. Those to whom the management of the Corporation had been entrusted during the past two or three years were not unappreciative of the patience and forbearance of the shareholders in the past, and they hoped that the measure of success which had attended their efforts, especially in connexion with the merger of the Corporation's interests with other and greater interests, had in some degree rewarded the shareholders.

SCHIMMEL AND CO.

This firm, which manufactures essential oils, flower ottos, natural isolates, synthetics, essences, etc., and has been the property of the Fritzsche family, Leipzig, for generations, has taken over by amalgamation the well-known concern in the same line of E. Sachsse & Co., of Leipzig. At the same time, it has been converted into a private limited company (registered capital £300,000 and ample reserves), the shares of which will remain in the family. Messrs. Schimmel & Co.'s business will be carried on as hitherto, the management remaining in the hands of the former owners, of whom the senior partner, Mr. Karl Fritzsche will act as chairman of the board, whereas Mr. Hermann Fritzsche will be the sole acting director of the limited company. Customers of Messrs. E. Sachsse & Co. will now be supplied exclusively from Miltitz near Leipzig.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime—£7 10s. per ton, packages extra.
Bleaching Powder—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
Borax, Commercial—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid—£5—£5 5s. per ton, carr. paid.
Copper Sulphate—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate—£38 per ton d/d.
Nickel Ammon. Sulphate—£38 per ton d/d.
Potash, Caustic—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
Salt Cake—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%—£21 per ton. Sod. Bicarbonate (refined)—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
Sod. Phosphate—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt)—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide—Golden.—6d.—1s. 5½d. per lb., according to quality.
Crimson—1s. 3d.—1s. 7½d. per lb., according to quality.
Arsenic, Sulphide, Yellow—2s. per lb.
Barytes—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide—2s. 9d. per lb.
Carbon Bisulphide—£20—£25 per ton, according to quantity.
Carbon Black—5½d. per lb., ex wharf.
Carbon Tetrachloride—£46—£55 per ton, according to quantity, drums extra.
Chromium Oxide, Green—1s. 2d. per lb.
Diphenylguanidine—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton. f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—5s. 3d. per lb. •
 Zinc Sulphide.—1s. 1d. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—1s. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s.—4s. 3d. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 8d. per lb. Crude 60's, 1s. 8d.—1s. 9½d. per gal.
 Acid Cresylic, 99/100.—2s. 6d.—2s. 8d. per gal. Steady 97/99.—2s. 2s. 2d. per gal. Pale, 95%, 1s. 10d.—2s. 2d. per gal. Dark, 1s. 9d.—2s. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 2½d.—1s. 3½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 4d. per gal., ex works in tank wagons; Pure, 2s.—2s. 3d. per gal., ex works in tank wagons
 Toluole.—90%, 2s. 1d. to 2s. 2d. per gal. Firm. Pure, 2s. 3d.—2s. 4d. per gal.
 Xylol.—2s. 1d.—2s. 6d. per gal. Pure, 3s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—9½d. per gal., according to quality. Solvent 90/160, 1s. 8d. per gal. Solvent 95/160, 1s. 7d.—1s. 8d. per gal. Solvent 90/190, 1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—80s.—85s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—9s. 6d.—10s. per gal. Nominal. 90/180—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d. per lb. Fair enquiry.
 m-Cresol 98/100%.—2s. 8½d. per lb. Only limited enquiry.
 p-Cresol 32/34° C.—2s. 8½d. per lb. Only limited enquiry.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d.—8d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Firm and brisk.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 5½d.—1s. 5¾d. per lb. Less 5%. Firm.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 3½d.—1s. 4½d. per lb. Technical 11½d.—1s. per lb. Both in good demand.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 2d. per lb. Less 5%. Firm market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb. Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d.—2s. 6d. per lb. Potassium.—1s. 11d.—2s. 1d. per lb. Sodium.—2s. 2d.—2d. 4d. per lb. All spot.

Calcium Lactate.—1s. 3½d.—1s. 4½d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ether meth.—1s. 1d.—1s. 1½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £33 per ton net.

Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Monthol.—A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 11s.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonal.—11s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. per lb.

Phenazone.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 90s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb. Very limited enquiry.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d.—per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net, according to quantity. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—7s. 6d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.

Thymol, Puriss.—11s. 6d.—12s. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (*ex Anethole*).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. 6d. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—3s. per lb.

Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—27s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb. Good demand.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—12s. per lb.

Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb.

Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—10s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb.

Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 18s. 9d. per lb. Japanese, 8s. 6d. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than June 4th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on April 21st. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Borg. Filtration. 8655. Mar. 20.
Glossop and Hodson. Kilns. 8584. Mar. 29.
I.-G. Farbenind. Preparation of emulsifying-agents. 8475. Mar. 28. (Ger., 27.3.26.) Manufacture of decomposition products etc. 8477. Mar. 28. (Ger., 3.4.26.)

Johnson (I.-G. Farbenind.). Production of gases. 9133. Apr. 2.

Metropolitan-Vickers Electrical Co., Ltd., and Bailey. Heat treatment of pulverulent materials. 8644. Mar. 29.

Semet-Solvay Co. Distillation systems. 9017. Apr. 1. (U.S., 17.4.26.)

I.—Complete Specifications

32,778 (1925). Wisner. Rotary furnaces. (246,118.)
32,800 (1925). Campbell. Apparatus for separating solids from liquids. (268,051.)

13,436 (1926). Excelsior Feuerlöschgeräte. Producing foam for fire-extinguishing. (252,727.)

14,842 (1926). Johnson (I.-G. Farbenind.). Feeding solids and gases into reaction vessels under pressure. (268,188.)

15,613 (1926). Grisco-Russell Co. Heating or cooling viscous liquids. (256,579.)

25,283 (1926). Meister. Drying-apparatus. (268,237.)

27,520 (1926). Bentley. Tube and like mills. (268,245.)

30,685 (1926). Vernay. Rotary drying-apparatus. (262,464.)

31,903 (1926). Siemens Schuckertwerke. Crucibles. (263,171.)

32,837 (1926). Loesche. Grinding-mills. (268,263.)

32,842 (1926). Albas-Chalmers Manufacturing Co. Comminuting-mills. (268,264.)

2270 (1927). Mercier. Apparatus for condensing vapours and extracting non-condensable gases. (265,199.)

*8007 (1927). Bergl and Dietrich. Production of cold. (268,358.)

*8460 (1927). Cerini. *See* VII.

*8475 (1927). I.-G. Farbenind. Emulsifying agents. (268,387.)

II.—Applications

Chambers. Purifiers for manufacture of gas. 8986. Apr. 1.

I.-G. Farbenind. Conversion of hydrocarbons of high boiling point into compounds of low boiling point. 8890. Mar. 31. (Ger., 1.4.26.)

Mallery. Utilising residue oils containing water. 8983. Apr. 1. (U.S., 5.4.26.)

Ringrose. Apparatus for detecting etc. inflammable vapours. 8975. Apr. 1.

Salerni. Treatment of hydrocarbon gases etc. 8481. Mar. 28.

Synthetic Ammonia & Nitrates, Ltd., and Horsley. Process of separating and recovering olefins from gases. 8705. Mar. 30.

III.—Complete Specifications

30,225, 23,985, and 30,307 (1925). Bonniksen and Barratt. Production of flame or smoke for signalling and smoke-screen purposes. (268,004.)

*31,520 (1925). Bone, Quirendon, and Gas Light & Coke Co. Manufacture of products by oxidising coal. (268,006.)

31,929 (1925). La Raboisiere. Fuels. (244,797.)

32,438 (1925). Siemens A.-G., and Bahr. Recovering sulphur compounds of ammonia from gas mixtures. (268,024.)

28,803 (1926). Lasmolles. Gas producers. (262,088.)

*25,872 (1926). Bensmann. Regeneration of lubricating-oils. (268,284.)

*6811 (1927). Seelig. Cracking oils. (268,323.)

*8268 (1927). Koppers Co. Manufacture of coal products. (268,372.)

III.—Application

I.-G. Farbenind. Production of conversion products of tars etc. 8476. Mar. 28. (Ger., 30.3.26.)

IV.—Applications

Carmichael (I.-G. Farbenind.). Manufacture of compounds of thiazolic series. 8789. Mar. 30.

Holliday & Co., Ltd., Kitson, and Shaw. Production of dyestuffs. 8685. Mar. 30.

I.-G. Farbenind. Manufacture of diazotised amines of the cyclic series. 8771. Mar. 30. (Ger., 30.3.26.) Manufacture of azo dyestuffs. 8931. Mar. 31. (Ger., 31.3.26.)

Imray (I.-G. Farbenind.). Manufacture of sulphur dyestuff. 8624. Mar. 29.

Scottish Dyes, Ltd., Smith, and Thomas. Dyestuffs etc. 9053. Apr. 1.

V.—Applications

Angel. Manufacture of cellulose. 9144. Apr. 2.

Bemberg A.-G. Manufacture of artificial silk. 8543. Mar. 28. (Ger., 27.3.26.)

Clavel. Treatment of artificial silk. 8784. Mar. 30.

Deutsche Zellstoff-Textilwerke Ges. Treating artificial silk. 8658. Mar. 29. (Ger., 30.3.26.)

Lucas, and Vickers, Ltd. Preparing fibrous vegetable materials. 9145. Apr. 2.

Silver Springs Bleaching & Dyeing Co., and Hall. Treating viscose silk. 8716. Mar. 30.

Verein f. Chem. Industrie. Recovery of acetic acid from acetyl cellulose. 8495. Mar. 28.

V.—Complete Specifications

*31,737 (1926). I. G. Farbenind. Manufacture of cellulose esters. (268,289.)

*8543 (1927). Bemberg A.-G. Manufacture of twisted artificial silk. (268,393.)

VI.—Application

Heberlein & Co. Producing pattern effects on textile goods. 8501 and 8623. Mar. 28 and 29. (Ger., 27 and 30.3.26.)

VI.—Complete Specifications

*7076 (1927). Adolph and Pietzsch. Bleaching. (268,325.)

*7189 (1927). Soc. Anon. Etabl. Petitdidier. Dyeing fabrics containing immunised cotton fibres. (268,327.)

*8147 (1927). Soc. Chem. Ind. in Basle. Manufacture of artificial forms or threads fast to water and easily dyed. (268,363.)

*8501 (1927). Heberlein & Co. Producing pattern effects on textiles. (268,389.)

VII.—Applications

Cerini. Purification of caustic soda etc. 8460. Mar. 28. (Italy, 26.3.26.)

Colombo. Chambers for manufacture of sulphuric acid. 8894. Mar. 31. (Spain, 6.5.26.)

Gerlach. 8741. *See* XI.

Goldschmidt and Goldschmidt. 8783. *See* XVIII.

I.-G. Farbenind. 8892. *See* X. Catalytic production of hydrocyanic acid from formamide. 9002. Apr. 1. (Ger., 10.4.26.) Manufacture of alkali bisulphate. 9035. Apr. 1. (Ger., 1.4.26.)

Kaiser and Lichtenberger. Manufacturing finely distributed barium sulphate etc. 8607. Mar. 29. (Ger., 3.4.26.)

Metallbank und Metallurgische Ges. A.-G. Treating lithium-containing silicates. 8943. Mar. 31. (Ger., 22.4.26.)

Verein f. Chem. Industrie. 8495. *See* V.

VII.—Complete Specifications

29,096 (1925). Lambert. Manufacture of potassium nitrate. (267,996.)

32,046 (1925). Haddan (Celite Co.). Manufacture of silicious alkaline earth compounds. (268,011.)

32,509 (1925). Deutsche Gold- u. Silberscheideanstalt. Production of concentrated solutions of alkali cyanides. (245,152.)

5218 (1926). Bentley, and Blythe & Co., Ltd. Manufacture of lead nitrate. (268,104.)

13,831 (1926). A.P.I.C.E. Soc. Anon. Prodotti Ital. Chim. Estrattivi, and Gasparrani. Manufacture of sodium chloride. (268,181.)

16,394 (1926). Rhenania Verein Chem. Fabr. Manufacture of moulded sulphur. (265,540.)

*4002 (1927). New Jersey Zinc Co. Manufacture of zinc oxide. (268,301.)

*4881 (1927). Collin A.-G. Discharging ammonium sulphate from saturating tanks. (268,309.)

*8460 (1927). Cerini. Apparatus for purifying impure solutions of caustic soda etc. (268,385.)

VIII.—Applications

British Thomson-Houston Co., Ltd. Apparatus for producing silica articles. 8609. Mar. 29. (U.S., 1,426.)

Despret. Continuous manufacture of molten and refined glass. 9056. Apr. 1.

VIII.—Complete Specifications

18,979 (1926). Gourdjian and Jones. Clay bodies for tiles etc. (268,204.)

29,514 (1926). Kruger. Process of producing cast articles, volcanic stones, etc. (262,413.)

IX.—Applications

Knibbs. Production of cementitious material. 9054. Apr. 1.

Soc. Le Nylum. Manufacture of magnesia cements. 9126. Apr. 2. (Fr., 16,426.)

IX.—Complete Specification

32,046 (1925). Haddan (Celite Co.). See VII.

X.—Applications

Allgem. Elektrizitäts-Ges. Production of metallic coatings upon non-conducting oxides. 9021. Apr. 1. (Ger., 1,426.)

Aluminum Co. of America. 8502. See XIII.

Aumund. Blast furnaces. 8864. Mar. 31. (Ger., 31,326.)

Blumey. Extraction of metals from ores. 9081. Apr. 2.

Boumphrey. Preventing corrosion of metals. 8819. Mar. 31.

Glennell. Extraction of cobalt and nickel. 9094. Apr. 2.

Ellis (Granular Iron Co.). Rail steels. 9143. Apr. 2.

Garnet, Holden, and Smith. Heat resistance alloys. 8649. Mar. 29.

Hofmann. Ore smelting. 8657. Mar. 29.

I.-G. Farbenind. Precipitation of heavy metals from ammoniacal solutions. 8892. Mar. 31. (Ger., 9,426.)

Minerals Separation, Ltd. (Beasley and Tiplin). Leaching ores. 9041. Apr. 1.

Ozberger. Alloy. 8900. Mar. 31. (Austria, 3,426.)

X. Complete Specifications

7560 (1926). Ellis, and United Steel Co. Treatment of steel ingots. (268,123.)

18,262 (1926). Corson. Copper alloys. (268,200.)

18,333 (1926). Job. Treatment of zinc ores etc. (268,201.)

23,318 (1926). Metallbank u. Metallurgische Ges. Copper alloys. (268,225.)

*16,842 (1926). Zinnwerke Wilhelmsburg Ges. Treating anthracite ores, especially tin ores. (268,278.)

*4262 (1927). New Jersey Zinc Co. Metallurgical operations. (268,302.)

*4516 (1927). Polanyi and Bogdandy. Determining the composition of copper and zinc alloys. (268,306.)

*6027 (1927). Lacell. Production of magnesium. (268,316.)

XI.—Applications

Allgem. Elektrizitäts-Ges. 9021. See X.

Fromont. Electric accumulators. 9147. Apr. 2. (Fr., 2,426.)

Gerlach. Electrolytic cells for decomposition of alkali chlorides. 8741. Mar. 30. (Ger., 17,426.)

Gjerulff. Galvanic cells. 8710. Mar. 30.

Standard Telephones and Cables, Ltd. Magnetic core materials. 8464. Mar. 28. (U.S., 17,426.)

Materials. 8465. Mar. 28. (U.S., 17,426.)

Vultex, Ltd. 8942. See XIV.

XI.—Complete Specifications

32,220 (1925). Billiter, and Siemens & Halske A.-G. Electrolytic filter diaphragms. (245,127.)

32,718 (1925). Mierow. Galvanic batteries. (268,047.)

30,795 (1926). Billiter, and Siemens & Halske A.-G. Electrolytic filter diaphragms. (262,470.)

*8176 (1927). Aletter. Producing electric lead accumulators. (268,366.)

XII.—Application

Industrial Spray-Drying Corp. Manufacture of soap powder. 8960. Apr. 1. (U.S., 19,426.)

XII.—Complete Specifications

29,673 (1925). Charlton, and Rowe & Co., Ltd. Manufacture of soap. (267,999.)

*6598 (1927). Maschinenfabr. Elite A.-G. Manufacture of soap flakes. (268,320.)

XIII.—Applications

Aluminum Co. of America. Production of corrosion-resistant articles. 8502. Mar. 28. (U.S., 22,127.)

Comp. Lorraine de Charbons, Lampes, et App. Electriques. Treatment of pulverulent fillers and pigments etc. 8480. Mar. 28. (Fr., 10,526.)

Kalbitum Paint Co., Ltd. Paints etc. 9118. Apr. 2.

XIV.—Applications

Barrows. Rubber etc. 8603. Mar. 29.

Dunlop Rubber Co., Ltd., and Thornton. Manufacture of articles from aqueous dispersions of rubber etc. 8582. Mar. 29.

General Rubber Co. Apparatus for drying rubber latex etc. 8470. Mar. 28. (U.S., 10,426.)

Vultex, Ltd. Production of caoutchouc articles etc. by electrodeposition. 8942. Mar. 31. (Ger., 5,726.)

XIV.—Complete Specifications

12,609 (1926). Kodak, Ltd. Coating materials with rubber. (261,700.)

22,359 (1926). General Rubber Co. Preserving latex. (268,219.)

*2764 (1927). Nantux Chemical Co. Treating latex. (268,299.)

XV.—Applications

Arnold (Laucks, Inc.). Protein colloids etc. 8505. Mar. 28.

I.-G. Farbenind. Hardening plastic masses from casein etc. 8922. Mar. 31. (Ger., 31,326.)

Matthews. Impregnating leather with wax etc. 8674. Mar. 29.

XVI. Application

Liljenroth. Production of manures. 8628. Mar. 29. (Sweden, 14,126.)

XVI.—Complete Specification

*32,802 (1926). Bennett. Treating seeds to augment their cultural value. (268,291.)

XVIII.—Applications

Commercial Solvents Corp. Butyl-acetonic fermentation. 8535. Mar. 28. (U.S., 1,1026.)

Goldschmidt and Goldschmidt. Obtaining concentrated potassium solutions from distiller's mash. 8783. Mar. 30. (Czecho-Slovakia, 30,326.)

Sak. Production of compressed yeast. 8932, 9028, 9029. Mar. 31 and Apr. 1.

XIX.—Applications

Arnot. Treatment and utilisation of animal blood etc. 8651. Mar. 29.

Posternak. Obtaining total nuclei of proteids of egg yolk. 8929. Mar. 31. (Switz., 31,326.)

Posternak and Posternak. Separating and purifying phosphorus nuclei of proteids in egg yolk. 8930. Mar. 31. (Switz., 31,326.)

Vautin. Preservation of eggs. 8670. Mar. 29.

XIX.—Complete Specifications

9047 (1926). Vidal (Anderson-Barngrover Manufacturing Co.). Treatment of condensed or evaporated milk. (268,138.)
26,219 (1926). Vietinghoff. Obtaining extractives from coffee. (268,241.)

XX.—Applications

Commercial Solvents Corp. 8535. See XVIII. Catalysts for synthesis of methanol. 8536. Mar. 28. (U.S., 25,10,26.)
Dehn (Chem. Pharm. A.-G. Bad Homburg). Production of solutions of basic quinine. 8888. Mar. 31.
Haskell. Solvent for essential oils etc. 8463. Mar. 28.

XX.—Complete Specifications

11,083 (1926). Thiermae. Separation and purification of vanillin. (268,158.)
*8285 (1927). I. G. Farbenind. Manufacture of alkylated or cyclo-alkylated arylsulphonic acids. (268,375.)

XXI.—Complete Specification

10,595 (1926). Silver Springs Bleaching and Dyeing Co. Ltd., and Hall. Development of photographic plates, films, and the like. (268,155.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*British India*: Boilers, steel boiler tubes (The South Indian Railway Co., Ltd., 91, Petty France, London, S.W.1); Acetone (Director General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Canada*: Lubricating apparatus (342a). *Greece*: Carbon paper, typewriter ribbons (357). *Norway*: Cattle feeding stuffs (361). *South Africa*: Earthenware, glassware (348); cast iron pipes (A.X. 4520); steel pipes (A.X. 4519).

Safeguarding of Key Industries

The Board of Trade give notice that representations have been made to them under Section 10 (5) of the Finance Act, 1926, regarding the article, Urea.

Section 10 (5) of the Finance Act, 1926, is as follows:—

"The Treasury may by order exempt from the duty imposed by Section 1 of the Safeguarding of Industries Act, 1921, as amended by this Act, for such period as may be specified in the order, any article in respect of which the Board of Trade are satisfied on a representation made by a consumer of that article that the article is not made in any part of His Majesty's Dominions in quantities which are substantial having regard to the consumption of that article for the time being in the United Kingdom, and that there is no reasonable probability that the article will within a reasonable period be made in His Majesty's Dominions in such substantial quantities."

Any person desiring to communicate with the Board of Trade with respect to this application should write to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, within one month from the date of this notice (April 6, 1927).

New Dyestuffs

A new pattern card No. S.C.68, published by the British Dyestuffs Corporation, shows a valuable addition

to the B.D.C. range of sulphur colours, in Thionol Brown CL4R. Unlike many of the usual bright red browns on the market, it possesses very good fastness to light, washing, alkalis, acids and cross-dyeing. The shade is practically unaffected by after-treatment with chrome and copper. It is applicable to all forms of cotton materials, and is suitable for dyeing in circulating machines.

A further addition to the B.D.C. chrome colours is "Solochrome Brown RH," which gives full reddish brown shades and possesses an additional advantage of being in powder form. It leaves cotton effects white. It is of interest for the dyeing of all forms of wool materials, and, owing to its very good fastness to light, good fastness to milling and levelling power, it is specially suitable for dyeing loose wool, slubbing and piece intended for the manufacture of suitings. In addition it is of interest for dyeing shoddy.

News from Advertisements

The Department of Scientific Research announces a vacancy for an analyst in the Building Research Station (p. viii).

A chemist is wanted for practical inorganic and physical chemical research (p. viii).

Technical chemist or chemical engineer with experience in the manufacture and blending of tanning extracts is wanted (p. viii).

The University College, Cork, invites applications for a vacant professorship and vacant lectureships (p. viii).

The University of St. Andrews draws attention to the Scholarships and Bursaries open to competition in June, 1927 (p. viii).

A large manufacturing company requires chemists for plant and laboratory. Previous experience in artificial silk essential (p. viii).

PUBLICATIONS RECEIVED

LES MATHÉMATIQUES DU CHIMISTE. By L. Gay. Pp. vii + 208. Paris: J. Hermann, 1926. Price 26 fr.

LE CAOUTCHOUC DURCI. By A.-D. Luttringer. Encyclopédie du Caoutchouc et des Matières Plastiques, edited by A.-D. Cillard. Pp. 198. Paris: A.-D. Cillard, 1926. Price 31.50 fr.

DIE SELTENEN ERDEN VOM STANDPUNKTE DES ATOMBBAUES. By Dr. G. v. Hevesy. Struktur der Materie in Einzeldarstellungen, edited by M. Born and J. Franck. Pp. viii + 140. Berlin: Julius Springer, 1927. Price, bound 10.20 r.m., paper 9 r.m.

WÄRMEWIRTSCHAFT IN DER KERAMISCHEN INDUSTRIE. By Dr. W. Steger. Part V. Wärmelehre und Wärmewirtschaft in Einzeldarstellungen, edited by Prof. H. Pfutzner, Prof. A. Naegel and Prof. W. Pauer. Pp. x + 147. Dresden and Leipzig: Th. Steinkopff, 1927. Price, paper 8 m., bound 9.50 m.

ANORGANISCHE CHEMIE. By Dr. R. Schwarz. Part XVI. Wissenschaftliche Forschungsberichte. Naturwissenschaftliche Reihe, edited by Dr. R. E. Liesegang. Pp. xi + 139. Dresden and Leipzig: Th. Steinkopff, 1927. Price, paper 8 m., bound 9.50 m.

DIE HERSTELLUNG KOLLOIDER LÖSUNGEN ANORGANISCHER STOFFE. By Dr. J. Reitstötter. Sonderausgabe aus der Kolloidchemischen Technologie, edited by Dr. R. E. Liesegang. Pp. 62. Dresden and Leipzig: Th. Steinkopff, 1927. Price 3 m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW
SERIES**

LONDON, APRIL 22, 1927

No. 16

EDITORIAL

Research Associations

READING through the Report of the Privy Council for Scientific and Industrial Research more at our leisure, we found ourselves regretting that two additional research associations at least, namely, those to work for the benefit of the portland cement and paper-making industries, were not in active being. Neither of these important industries is actually languishing, but it can surely not be held that nothing remains to be discovered which shall be of value to them. In both instances it is true that mechanical and engineering skill has been largely responsible for lowering the costs of production, and the manufacturer naturally pays great heed to improvements in plant and equipment. In the cement industry, producing after a hundred years at the rate of around four million tons of cement a year, more than twice as much capital per man employed is invested as compared with the average for all other industries, and the manufacturer appears ready to spend still further upon improved kilns, clinker coolers, grinding mills, mechanical conveyors and packing machines, dust filters and electrical drive mechanism. He is ready, too, to march with the times when he realises that the recovery of heat from kiln gases by means of waste-heat boilers may be sufficient to generate the whole of the electrical power required throughout the cement plant. It is, therefore, the more difficult to understand why the study of fundamentals is so neglected not only upon the purely chemical side, but also in the matter of important engineering problems. Dr. Martin said in a paper which we published a few months ago upon

"Some recent researches in the science of fine grinding," that although the subject was of great importance to the cement industry, which spent over a million pounds annually upon grinding clinker, the scientific work striking at the very basis of the problem

was carried out in most worrying and discouraging circumstances. The Government withdrew their grant long before the British Portland Cement Research Association was on its feet, while the cement trade itself was openly hostile." In matters chemical, too, there appears to be the same lack of enterprise. The state of combination which exists amongst the lime,

silica and alumina in portland cement is still unknown, and who may say what will come of a full study of this problem. Already it is known that by using a different "raw mix" containing more than the usual proportion of alumina the rapid hardening high strength cement of the type of the French fused cement can be made, and that by paying full attention to materials, control, and extreme fine grinding of clinker similar portland cements can be produced as, for instance, in the case of the British "Ferrocrete." By controlling the cement-water ratio during the making of concrete, American investigators have shown us how to make better concrete with less cement. But we shall not be expected to tabulate a series of researches bearing upon cement in order to press the claims of research. Organised research has been accepted as worth while by twenty-three Associations, and the cement industry, as a whole, is neither too poor, too highly organised within itself, nor too unscientific to neglect true research. At the recent annual meeting of the Technical Section of the Paper Makers' Association of Great Britain and Ireland a very satisfactory financial position was revealed. The manufacturers who so willingly support their own Association should surely support their own Research Association, assisted by the Department for Scientific and Industrial Research, for all that appertains to the science of paper making is not yet revealed. The value and methods of applying the various sizes, the use of silicate of soda in paper making—an address upon which subject was given at the above-mentioned meeting by Mr. Rex Furness—the matter of fibre hydration, the resistance of papers to aqueous and oily ink penetration, and a variety of problems of general interest and importance to the paper-maker can best and most economically be tackled by a central research organisation. Is it not possible to resurrect the Portland Cement Research Association and to create a Paper-makers' Research Association under the auspices of the Department of Scientific and Industrial Research?

Colour

We recently took a rash resolve that, this Easter at least, chemistry should be laid aside and forgotten for

a short while. We had no visions of tramping moors or of sliding smoothly along mirrored rivers; the salty tang of the sea or the moan of the saxophone did not lure us. But we had visions of a little patch of earth which suffers from the too kindly shade of ancient trees and the attentions of the local fauna and flora, and grows far too many weeds to satisfy our requirements of orderliness. Weeds, we once were told, are plants which are growing out of place—and so a recent morning, glorious with Spring's freshness, saw us labouring hard to control the stubborn earth. As we paused a moment to rest, we reflected that Finsbury Square for once seemed far away, that the sun was hard at work activating our ergosterols. The saucy eye of a gay robin which came to inspect our handiwork reminded us that, already, we had broken our resolve. Chemistry was still with us, and we were reflecting upon the problems of colour. The robin continued to watch us, delightfully poised on a twig, and as we admired his plumage, we mentally tried to match it with artificial colours. A very good match could be made, we thought, but how unlike the reality. Have we really the power to match Nature's hues exactly? Would not the spectral transmission be often different, and would not there be divergence of opinions about the correctness of the matching if the light happened to vary. A standard of colour is still wanted, a number which will express a colour so exactly that it could be reproduced with spectroscopic accuracy without reference to changeable samples. Other forms of vibrations such as heat and electricity can be made to do work and so can be standardised accurately, but light and colour and sound seem, as far as we are aware, to elude the grip of exact standardisation. Much can be done, we know, by the aid of empirical standards for comparison of colours, but the possession of an exact method of definition would be of immense value to several industries. The Society of Dyers and Colourists, and some of the research associations, are devoting some attention to problems such as the standardisation of colours, and we hope that it will not be long before we can record that a completely satisfactory solution has been reached. The human eye is a wonderful instrument. It makes a very good pyrometer when its owner has had sufficient experience: if it is of the right kind, it can be used with considerable advantage to its proprietor in the dyeing trade; and its sensitivity is greater than that of even the most rapid photographic plate. But it suffers from the vagaries to which the biochemistry of the body is subject, and on occasion it can be very much "out," and then material may be spoiled. Some of the light-sensitive cells are used for the purpose of photometry, but we wonder if they find any application connected with colour. We know very little about such cells, though we are aware that selenium is used in some of them. The New York Public Library has recently published a list, costing 65 cents, and covering nearly one hundred pages of references to the whole literature of selenium from 1817 to 1925. The list includes some 30 pages of titles of papers and patents relating to the optical and electrical properties of selenium and to its industrial applications. It seems very suggestive. But our reflections were suddenly stopped, as the robin got tired of waiting for a fresh patch of soil to be turned, and so flew away.

THE PROBLEM OF SEPARATION IN THE CHEMICAL INDUSTRIES

The two chief problems of separation occurring in the chemical industries are those of separating solids from solids and solids from liquids. The commonest method of separating solids from solids is by sizing, which is carried out wet or dry by a wide range of screening and sifting devices.

The dry separation of solids from solids is commonly carried out by screening, a process well known to every engineer. A recent development in screening is the use of electrical vibrating screens, in which the screening surface is vibrated at a very high speed so as to assist the process of mechanical separation. These screens are used for the separation of very fine substances, a purpose for which other processes, viz., air and water currents, have been found useful. In such plant, horizontal currents of water carry along the fine particles or light particles and leave the heavier and larger particles behind. An instance of this method of separation is found in the cleaning of coal by the Rheolaveur process, in which the coal is carried along a trough by the current of water, and the shale and stone sinks to the bottom, being withdrawn at intervals through traps.

In separators employing air currents, a vertical current of air carries the finer particles upwards and leaves the heavier particles behind. This process is applicable to the cleaning of fine felspar, talc, and pulverised coal.

In processes such as these, successful operation depends upon differences in specific gravity, and in many cases separation is not reliable. In the chemical industry, such separation is often carried out in water, or in air, the fundamental principles being the same and the apparatus being similar. In other cases—for instance, the jig separator—the mass of material is subjected to vertical pulsations, alternating with suction of air or water, the result being that the heavier matter stratifies underneath the lighter. This method gives good results in its later modifications, though it cannot be said to be 100% efficient.

Another method is to use a table with an inclined surface, on to which the material is fed, together with water, at the top. In this apparatus the heavier material lags behind the lighter particles. In addition, the larger particles are floated down more quickly than the smaller particles, so that separation of two kinds may be carried out on apparatus which is both cheap and simple. In other cases the tables have a bed of pulp or a mixture of solid and water, and a shaking motion serves to keep the pulp mobile. The result is that stratification takes place, and the lighter stratum is washed off by a current of water, whilst the heavier matter is carried on and ejected at the end of the table.

In other methods of separating solids from solids, a liquid medium of specific gravity intermediate between that of the two solids is used as a floating medium, the result being that one solid will float and the other will sink. For instance, a solution of zinc chloride can be employed to separate coal from slate. A process which employs the same principle is the Columbus coal separator, in which a mixture of water and clay is used, the coal floating and being carried off continuously, while the slate

sinks to the bottom. In the Chance process, the separation solution is an intimate mixture of sea sand and water, which is continually agitated. The coal, floating on the top, is carried off the surface by a current of water, while the slate sinks to a lower strata. In each of these processes the specific gravity of the separating solution is easily regulated.

The flotation process is another process which first was used for ores, and has now been employed for separating coal from slate. In this a certain amount of reagent is mixed with water and the material to be separated. These reagents reduce the surface tension of the liquid and, with suitable agitation of the entire mixture, air or gas bubbles are formed, which carry such substances as mineral sulphides, coal and graphite to the surface in a scum or froth, while the waste particles sink to the bottom of the vessel. This process is, of course, applicable only to very fine particles, say about $\frac{1}{4}$ mm. in size, or below 50 mesh.

An even later method of dry separation, which has the advantage over flotation that the materials have not to be dried subsequently, is air separation, which has proved very successful in dealing with such substances as coal below about 2 inches in size. The coal is fed on to a table fitted with a perforated top, and a current of air, forced up through the perforations, carries the lighter particles to the top of the bed, while the heavier material remains at the bottom of the bed and slides off the table down inclined surfaces.

Other dry methods of separation are the spiral separator and the magnetic pulley. In the spiral separator, which depends upon specific gravity, the mixture is fed to the top of a series of spirals, and the heavier particles attain a greater velocity of descent, being finally thrown clear of the lighter. This method is being used successfully for separating coal from slate.

The magnetic separator is not a classifying medium, but a purifier, in that it removes magnetic substances which are liable to damage machinery or taint a finished product. An instance of this is the removal of iron scrap from coal and other substances to prevent damage to crushing machinery. The magnetic pulley consists of an end pulley on a belt conveyor, which attracts and holds magnetic substances until they are out of the main stream of the material and finally ejects the impurities into a bin under the conveyor. This process also presents the advantage that the material does not need subsequent drying, though it has been applied successfully to the treatment of substances in solution.

A method of separating solids from solids which has come very much to the front in recent years is the centrifugal separator. In this appliance the material is fed through a stationary feed pipe on to a revolving distributing plate, which throws it off in a thin sheet. The material is then caught by a rising current of air, and all but the heaviest particles are carried up to the centrifugal separating chamber, where the air carrying the fine particles is made to rotate by vanes fixed to the central shaft. The heavier particles are thrown against a screen, while the lightest particles of all are carried upwards into a separate chamber. In this way several degrees of classification are obtained. This apparatus has enabled great advances to be made in the

separation of very fine particles, and has made possible the commercial use of waste products; for instance, slate dust, which can now be reduced to a mesh fine enough to be used as a paint filler, and clay and marl fines as rubber fillers.

The separation of solids from solids has involved special study in the paper pulp industry, in that bundles of fibrous matter, knots, and metal parts have to be eliminated. During recent years a rotary screen has made its appearance, in which slotted copper plates fastened to a cylinder are revolved slowly in a vat of stock. The discharge is from the outside of the cylinder to the inside. The screening action is obtained by means of a cam or crank motion which oscillates the sides of the vat, causing the stock to be forced alternately towards the plates and away from them. This type of screen has proved very successful, and has taken its place with the centrifugal and the flat screens as an aid in obtaining pure pulp.

CANADIAN INDUSTRIAL NOTES

The announcement has been made that a British syndicate plans to spend \$500,000,000 in the next five years in industrial development of the Lake St. John district of Quebec. A railway will be built round Lake St. John, pulp and paper mills, smelters and iron furnaces constructed, the last-named for the magnetic iron ores of the district. Premier Taschereau has admitted that negotiations had been in progress for some time.

The William Cooke & Co. (Canada) will construct a large wire-rope plant on Granville Island, B.C. The machinery is being forwarded from England. All sizes of rope up to 3 inches will be manufactured. C. D. Hobbs, general manager of the Western Hardware & Steel Co., will be managing director.

The Canada Cement Co., Ltd., has purchased 24 gypsum properties on the north side of Antigonish Harbour, N.S., with good shipping facilities. Work will begin immediately, and docks for steamers of 10,000 tons constructed. The quarries will be equipped with crushers and storage facilities.

The largest cereal mill west of the Great Lakes is under construction by the Quaker Oats Co., at Saskatoon, Saskatchewan.

The Lumber Chemical Co., Ltd., of Penticton, B.C., manufacturers of insecticides etc., has recently incorporated the Oliver's, Limited, for the utilisation of by-products from the packing houses, manufacturing sweet cider, concentrated cider, vinegar, pectin, etc. Charles E. Oliver is manager and chemical engineer.

The passage of legislation for the sale of liquors, wines and beers, under Government control, by the Ontario Assembly has produced a boom in the stock of breweries and distilleries, and also in their erection. The Peace Bridge Brewing Co., Ltd., Bridgeburg, Ontario, has a million-dollar brewery under construction. Prominent Buffalo, N.Y. (across the river), financial men are interested. The management will be in their hands, and American lager will be the chief product.

British interests (not the Distillers Co., Ltd.) have acquired large holdings in the Seagram Distillery Co., Ltd., Waterloo, Ontario.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING, JULY 4 to 8, 1927

In accordance with the provisions of By-law 68 notice is hereby given that the Annual General Meeting of the Society of Chemical Industry will be held in the Debating Hall, The Union, University of Edinburgh, on Tuesday, July 5, 1927, at 10 a.m.

A preliminary programme appeared on page 265 of CHEMISTRY AND INDUSTRY, for March 25, 1927, but a more detailed programme will be issued shortly.

In accordance with the provisions of By-law 23, notice is hereby given that the following members of Council retire from their respective offices at the forthcoming Annual General Meeting:—

Mr. Francis H. Carr, C.B.E., *President*; Dr. E. Frankland Armstrong, F.R.S., *Professor J. W. Hinchley*, *Professor J. C. Philip*, F.R.S., and *Sir Richard Threlfall*, K.B.E., F.R.S., *Vice-Presidents*. Mr. W. A. S. Calder, Mr. W. H. Coleman, Dr. William Cullen, and Mr. J. Arthur Reavell, *Ordinary Members*.

Mr. Francis H. Carr, C.B.E., has been nominated for re-election to the office of President under By-law 19. Mr. E. V. Evans, Mr. C. S. Garland, Dr. H. Levinstein, and The Right Hon. Sir Alfred Mond, Bart., M.P., have been nominated Vice-Presidents under By-law 20.

Dr. E. W. Smith has been elected Hon. Treasurer, and Dr. E. Frankland Armstrong has been elected Hon. Foreign Secretary.

Members are requested to nominate on or before May 13 next fit and proper persons to fill the four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the General Secretary of the Society.

By-law 22.—An ordinary Member of Council shall be nominated by five or more members upon Form B in the Schedule, a copy of which form shall be furnished by the General Secretary upon the written or verbal request of any member; but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form.

A nomination shall be declared invalid by the Council if—

(a) The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

(b) The nomination is not made on the authorised printed form, or substantially not in the manner directed thereon.

(c) The nomination form is signed by less than five members not disqualified or not ineligible to nominate as provided by the By-laws.

(d) The nomination form is not received before or upon the day appointed therefor.

(e) The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the General Secretary, and shall not be submitted for election.

J. P. LONGSTAFF,
General Secretary

LONDON SECTION

At the meeting at Burlington House, on April 4, Dr. R. Lessing described the proceedings at the International Conference on Bituminous Coals which took place at Pittsburg in November last year. The attendance was over 1700, and the meetings were held during the mornings, afternoons and evenings of the four days from November 15 to 18, inclusive. The aim of the Conference, which was organised by Dr. S. Baker, President of the Carnegie Institute of Technology at Pittsburg, was said to be to take stock of existing knowledge of practical fuel technology, to acquaint workers on the other side of the Atlantic with the work done in Europe in this branch of research, and to stimulate research in the coal problem in America. A brief outline of many of the 43 papers which were submitted was given, and the general conclusion to be drawn from them seemed to be that the trend of present-day thought in fuel matters shows a distinct bias towards the conversion of coal into oil and the use of solid fuel in powdered form. It was curious that such a state of affairs should exist in America, where so much petroleum oil is produced, but this fact was accounted for by Dr. Lessing in the enormous increase of motor traffic and the need for finding new sources of oil fuel. The Conference was an unqualified success, and Dr. Lessing added that the general tenor of the contributions to the proceedings gave weight to the opinion that we are on the threshold of a new era in the utilisation of coal, and the possibility foreshadowed of refining the natural product, of concentrating its intrinsic value, and of applying it in novel ways, is changing our conception of its potentialities and making us realise that we are witnessing the beginning of a revolution in the application of our principal store of energy. The problem of coal utilisation, he said, is becoming an international one, and not merely a national one. Special attention was called to papers on the Bergius, the Fischer, and the Patart systems for the production of liquid fuels from coal, and the possibility of the combination of such processes with ordinary gasworks was pointed out as being the most likely course of development on practical lines.

In the discussion, after Dr. Dyvorkowitch had mentioned the fact that he himself had read a paper in the Chemical Society's rooms 34 years ago, when he referred to the production of oils by high-pressure processes and generally had called attention to the need for more scientific study of coal, Mr. P. C. Pope expressed regret that only one paper had been read at the Pittsburg Conference dealing with the subject of inorganic matter in coal, and that by Dr. Lessing himself. If we could bring the ash down to 0.5% we should considerably improve combustion conditions in boiler and other furnaces. Although we had given greater attention in this country than had been the case in America to the cleaning of coal, we had not paid anything like sufficient attention to the matter. There had been no real research in this country to get down to the real fine art of cleaning coal, and people were too much inclined to be satisfied with anything from 5 to 20% of ash. That ought to be reduced to 1% or even 0.5%, and the cost of so doing would be repaid in the additional worth per calorie in oil or gas.

Dr. Lessing made a brief reply, in which he spoke

of the possibilities of the various processes now being evolved for the production of oil from coal, pointing out that preparations are being made for testing some of these systems on a large practical scale.

CALENDAR OF FORTHCOMING EVENTS

Apr. 22 FARADAY SOCIETY. *Oxford Meeting*. University [and 23. Museum, Oxford. (See issue of April 15, p. 340.)

Apr. 25. INSTITUTION OF MECHANICAL ENGINEERS. *Graduates' Section*, London. Storey's Gate, St. James's Park, S.W.1, at 7 p.m. "Parcel and package conveying plant," by H. W. Cadman.

Apr. 25. SOCIETY OF CHEMICAL INDUSTRY. *Chemical Engineering Group*. Additional Meeting at the American Film Co., Ltd., 89-91, Wardour Street, London, W.1, at 8 p.m. "Permanent moulding machines for cast iron," by Prof. J. W. Hinchley, illustrated by a film showing the process. Informal dinner at 6.30 p.m., at the Restaurant Au Petit Riche, 44, Old Compton Street, W.1.

Apr. 25. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. (Cantor Lecture I). "The measurement of light," by J. W. T. Walsh. (Also on May 2.)

Apr. 26. ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, 35, Russell Square, W.C.1, at 7 p.m. (1) "A contribution to the theory and practice of the carboprocess" by C. Lighton. (2) "Thiocarbamide as an impurity in thiocyanates," by Dr. T. Slater Price and J. W. Glassett. (3) "Note on the performance of the B.P.R.A. photo-electric density meter," by J. O. C. Vick.

Apr. 26. INSTITUTE OF BREWING, *Scottish Section*, Caledonian Station Hotel, Edinburgh. "Some notes on water drilling practice and refrigeration as applied to the sinking of shafts." By A. D. Brydon.

Apr. 27. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2, at 8 p.m. "Fire waste (loss of property by fire) and its effects on the economies of national life in Great Britain." By G. E. Keay.

Apr. 27. SOCIETY OF GLASS TECHNOLOGY. Tenth Annual General Meeting in Sheffield. At 1 p.m., luncheon at the King's Head Hotel, Change Alley, High Street, Sheffield. At 2.30 p.m. The annual General Meeting. Short discussion on the proposed Glass Convention. At 3 p.m. Ordinary General Meeting at the University, St. George's Square, Sheffield. General discussion on furnace efficiency, introduced by "A brief review of furnace developments," by Prof. W. E. S. Turner.

Apr. 27. INSTITUTE OF CHEMISTRY, *London Section*, 30, Russell Square, W.C.1, at 8 p.m. "Some recent legislation affecting chemists," G. Stubbs.

Apr. 27. INSTITUTE OF CHEMISTRY, *Belfast and District Section*. Visit to Belfast Electric Power Station.

May 6. SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group*. Annual General Meeting. Imperial College of Science and Technology, Kensington, S.W.7. Formal business meeting at 6 p.m. An informal dinner will probably be held at 6.30 p.m., and at about 8 p.m. a paper entitled "Chemical fire extinguishers" will be read by Dr. W. R. Ormandy.

CHEMICAL SOCIETY

At a meeting held on April 7 the President, Prof. H. Brereton Baker, C.B.E., F.R.S., announced the personnel of the Committees for the year 1927-1928; the Research Fund Committee will meet early in June, and applications for grants must be received by June 1. The Faraday Lecture, entitled "Problems and Methods in Enzyme Research," will be delivered by Prof. Richard Willstätter at the Royal Institution on Wednesday, May 18, at 5.30 p.m., admission being by ticket only.

Prof. Willstätter was elected by ballot as an Honorary Fellow of the Society

Dr. H. King discussed:—

Trypanocidal Action and Chemical Constitution. Part VI. Amphoterie s-Carbamidoarsinic acids.

SOME s-carbamidoarsinic acids with a free basic centre have been prepared and examined for trypanocidal activity. A study has also been made in continuation of work done in Part IV of the nitration of *o* aminophenol derivatives. The results obtained, together with those of Reverdin, are consistent and show that the relative orienting powers in *o*- and *p* aminophenols are in the order $\text{OH} > \text{NHAc} > \text{OAc}$.

Prof. C. K. Ingold said that the anomalous orienting activity of the free hydroxyl group was due to the production by ionisation of the powerfully orienting negative pole O^- , which promotes rapid substitution through the ion, even although very little of it is present at any moment. Soper and Smith's experiments on the chlorination of phenol were illuminating in this connexion. The speaker asked whether Dr. King had observed a diminution in the activity of the hydroxyl group relatively to that of the competing group when the conditions were made less favourable to ionisation: if ionisation could be completely prevented the series should be NMeAc , $\text{NHAc} > \text{OMe}$, $\text{OH} > \text{OAc}$. Prof. Ingold believed that all the observations which had previously been held to support the theory that oxygen supersedes nitrogen in the *op*-orienting series involved the substitution of free phenols under conditions in which they could ionise.

Prof. R. Robinson remarked that he had already drawn attention to the unique position of hydroxyl in the series OR, but the view that a significant concentration of phenoxide ions can exist in a strongly acid solution could hardly be maintained. It was more probable that the high directive power of OH relative to OR is due to *potential* ionisation; i.e., a mechanism is provided in the former case for the ready expulsion of a proton in the course of chemical change. Thus a higher proportion of tentative unions between the substituting agent and the aromatic compound became fruitful.

Dr. King replied that experiments to elucidate Prof. Ingold's point had not been performed.

Mr. E. J. B. Willey discussed:—

Active Nitrogen Part III. Active nitrogen and the metals.

In Parts I and II experiments were described in which it was shown, on the assumption that the active nitrogen

content of a gas mixture could be evaluated by means of the reaction $N'_2 + 2NO \rightarrow 2N_2 + O_2$, that the energy content of active nitrogen was of the order of 2.0 volts. By passing active nitrogen over thin metallic spirals of various metals, it is shown that the metals vary in their powers of effecting the catalytic decomposition of active nitrogen. This variation is attributed to the difference in the stability of the nitrides of the metals. Copper is active at the ordinary temperature, platinum and zinc at somewhat elevated temperatures. The nitrides of molybdenum and tungsten are too stable to effect catalytic decomposition of active nitrogen even at high temperatures. From the rise in temperature of the spirals for different flow speeds of active nitrogen the energy content of the latter has been determined, and shown to agree with the values obtained previously, viz., 2 volts.

In reply to Dr. N. V. Sidgwick, the author agreed that the results depended on the validity of the reaction between active nitrogen and nitric oxide, but said that another method, depending on the formation of iron nitride in the iron-nitrogen arc, was available.

Dr. H. E. Watson described:

Esterification in mixed Solvents. [With B. V. Blude] THE velocity constants for suberic and *n*-butyric acids in mixtures of isoamyl alcohol with benzene and petroleum have been measured using hydrochloric acid as catalyst; Goldschmidt and Udby's formula $(r - a) \log a/(a - r) = r = Kt$ gives satisfactory values. These constants increase very considerably with increase in the proportion of inert solvent, the values for 90% benzene and petroleum rising in a hyperbolic manner to approximately 14 and 20 times the values in the pure alcohol.

It is suggested that the velocity depends not on the concentration of catalyst in the whole solution, but on the ratio of catalyst to alcohol molecules. If this were so, the velocity constant for a 90% solution would be 10 times that calculated in the ordinary way. The additional rise observed is qualitatively explained by the relative increase in velocity which occurs on increasing the concentration of catalyst.

The results show that reaction can take place readily when very few ions are present in the solution.

An observed decrease in velocity constant for small additions of inert solvent and certain minima in the conductivity values have not yet been explained.

Dr. R. H. Pickard asked whether ordinary amyl alcohol, containing a constituent which readily reacts with hydrochloric acid, was employed.

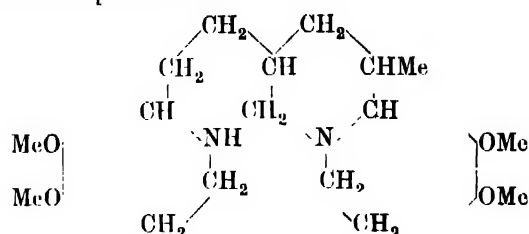
Dr. Watson replied that the amyl alcohol did not react appreciably with hydrochloric acid in 48 hrs., the experiments lasted only 6-7 hrs.

Prof. F. L. Pyman discussed:-

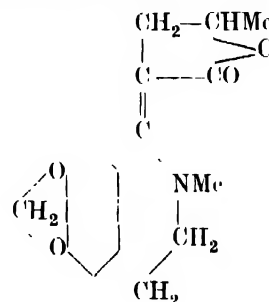
The Alkaloids of Ipecacuanha. Part IV. [With W. H. Brindley.]

It is shown that the formula given below, which has been developed from a suggestion made by Prof. Robert Robinson, F.R.S., on phytochemical grounds, is in accord with the known properties of emetine, and enables

intelligible formulæ to be deduced for the subsidiary alkaloids of ipecacuanha.



Mr. F. H. Carr having spoken in congratulatory terms, Prof. R. Robinson said that Prof. Pyman and Mr. Carr had greatly overestimated the importance of the part which he had played in this development. Analogies now suggested that the constitution of lycovine (narcissine) may require modification in the sense of the emetine formula. Thus instead of the normal C_6 chain lycovine may contain a branched chain as in the formula



or in the related δ -lactone.

SOCIETY OF PUBLIC ANALYSTS

An ordinary meeting was held at the Chemical Society's Rooms, Burlington House, on April 6, Mr. John White, Vice-President, being in the Chair.

Certificates were read for the first time in favour of Messrs. F. C. Bullock, B.Sc., T. H. Fairbrother, M.Sc., R. S. Rack, and S. G. Sherman.

Certificates were read for the second time in favour of Messrs. A. G. J. Lipscomb, B.Sc., W. L. Matthews, S. J. Rogers, B.Sc., E. F. Waterhouse, H. W. Webb, A. S. Wood, M.Sc., Ph.D.

The following were elected Members of the Society:- W. G. Carey, F.I.C., W. F. Elvidge, B.Sc., L. S. Fraser, B.Sc., A.R.C.Sc., F. P. Hornby, B.Sc., G. R. Lynch, O.B.E., M.B., B.S., D.P.H., E. C. Martin, and G. G. Philip.

The following papers were read and discussed:-

"The sequence of strokes in writing," by C. Ainsworth Mitchell, M.A., and T. J. Ward.-Systematic experiments have been made to determine to what extent one may trust to the appearance of one of two intersecting lines being uppermost, as a proof that it was made more recently than the other. It is shown that the appearance coincides with the fact in the case of insoluble opaque pigments such as lead pencil, but is deceptive when a transparent pigment, such as an aniline dye, is in question. The relative position of lines made with writing inks which undergo oxidation, and thus form an opaque

insoluble pigment, can usually be accurately determined, but if the ink has been blotted the observation is, as a rule, untrustworthy.

"Observations on the washing of gluten from flour," by D. W. Kent-Jones, Ph.D., and C. W. Herd, B.Sc.—It is shown that the use of a special washing solution, such as that suggested by Dill and Alsberg, does not eliminate the errors inherent in gluten determinations. Even when the same amount of washing water is used and the same procedure followed, personal differences in the manipulation of the dough and gluten cause large variations in the result. It has been found, however, that each operator gets essentially consistent results, which means that the ratio between the nitrogen of the flour and the dried gluten is approximately constant for each worker.

"A numerical expression for the colour of flour," by D. W. Kent-Jones, Ph.D., B.Sc., and C. W. Herd, B.Sc.—The colour of flour may be expressed by the tints given to two distinct solvents. The yellow colouring matter is extracted by means of petroleum spirit, and its colour is measured in a special form of colorimeter. This figure indicates the natural whiteness, or alternatively, the artificial bleaching of the flour. The grade of the flour may be judged by the amount of the reddish-brown pigment present which, presumably, comes from the finely-powdered offal present. This pigment is determined in the colorimeter after extraction with alkaline methyl alcohol.

"The determination of free mercury in commercial products," by H. B. Dunncliff, M.A., Sc.D., and Kishen Lal, M.Sc.—The main constituents of the substance containing free mercury are removed by extraction with a suitable solvent. The residue is treated with bromine water, the resulting mercuric bromide is dissolved in alcohol, and the mercury is precipitated as mercuric sulphide, which is filtered off and weighed in a Gooch crucible. The method is shown to give accurate results with various commercial products, such as mercury ointment, grey powder and mercury fulminate.

BRITISH ASSOCIATION OF CHEMISTS

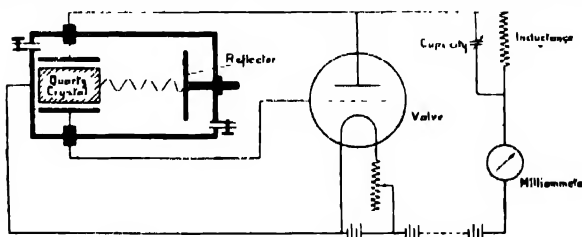
The annual meeting of the Manchester Section was held at the Exchange Hotel, Manchester, on March 30. Mr. E. N. Marchant, in his chairman's address, surveyed the activities of the Association during the past year, giving instances in which the Association had been able to obtain legal or other redress for its members which members had been unable to secure by personal action. It was highly important that members should realise the assistance the Association was able to afford in legal and other matters, and that they should not hesitate to seek the advice of its officers in any difficulty confronting them. After reviewing the reasons underlying the recent modifications in the Unemployment Benefit Fund, Mr. Marchant referred to progress in the matter of registration. Membership of the Section had increased from 220 to 250 in the course of the year.

A vote of thanks to the Chairman for his address was proposed by Mr. W. E. Kay and seconded by Mr. F. Scholefield. Mr. R. Brightman proposed, Mr. F. S. Choate seconded, a vote of thanks to the Hon. Secretary, Hon. Treasurer and members of the retiring Committee. Mr. E. N. Marchant, Mr. T. O. Morgan and Mr. P.

Chorley were re-elected Chairman, Hon. Secretary and Hon. Treasurer respectively. The meeting was preceded by a hot-pot supper, and the evening concluded with musical items.

PHYSICAL SOCIETY

At the meeting on April 8, Dr. E. Griffiths described and exhibited an instrument for determining the carbon dioxide content of a mixture of air and carbon dioxide based on the measurement of the velocity of sound in the mixture. Essentially the instrument is a compact and portable modification of Kundt's tube. The vibrating source consists of a quartz crystal set into vibration electrically as a piezo electric resonator. The frequency of vibration of the crystal is about 40,000 per sec., and as in the familiar Kundt's tube experiment the vibrations are reflected from a disc carried by a micrometer screw. The quartz crystal is placed in contact with a pair of electrodes, one of which is connected with the plate and the other with the grid of a thermionic valve, as shown in the figure. When the



reflector is at such a distance that it corresponds to a node of the stationary train of waves set up in the chamber containing the oscillating crystal, the reaction of the reflected wave on the crystal produces a sharply defined peak in the anode current, which is indicated by the milliammeter inserted in the circuit. The distances between successive nodes can thus be readily determined, and after suitable calibration of the instrument with mixtures of known composition, the results can be interpreted in terms of the CO_2 content of the mixture. An accuracy of about 2% is claimed for the method, but in the ensuing discussion it was shown how this limit of accuracy could be much improved upon by using the whole train of stationary waves set up.

B. L. Worsnop read a paper on "The scattering of X-rays and the 'J'-phenomenon." The J-phenomenon was first observed and described by Prof. C. G. Barkla. Essentially, the evidence for the existence of the J-phenomenon consists in the discontinuities observed in the scattering of X-rays by a light atom as the penetration of the incident radiation is progressively increased. The author, using a modification of Barkla's experimental method, designed to reveal directly the discontinuities, if present, failed to detect any evidence whatever of the reality of the phenomenon. Dr. E. A. Owen, in the ensuing discussion, remarked that, experimenting with a wedge of scattering material, he had found no discontinuity in the intensity of the radiation transmitted by progressively increasing thicknesses of the wedge—a result indicating the absence of the J-phenomenon.

Prof. C. L. Fortescue read a paper on "The characteristics of thermionic rectifiers."

CORRESPONDENCE

MERCURY IN COAL TAR

SIR.—In your issue of April 8 a paragraph appears on the above topic. It is of special interest to persons engaged in the carbonising industries, as quite likely most workers have at some time or other found mercury in their tar.

The amount found by Mr. Kirby corresponds very closely to the concentration found in a tar tank dealt with recently. This is not altogether surprising, as the tank contained 7 tons of tar, and the mercury which entered from a broken thermometer weighed approximately 1 grm. This gives a result tolerably close to one part in seven millions.

It does not appear at all strange that Dr. Aston found that the groups of isotopic lines were indistinguishable from those of ordinary mercury.

Thermometers inserted in gas, liquor and tar mains sometimes break. The bulb and mercury find their way into the pipe. This constitutes a possible source of origin of mercury in coal tar.

I am,

Yours etc.,

"FREE CARBON"

PERSONAL AND OTHER ITEMS

The late Mr. H. E. Nichols, a director of the Anglo-Persian Oil Co., Ltd., Scottish Oils, Ltd., and other oil companies, left £33,030, with net personalty of £28,213.

The late Mr. E. J. Woolley, chairman of James Woolley, Sons & Co., Ltd., manufacturing chemists, Manchester, left £167,173, with net personalty £158,419.

Preservatives in Food

The Minister of Health has issued an Order amending the Public Health (Preservatives etc. in Food) Regulations. It states that the following proviso shall be inserted at the end of Article 4 (1) and at the end of Article 11 (1): "The provisions of this Article shall not apply so as to prohibit the presence of sulphur dioxide in any article of food other than meat if it is shown either (a) that the article, not being an article specified in Part II of the said Schedule, is intended to be used in the preparation of an article which is so specified or (b) that the article, being itself an article so specified, other than fruit or fruit pulp, is intended to be so treated before it is sold or exposed for sale by retail, so as to comply with the provisions of the Schedule as regards the proportion of sulphur dioxide contained."

It is also stated that, in the first line of proviso (a) to Article 1 the words "manufacture for sale or" shall be inserted after the words "prohibit the."

Mineral Oil Refining in Great Britain

The growth of this industry in Great Britain in recent years is indicated by the figures of imports of crude petroleum for refining, which rose from 1 million gall. in 1913, 7½ million gall. in 1919, and 4 million gall. in 1920 to 10½ million gall. in 1921, and increased steadily to 569 million gall. in 1925, falling back slightly to 539 million gall. in 1926. Approximately 1½% of the world's production of crude petroleum in 1926 was refined in Great Britain, the chief sources of the supplies

of imports being Persia (419 million gall., compared with 381 in 1925), Venezuela (64 million gall., compared with 151 in 1925), Mexico (38 million gall., against 27 in 1925), Colombia (7½ million gall.), and the United States (5½ million gall.). British countries (Trinidad and Sarawak) contributed a little over 2 million gall. Apart from oil included in the Customs Returns as crude, certain other kinds of imported petroleum, mainly kerosene, from Rumania and Russia, were treated by refining or cracking. The total output of liquid products from the refineries in Great Britain (including cracking plants, the output of which, however, is relatively small) is returned by the companies concerned as 554 million gall., in addition to certain quantities of asphalt, pitch and wax. These products were derived from distilling (and, to a small extent, cracking) 576 million gall. of petroleum, of which, approximately, 80% was crude oil, and about 15% was semi-refined oil, and 5% was kerosene; together with 40 million gall. of oil and naphtha obtained by retorting Scottish shale. In 1925 the total output of liquid products amounted to 605 million gall. Of the 677 million gall. of motor spirit (petrol) retained in Great Britain and Northern Ireland in 1926 for consumption or replenishing stocks, 133 million gall. (or 20%) was manufactured in this country, the corresponding figure for 1925 being 487 million gall., retained, of which 26% was manufactured in this country. As regards kerosene, 204 million gall. was retained in 1926, of which 18% was of home manufacture (as against corresponding figures of 165 million gall., and 33% in 1925). Of fuel oil 359 million gall. was retained and 253 million gall. shipped for the use of steamers engaged in the foreign trade, and of this total of 612 million gall., 35% was home produced (the corresponding proportion in 1925 being 42%).

New British Chemical Standard Cast Iron "D2"

The organisers of the British Chemical Standard movement announce that they now have ready a grey phosphoric cast iron in the form of very fine turnings, and having the following standardised compositions:—

Silicon	...	...	...	...	1.31%
Phosphorus	...	...	...	...	1.07%
Manganese	...	...	...	...	1.64%

The approximate composition of the elements is graphitic carbon 2.5%, combined carbon 0.8%, sulphur 0.03%.

This iron takes the place of iron "D" as regards phosphorus content, but also fulfils the need for a low silicon iron and a high manganese pig iron standard. Used in conjunction with Hematite Iron "A" this covers the range of most irons met with by the foundry chemist. As usual, it is packed in bottles containing 500, 100 and 50 grms. of fine turnings free from dust and may be obtained either from Organising Headquarters or most laboratory furnishers at a price which is estimated as sufficient to cover the cost.

The Centenary of the Friction Match

In *Nature* of April 2 will be found an interesting article by Prof. W. A. Bone, F.R.S., on the centenary of the friction match, in which he gives information about the nature and circumstances of this pioneer invention.

PARLIAMENTARY NEWS

Sugar-Beet Factories

In reply to Mr. Duckworth, Mr. Guinness said he understood that four new beet sugar factories would be erected this year, namely, at Bardney, Selby, King's Lynn, and Alscott. Of these, the Bardney factory only had received guarantees under the Trade Facilities Act. The Act expired on March 31 last.—April 4.

Safeguarding of Industries (Paper Industry)

Sir P. Cunliffe-Lister informed Mr. Smedley Crooke that duty was imposed on packing and wrapping paper, including tissue paper, exceeding 10 lb., but not exceeding 90 lb. per ream, on May 1, 1926. It was not possible to distinguish, for any period before that date, between the imports of paper which then became dutiable and those which still remained free of duty. Consequently, it was necessary to give figures throughout relating to the total imports of packing and wrapping paper, including tissue paper. The average declared value (c.i.f. British port) of this paper imported into the United Kingdom in 1925 was £1.21 per cwt.; in January–April, 1926, £1.19; in May to December, 1926, £1.15; in the whole year 1926, £1.17, and in January–February, 1927, £1.14. Apart from the inevitable increase in unemployment during the coal stoppage, the orders and employment were considerably better. April 5.

Artificial Silk Industry

In reply to Mr. Thurtle, Mr. McNeill said that the total amount of capital guaranteed by the State under the Trade Facilities Act to companies engaged in the artificial silk industry was £85,000; there was no reason to anticipate any loss. April 7.

British Industries Fair

In reply to Mr. Williams, Sir Burton Chadwick said that the loss on the series of British Industries Fairs from 1915 to 1927, was £9,500. Grants had also been provided from public funds in the last two years for publicity expenditure totalling £46,000. In 1902 the home buyers attending the exhibition were 49,000, whereas in 1926 they were 73,000.—April 11.

Cream Substitutes

Replying to Brigadier-General Clifton Brown, Sir K. Wood said it was not possible to make Regulations to stop the manufacture of cream from a cheap type of imported butter and milk powder, but the existing provisions of the Sale of Food and Drugs Acts would appear to be sufficient to prevent it being sold as cream. The prohibition of preservations would apply to the substitute as well as to cream, and he was advised that the keeping properties of the substitute might be expected to be less than those of genuine cream. April 11.

Safeguarding of Industries (Wrapping Paper)

Mr. McNeill informed Mr. A. V. Alexander that baked paper consisted of paper with a coating of varnish or other material, and that the body paper was usually of a dutiable description. In such cases duty was chargeable under Sub-section (2) of Section 11 of the Finance Act, 1926, on the value of the coated paper, as a whole, if within the limits of dutiable weight. April 12.

Safeguarding Duties

Mr. Churchill stated, in a written answer to Mr. Wardlaw-Milne, that the approximate amounts derived from the safeguarding duties on key industry goods, mantles for incandescent lighting, and packing or wrapping paper, from the date of imposition up to March 31, 1927, were £2,277,000, £15,000 and £495,000 respectively.—April 12.

COMPANY NEWS

BELL'S UNITED ASBESTOS CO., LTD.

The thirty-ninth annual meeting, held on April 7, was presided over by the chairman, Mr. J. Alfred Fisher. The past year had been an exceptionally trying one. Whilst there was a decline in their ordinary business with coal, iron and other companies, this was compensated for by greater activity in the building trade and a larger turnover in Poilite and Everite materials, and also by an increased demand for certain other goods. A larger return was also obtained from overseas business. With reference to the future, the outlook appeared to be a little more hopeful than it had been for a long time. The activity in the building trade seemed likely to continue, and this, together with an increasing demand for Everite roofing material—the value of which for factories, railway and dock buildings and similar works was widely recognised on account of its great strength and durability—should favourably affect Bell's Poilite and Everite Company. Also certain negotiations were in progress which, if completed, should lead to a material increase in the scope of their joint operations. It was not unreasonable to expect further considerable developments in the motor industry, which should be accompanied by an increasing demand for brake and clutch equipment manufactured at the company's asbestos factory at Harefield, solely for Raybestos-Belaco, Ltd., in which concern they held half the share capital.

For the accounts see CHEMISTRY AND INDUSTRY, April 1, 1927, p. 298.

TARMAC, LTD.

The report for 1926 shows a net result, after providing for general establishment charges and taking into account £2446 interest and dividends received from and providing for trading losses incurred by subsidiary undertakings, of a loss of £6202, to which must be added provision for income tax based on the average of the last three years £23,500, making a loss of £29,702. The balance of profit brought forward was £16,882, and £40,000 has been transferred from reserve account. After deducting the above loss, there remained a balance for disposal of £27,180. Dividend on preference shares for the half-year to June 30, 1926, absorbed £5500, and after writing off £18,124 for depreciation, and paying directors' fees at half the rate voted for 1925, £1806 remained to be carried forward. During the strike manufacturing conditions became increasingly difficult, and many of the company's works had to close down. Cost of production was also increased by the shortage of tar and coal and the high prices charged for them. The directors state that the demand for the company's manufactures continued to be satisfactory. Mr. Cecil Martin, one of the directors, has been appointed managing director, and Mr. C. E. Hickman has been appointed a director.

CENTRAL PROVINCES MANGANESE ORE CO., LTD.

The nineteenth ordinary annual general meeting, held on April 8, was presided over by the chairman, Mr. M. Wilkinson. Trading profits for 1926 amounted to £294,368, against £456,693 for 1925, the net profits being £246,176, against £347,054. Reserve received £19,197, compared with £100,000, and a final dividend of 15%, accompanied by a 5% bonus, was declared, making 30%, tax free, for the year, carrying forward £66,034. The reduced profits were accounted for by the exceptional difficulties occurring during the year. Owing to the coal strike, for upwards of seven months practically no ferro-manganese was made in this country, the Continental and American demand keeping the company going. The chairman referred to the arrangement made with the United Kingdom Ferro-Manganese Co., Ltd., for the unification of interests. The company is to supply manganese ore to the new company at an arranged price, and the ferro manganese makers who are concerned in the new company are to purchase all their ore requirements from the new company. The new company is to buy from the ferro-manganese makers the whole of their production of ferro-manganese at an arranged price, and to sell it for the benefit of the ferro-manganese makers and the Central Provinces Manganese Ore Co., Ltd. The capital of the United Kingdom Ferro-Manganese Co., Ltd., is £350,000, and the ferro-manganese makers concerned are the Darwen and Mostyn Iron Co., Ltd.; Dorman, Long and Co., Ltd.; United Steel Companies, Ltd.; and Wigan Coal and Iron Co., Ltd. The supply of manganese ore suitable for making ferro-manganese was a matter of concern to British steel makers, as the deposits in the Caucasus, at Niropol, and in West Africa and Brazil were not under British control, and the only other available supply of any importance was from India. The mines owned by the company were the most important in that country, so that the advantage to the British steel makers of having an adequate supply of high-grade ore at their command was obvious. By the arrangement the company had secured an outlet for a considerable portion of its production, and had consolidated its interests with a number of ferro-manganese makers who had taken supplies of its ore for many years past. The directors were of opinion that the production of ferro-manganese in this country was now on a sound and profitable basis.

BRANSTON ARTIFICIAL SILK CO., LTD.

An issue has been made of 1,000,000 ordinary shares of £1 each at par and 1,000,000 deferred shares of 4s. at 5s. each. The company has purchased a nucleus plant already producing artificial silk, which will be installed in the Branston factory. A contract has been let to John Hetherington & Sons to supply the necessary machinery to a value of £403,000. The board consists of the Marquess of Carisbrooke (chairman), who is associated with Lever Bros., Mr. C. T. Bazell, Mr. F. J. Farrell, Mr. J. Spence, Mr. H. E. Garle, and Sir Edmund Russborough Turton, M.P. The technical advisers are Dr. J. N. Goldsmith, the consulting chemist; Dr. A. Perl, managing director of Oscar Kohorn & Co., Vienna; and Mr. J. Swinburne, M.Inst.C.E., F.R.S., the

consulting engineer. The factory allows for expansion in working space for future extensions. The buildings as they stand, with certain adaptations and additions, will be sufficient for a daily production of 10 tons of artificial silk, and with other extensions the output could be raised to 16 tons per day.

BRITISH PORTLAND CEMENT MANUFACTURERS, LTD.

The total income for the year to December 31, 1926, including a refund of Excess Profits Duty, was £644,169, compared with £773,036 for 1925. A final dividend has been declared on the ordinary shares of 7½%, making 12½% for the year. To facilitate the improvement and extension of the company's manufacturing position, both at home and abroad, it was necessary to increase the capital from £2,800,000 to £4,000,000, and the required resolution was passed at the sixteenth ordinary general meeting held on March 19.

BABCOCK AND WILCOX, LTD.

After allowing for all expenses and taxation, the net profit for 1926 was £716,577, compared with £785,026 for 1925. Pension fund received £20,000, and reserve fund £150,000. A final dividend has been recommended of 8%, making 13%, tax free, for 1926, a similar dividend being paid in 1925, leaving £161,442 to be carried forward.

L. AND N. COAL DISTILLATION, LTD.

This company has been formed by a committee representative of the British heavy industries for the purpose of applying the L. and N. low-temperature coal-distillation process. The whole of the capital was privately subscribed.

UNITED MOLASSES CO., LTD.

The first annual general meeting of this company, which was registered in January, 1926, with a share capital of £1,000,000, took place on April 5, Mr. F. K. Kielberg, chairman and managing director, presiding. The business has shown steady progress since its inception in 1911 with the erection of a small tank installation at Hull of a capacity of 2800 tons. From this modest start had sprung a world-wide organisation with tank installations in all the most important sugar-producing countries, the total capacity to-day approaching 400,000 tons, or an increase of nearly 150,000 tons since January last year.

The profits amounted to £344,858 up to December 31, 1926. Depreciation absorbs £87,575, preliminary expenses £13,200, leaving net profits amounting to £244,083. General reserve received £30,000, a staff superannuation fund was started with £2500, and a dividend of 10%, less tax, was declared on the ordinary shares. After providing for the 8% dividend on the preference shares, the sum of £19,883 was carried forward.

The company had recently sold their entire holding of 90% in Crosfields Oil and Cake Co., Ltd., Liverpool, at a substantial profit, their sole reason for selling being that Crosfield's business unavoidably led them into competition with the company's most important buyers of molasses. Trading during the first three months of the current year had been satisfactory, and prospects for the remainder of the year were favourable.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb., according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbanilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—1s. 10° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s.—4s. 3d. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 10s. per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals, 8½d.—9d. per lb. Crude 60's, 2s. 6d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 6d.—2s. 8d. per gal. Steady. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 2s.—2s. 3d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 9½d. to 2s. 2d. per gal. Firm. Pure, 2s. 1d.—2s. 4d. per gal.
 Xylol.—2s. 1d.—2s. 6d. per gal. Pure, 3s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/160, 1s. 10d.—1s. 11d. per gal. Solvent 95/160, 1s. 7d.—1s. 8d. per gal. Solvent 90/190, 1s. 1½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—75s.—85s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—9s. 6d.—13s. per gal. Nominal. 90/180.—5s. per gal. Heavy.—6s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d. per lb. Fair enquiry.
 m-Cresol 98/100%.—2s. 8½d. per lb. Only limited enquiry.
 p-Cresol 32/34° C.—2s. 8½d. per lb. Only limited enquiry.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£81 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d. — 1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d.—8d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Firm and brisk.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P. Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 5½d. per lb. Less 5%. Firm.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 3½d. 1s. 4½d. per lb. Technical 11½d.—1s. per lb. Both in good demand.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 2½d. per lb. Less 5%. Firm market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzophenanthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d. 14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuth B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 4d.—2s. 6d. per lb. Potassium.—1s. 11d.—2s. 1d. per lb. Sodium.—2s. 2d.—2d. 4d. per lb. All spot.
 Calcium Lactate.—1s. 3½d.—1s. 4½d. per lb.
 Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £33 per ton net.
 Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol. A.B.R. recryst., B.P., 18s. 9d. per lb. net. Synthetic, 11s.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig., 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—11s. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. per lb.
 Phenazone.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 96s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s. per lb. spot.
 Saccharin.—55s. per lb. Very limited enquiry.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C. 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—7s. 6d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—11s. 6d.—12s. per lb., according to quantity.
 Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
 Aubepine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. 6d. per lb.
 Citronellol.—14s. 6d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—10s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa). 17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. 6d. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—27s. 6d. per lb. Safral.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb. Good demand.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—12s. per lb.
 Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 3d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—10s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 18s. 9d. per lb. Japanese, 8s. 6d. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than June 11th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court,ancery Lane, London, W.C.2, on April 28th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

Applications.

Akt. Separator. Centrifugal separators. 9349. Apr. weden, 24.4.26.)
 Ashcroft. 9603. See X.
 Blackett. 9724. See X.

British Separators, Ltd., and Cahill. Centrifugal separating apparatus. 9628. Apr. 7.
 Cooper, Henshaw, and Holmes & Co. Drying gases. 9618. Apr. 7.
 Hall, and Reckitt & Sons. Rotary drum etc. filters. 9630. Apr. 7.
 Howe. Furnaces. 9237. Apr. 4. (U.S., 5,426.)
 Hughes, and Synthetic Ammonia and Nitrates, Ltd. Carrying out chemical reactions. 9421. Apr. 6.
 Knupffer. Furnaces. 9296. Apr. 5.
 Poverud and Sonsthagen. Apparatus for mixing, degassing, etc. viscid materials. 9442. Apr. 6.
 Priest. Kilns or furnaces. 9242. Apr. 4.
 Proctor. Furnaces. 9775. Apr. 9.
 Smith. Wet treatment of subdivided materials. 9374. Apr. 5.

I.—Complete Specifications

23,555 (1925) and 8400 (1926). Davidson. See X.
 58 (1926). Baker Perkins, Ltd., Baker, Prescott, and Soc. Anon. Anc. Etabl. Savy, Jeanjean, et Cie. Apparatus for concentrating and evaporating liquids such as syrups. (268,437.)
 218 (1926). Benson. Mixing-machines. (268,447.)
 5409 (1926). Haddan (Akt. Ljungströms Angturbin). Furnaces. (268,578.)
 15,385 (1926). Evershed & Vignoles, Ltd., and Perry. See XXXIII.
 15,590 (1926). Johnson (I.-G. Farbenind.). Heating granular materials. (268,599.)
 21,786 (1926). Scherbaum. Centrifugal grinding-mills. (257,917.)
 22,260 (1926). Ges. für Lande's Eismaschinen. Separating from gas mixtures the readily condensable constituents. (258,856.)
 23,960 (1926). Burn and Lancaster. Rotary mixing machines. (268,658.)
 29,529 (1926). France. See X.
 32,922 (1926). Dunsmore. Hydro-extractors or centrifugal machines. (268,701.)
 2753 (1927). Weidmann and Littel. Fire-extinguishing compositions. (268,711.)
 *26,661 (26,746 (1926). Soc. L'Air Liquide. Carrying out exothermic chemical reactions. (268,721—2.)
 *9237 (1927). Howe. Furnaces. (268,834.)

II.—Applications

American Hydrocarbon Co. Apparatus for extracting vaporisable matter from fragmentary solid materials etc. 9282. Apr. 5. (U.S., 4,526.)
 Billen and Enders. Apparatus for manufacture of charcoal. 9767. Apr. 9.
 Haddan (Stettiner Chamotte A.-G.). Distilling ovens etc. 9831. Apr. 9.
 I.-G. Farbenind. Production of liquid hydrocarbons. 9196. Apr. 4. (Ger., 14,426.)
 Johnson (I.-G. Farbenind.). Treatment of montan wax. 9716. Apr. 8. Production of products from montan wax. 9717. Apr. 8.
 Laing and Nielsen. Manufacture of illuminating etc. gases. 9523. Apr. 6.
 Namml. Vennoot. Silica en Ovenbouw Mij. Coke ovens. 9216 and 9606. Apr. 4 and 7. (Ger., 3,426, and Holland, 7,426.)
 Nyrop. Manufacture of oil products. 9250. Apr. 4.
 Reynard and Tapping. Binding material for finely-divided fuels etc. 9191. Briquetting finely-divided coal etc. 9192. Apr. 4.
 Salerni. Treatment of hydrocarbon gases etc. 9520. Apr. 6.
 White (Internat. Bitumenoil Corp.). Retorts. 9393. Apr. 5.

II.—Complete Specifications

24,183 (1925) and 16,265 (1926). Sutcliffe. Distillation of coal etc. (268,080.)

32,999 (1925). Holmes & Co., Ltd., Parker, and Henshaw.

Drying of fuel gases. (268,429.)

60 (1926). Daniels. Ovens for distilling coal and the like. (245,764.)

8604 (1926). Robinson and Parkes. *See* III.

12,071 (1926). I.-G. Farbenind. Manufacture of liquid fuels. (252,018.)

17,761 (1926). Pamart. Apparatus for carbonising combustibles at low temperatures. (268,613.)

21,748 (1926). James (Brown Instrument Co.). Gas analysis apparatus. (268,637.)

*23,527 (1926). Geipert. Testing samples of coal by distillation. (268,718.)

*27,947 (1926). Allgem. Ges. für Chem. Ind. Liberating hydrocarbons. (268,726.)

*6800 (1927). Bamat-Megum A.-G., and Heller. Low-temperature distillation. (268,745.)

*8476 (1927). I.-G. Farbenind. *See* III.

*8890 (1927). I.-G. Farbenind. Conversion of hydrocarbons of high boiling-point into compounds of lower boiling-point. (268,796.)

*8983 (1927). Mallery. Utilising residue oils containing water. (268,814.)

*9216 (1927). Nauml. Vemoots. Silica en Ovenbouw My. Coke ovens. (268,832.)

III.—Complete Specifications

8604 (1926). Robinson and Parkes. Resolution of emulsions or suspensions containing tar or oil. (268,547.)

*8476 (1927). I. G. Farbenind. Production of conversion products of tars, mineral oils, and the like. (268,774.)

IV.—Applications

British Dyestuffs Corp., Ltd., Bunbury, Shepherdson, and Tatum. Production of anthraquinone intermediate. 9388. Apr. 5.

I.-G. Farbenind. Manufacture of vat dyestuffs. 9471. Apr. 6. (Ger., 18.11.26.) Production of dyestuffs containing chromium. 9197. Apr. 4. (Ger., 15.4.26.)

Manufacture of benzanthrones. 9214. Apr. 4. (Ger., 3.4.26.)

IV.—Complete Specifications

7663 (1926). Brit. Dyestuffs Corp., Ltd., and Tatum. Anthraquinone dyestuffs. (268,542.)

25,315 (1926). Bensa. Manufacture of dinitro products of perylene and its halogen derivatives. (260,568.)

*7439 (1927). I.-G. Farbenind. Metallic compounds of *o*-hydroxy-azo dyestuffs. (268,754.)

*8771 (1927). I. G. Farbenind. Manufacture of diazotised amines of the cyclic series. (268,789.)

*8931 (1927). I.-G. Farbenind. Manufacture of azo-dyestuffs. (268,807.)

*9214 (1927). I.-G. Farbenind. Manufacture of benzanthrones. (268,830.)

V.—Applications

British Celanese, Ltd. Manufacture of artificial silk etc. 9175. Apr. 4. Manufacture of cellulose derivatives etc. 9684—6. Apr. 8. (U.S., 14 and 16.4.26.)

Carpmuel (I.-G. Farbenind.). Production of dycings. 9526. Apr. 6.

Draper. Spinning artificial yarns etc. 9277. Apr. 5.

Johnson (I.-G. Farbenind.). Production of coloured cellulose. 9715. Apr. 8.

Mallabar. Manufacture of cellulose acetate. 9418. Apr. 6.

Soc. Chimique des Usines du Rhône. Continuous manufacture of cellulose acetate. 9500. Apr. 6. (Fr., 26.7.26.)

Welch. Manufacture of artificial silk etc. 9175. Apr. 4.

V.—Complete Specifications

514 (1926). Courtaulds, Ltd., Glover, and Topham. Production of artificial silk. (268,455.)

4048 (1926). Harrison. Manufacture of wool-like cellulosic material. (268,505.)

9535 (1926). Courtaulds, Ltd., Glover, and Diamond. Manufacture of cellulose derivatives. (268,552.)

*3832 (1927). Comptoir des Textiles Artificiels, and Chavassieu. Manufacture of artificial textile threads, fibres, etc. (268,734.)

*8495 (1927). Verein f. Chem. Ind. *See* VII.

*8658 (1927). Deutsche Zellstoff-Textilwerke. Treating artificial silk made from viscose. (268,783.)

VI.—Applications

British Celanese, Ltd. Treatment of yarn packages with liquids. 9683. Apr. 8. (U.S., 12.4.26.)

Heberlein & Co. Producing pattern effects on goods made of artificial fibres. 9215. Apr. 4. (Ger., 3.4.26.)

IV.—Complete Specifications

32,912 (1925). Chem. Works (Sandoz). Increasing the affinity of animal fibres for dyestuffs. (245,759.)

*8623 (1927). Heberlein & Co. Producing pattern effects on textiles. (268,781.)

*9215 (1927). Heberlein & Co. Producing pattern effects on goods made of artificial fibres. (268,831.)

VII.—Applications

Jacobsson. Dissolving aluminiferous raw materials. 9227. Apr. 4. (Sweden, 6.4.26.)

Mond (I.-G. Farbenind.). Production of anhydrous chlorides free from oxides. 9494. Apr. 6.

Storer and Taylor. Manufacture of red oxide of iron. 9769. Apr. 9.

VII. Complete Specifications

32,508 (1925). Deutsche Gold- und Silber-Scheideanstalt, and Andrich. Production of concentrated solutions of alkali cyanides. (268,420.)

3592 (1926). Azogeno Soc. Anon., and Toniolo. Manufacture of ammonium nitrate. (247,227.)

3593 (1926). Azogeno Soc. Anon., and Toniolo. Rapid evaporation of ammonium nitrate solutions. (247,228.)

15,584 (1926). Comp. de Prod. Chim. et Electro-Metallurgiques Alais, Froges, et Carmargue. Manufacture of anhydrous magnesium chloride. (255,042.)

23,200 (1926). I.-G. Farbenind. Regeneration of catalysts used in the production of phosphorus pentoxide or phosphoric acid. (259,201.)

*8254 (1927). Andreas. *See* IX.

*8405 (1927). Verein f. Chem. Ind. Recovery of acetic acid from solutions of acetyl cellulose. (268,778.)

*8607 (1927). Lichtenberger and Kaiser. Manufacturing pure white barium and calcium sulphate. (268,779.)

*8783 (1927). Goldschmidt. *See* XVIII.

*9035 (1927). I.-G. Farbenind. Manufacture of alkali bisulphate. (268,817.)

VIII.—Complete Specifications

33,009 (1925). United Glass Bottle Manuf., Ltd., and Moorshead. Glass furnaces. (268,432.)

*8609 (1927.) Brit. Thomson-Houston Co., Ltd. Producing silica articles. (268,780.)

IX.—Applications

Chem. Fabr. Grunau, Landshoff & Meyer, and Kirchner. Accelerating setting of hydraulic binding-agents. 9354. Apr. 5.

Doughty. Producing coloured cement etc. 9783. Apr. 9.

Johnson (I.-G. Farbenind.). Production of plasters etc. 9818. Apr. 9.

IX.—Complete Specifications

30,613 (1925). Levy. Bituminous emulsions. (268,411.)

*4110 (1927). Eckel. Cement. (268,736.)

*8254 (1927). Andreas. Burning of cement, lime, etc. (268,767.)

X.—Applications

Ashcroft. Separation etc. of minerals etc. 9603. Apr. 7.
 Blackett. Separating minerals of different densities. 9724. Apr. 8.

Dehn (Thompson Products, Inc.). Alloy steel. 9712. Apr. 8.

Deutsche Versuchsanstalt für Luftfahrt. Manufacture of aluminium. 9514. Apr. 6. (Ger., 2.12.26.) Aluminium alloys. 9515. Apr. 6. (Ger., 27.12.26.)

General Electric Co., Ltd., and Smithells. Manufacture of alloys of nickel and chromium. 9590. Apr. 7.

Gustafsson. Producing metals from oxide ores. 9441. Apr. 6. (Sweden, 10.4.26.)

King, Morris, Schiff, and Wilder. Mineral-concentrating apparatus. 9508. Apr. 6. Treatment of ores etc. 9509, 9511 and 9512. Apr. 6. Extraction of tin from ores. 9510. Apr. 6.

Remy and Roitzheim. Extraction of zinc. 9470. Apr. 6.
 Smith. Treatment of ores etc. 9362. Apr. 5.

X.—Complete Specifications

23,555 (1925) and 8400 (1926). Davidson. Separation of minerals and other substances. (268,043.)

653 (1926). Poldihütte. Steel alloys. (245,792.)

12,019 (1926). Corneliuss. Producing iron and other metals and alloys having a very low percentage of carbon. (252,017.)

17,878 (1926). Krupp Grusonwerk. Production of zinc. (255,482.)

18,528 (1926). Vegesack. Manufacture of steel. (268,616.)

23,319 (1926). Metallbank und Metallurgische Ges. Copper-aluminium alloys. (268,654.)

29,529 (1926). France. Washing minerals by means of liquid streams. (268,682.)

*32,173 (1926). Krupp. Making steel insensible to the action of hot gases and vapours. (268,730.)

*4512 (1927). Jessup. Electrolytic production of metals, in particular, magnesium. (268,738.)

*4511 (1927). Jessup. Manufacture of magnesium. (268,737.)

*5949 (1927). Denumer. Annealing metal articles. (268,740.)

*8354 (1927). I.-G. Farbenind. Fining iron. (268,770.)

*8864 (1927). Aumund. Blast furnaces. (268,793.)

*8900 (1927). Oelberger. Copper-tin-nickel alloy. (268,798.)

*9021 (1927). Allgemeine Elektrizitäts-Ges. Production of metallic coatings upon non-conducting oxides. (268,815.)

XI.—Applications

Crossley. Primary cells. 9200. Apr. 4. Secondary cells. 9201. Apr. 4.

Goeddertz. Production of lead accumulator batteries. 9333. Apr. 5.

Lobley and Wiggin & Co. Electric furnaces etc. 9670—7. Apr. 8.

Siemens-Elektrowärme-Ges. Insulating-stone for electric furnaces. 9360. Apr. 5. (Ger., 6.4.26.)

Williams. 9682. See XIV.

XI.—Complete Specifications

32,918 (1925). Noeggerath. High-pressure system for electrolytic processes. (268,426.)

26,456 (1926). Hagsphl. Electrodes for electric accumulators. (265,918.)

*22,994 (1926). Kodak, Ltd. Electrical deposition of organic materials. (268,717.)

*4512 (1927). Jessup. See X.

*9147 (1927). Fromont. Electric accumulators. (268,828.)

XII.—Applications

Bushill, Lampitt, and Lyons & Co. Treatment of animal furs. 9348. Apr. 5.

Cowell. Washing-soaps. 9550. Apr. 7.

Hiltermann. 9235. See XIX.

Marks (Chem. Fabr. Stockhausen & Co.). Treating oils, fats, etc. 9485. Apr. 6.

Marks (Perfection Co.). Purification of animal fats. 9261. Apr. 4.

Nyrop. 9250. See II.

XII.—Complete Specification

2689 (1926). I.-G. Farbenind. Stabilising emulsions of wool-oils and water. (246,867.)

XIII.—Application

Storer and Taylor. 9769. See VII.

XIII.—Complete Specifications

24,366 (1925) and 5058 (1926). Pollak. See XX.

1929 (1926). Bakelite Ges. Production of phenol-aldehyde resins. (246,834.)

XIV.—Application

Williams. Electrodeposition of rubber etc. 9682. Apr. 8.

XV.—Applications

British Glues & Chemicals, Ltd., and Drew. Mixing colloidal substances with oil. 9607. Apr. 7.

Rohm & Haas. Tanning process. 9633. Apr. 7. (Ger., 30.4.26.)

XV.—Complete Specification

*8922 (1927). I.-G. Farbenind. Hardening plastic masses from casein etc. (268,804.)

XVI.—Application

Hoffmann, and Prép. Ind. des Combustibles. Manufacture of phosphatic fertilisers. 9731. Apr. 8. (Fr., 8.4.26.)

XVI.—Complete Specification

*8749 (1927). Boehringer & Soehne. Manure. (268,744.)

XVII.—Application

Marks (Corn Products Refining Co.). Manufacture of starch. 9736. Apr. 8.

XVII.—Complete Specification

58 (1926). Baker Perkins, Ltd., Baker, Prescott, and Soc. Anon. Anc. Etabl. Savy, Joazeur, et Cie. See I.

XVIII.—Complete Specifications

19,986 (1926). Jalowetz. See XXIII.

*30,219 (1926). U.S. Industrial Alcohol Co. Absolute alcohol process. (268,728.)

*7111 (1927). Commercial Solvents Corp. Butyl-acetonic fermentation process. (268,750.)

*8783 (1927). Goldschmidt. Obtaining concentrated potassium solutions from distillers' mash. (268,790.)

XIX.—Applications

Bushill, Lampitt, and Lyons & Co. 9348. See XII.

Hiltermann. Emulsions. 9235. Apr. 4. (Holland, 7.3.27.) Production of artificial milk and cream. 9236.

Apr. 4. (Holland, 7.3.27.)

Marks (Perfection Co.). 9261. See XII.

XIX.—Complete Specifications

10,742 (1926). Hoefelmayr. Manufacture of invalid food from milk. (265,910.)

23,598 (1926). Agopian. Obtaining concentrated vitamin preparations. (268,655.)

*8929 (1927). Posternak. Obtaining the total nuclei containing phosphorus and iron, which are comprised in proteids of egg yolk. (268,805.)

*8930 (1927). Posternak and Posternak. Separating and purifying the three phosphorus nuclei of the proteids contained in egg yolk. (268,806.)

XX.—Applications

Dehn (Chem.-Pharm. A.-G. Bad Homburg). Manufacture of quinone solutions. 9246. Apr. 4.

Henry, Sharp, and Wellcome Foundation, Inc. Preparation of therapeutic substances. 9351. Apr. 5.

Hofmann and Otto. Polymerisation of olefines. 9737. Apr. 8.

Imray (Kirkham and Raymond). Manufacture of alkaline earth and magnesium salts of eugenol etc. 9535. Apr. 6.

Rheinische Kampfer-Fabr. Production of inactive menthol. 9230. Apr. 4. (Ger., 15.2.27.)

Silur Techn. and Chem. Produkte Ges., and Thorn. Condensation products. 9829. Apr. 9.

XX.—Complete Specifications

24,366 (1925) and 5058 (1926). Pollak. Treatment of condensation products of carbamide or its derivatives with formaldehyde. (240,840 and 266,389.)

*30,219 (1926). U.S. Industrial Alcohol Co. See XVIII.

*7111 (1927). Commercial Solvents Corp. See XVIII.

*8744 (1927). I.-G. Farbenind. Manufacture of decomposition products of organic compounds. (268,775.)

XXII.—Application

Du Pont, Du Pont, and U.S.F. Powder Co. Explosives. 9617. Apr. 7.

XXIII.—Complete Specifications

15,385 (1926). Evershed & Vignoles, Ltd., and Perry. Apparatus for the detection and estimation of impurities and dissolved matter in water and other fluids. (268,597.)

19,986 (1926). Jalowetz. Treating waters for brewing. (261,708.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Weldless steel pipes (A.X. 4553). *British India*: Chemical and pharmaceutical products (366). Tinplate (A.X. 4555); Hematite iron pig (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *British West Indies*: Fertilisers (367). *Bulgaria*: Galvanised iron wire (A. 4536). *Burma*: Perfumery, patent medicines (373). *Canada*: Tiles, brass, galvanised fittings, lamps (372). black steel pipe (A.X. 4518); black iron pipe (A.X. 4550). *Ceylon*: Perfumery, patent medicines (373). *Czechoslovakia*: Vegetable and animal fats and oils (377). *Germany*: Shellac, mercury (379); leather (380); bitumen (382). *India*: Perfumery, patent medicines (373). *Malaya*: Perfumery, patent medicines (373). *New Zealand*: Iron, non-ferrous metal rods and tubes, hollow-ware, oils, paint, pigments, varnish, steel, india-rubber goods, glass, lamps, leather, crockery, glassware, tinware (C.X. 2262).

News from Advertisements

A special course of eight lectures upon high-pressure gas research is again announced by the Imperial College of Science and Technology, London (page viii).

Applications are invited for the post of chief chemist to an important woollen firm (p. viii).

A chemist is wanted for practical inorganic and physical chemical research (p. viii).

A New "S.R.A." Colour

British Celanese Limited announce a new addition to their range of "S.R.A." colours for celanese, namely, "S.R.A." Blue VII. The characteristics of this colour are good solubility and yield, greenness of shade this being the greenest blue dyestuff of the "S.R.A." range

—and good all-round fastness properties. Whilst it is not recommended for guaranteed fadeless work, it is, nevertheless, of a high standard in resistance to light, whilst its fastness to acids, alkalis, soaping, ironing, cross dyeing, etc. conform well to the high standards of the remainder of the "S.R.A." range of colours. Further, it does not redden at all in artificial light, a property which makes it very valuable for the production of all types of mode and general shades in which retention of the daylight shade is desirable for artificial light. It is of particular use for the production of navy blues by mixture with other "S.R.A." colours on account of its good yield. For the highest yield this colour is best dissolved in hot soft water instead of in soap solution, which retards the dyeing somewhat. Where mixing with other S.R.A. colours for compound shades they also should be dissolved in a similar manner.

PUBLICATIONS RECEIVED

SELENIUM. A LIST OF REFERENCES (1817-1925). Compiled by Marion F. Doty. Pp. 114. New York. The Public Library, 1927. Selling price, 65 c.

PUBLICATIONS OF THE DEPARTMENT OF COMMERCE, BUREAU OF MINES. MINERAL RESOURCES OF THE UNITED STATES. Washington: Government Printing Office, 1927: Gold, Silver, Copper, Lead and Zinc in New Mexico and Texas in 1925. Mine Report. By C. W. Henderson. Manganese and Manganiferous Ores in 1925 (10 c.). By J. W. Furness. Tale and Soapstone in 1925. By B. H. Stoddard. Price 5 c. each.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF STANDARDS. Washington: Government Printing Office, 1926: Hollow Building Tile. First revision. February 15, 1926. Elimination of Waste. Simplified Practice Recommendation No. 12. Pp. 9. Price 5 c.; U.S. Government Master Specification No. 428 for Matches, Safety (Full size, in Boxes). (Circular No. 318. Price 5 c.; Paint and Varnish Brushes. Elimination of Waste, Simplified Practice Recommendation No. 43. Pp. 13. Price 5 c.; Steel Spiral Rods (For concrete reinforcement). Elimination of Waste. Simplified Practice Recommendation No. 53. Report of the National Committee on Metals Utilisation. Pp. 12. Price 5 c.; High Silicon Structural Steel. By H. W. Gillett. Technologic Paper No. 331. Pp. 121-141. Price 15 c.; Magnetic Testing. Circular No. 17. Pp. 24. Price 15 c.; Relations between Rotatory Power and Structure in the Sugar Group. Part I. By C. S. Hudson. Scientific Paper No. 533. Pp. 241-384. Price 35 c.; Statical Hysteresis in the Flexure of Bars. By G. H. Kenlogan. Technologic Paper No. 332. Pp. 145-162. Price 10 c.; U.S. Government Master Specification No. 429 for Ash, Soda, Circular No. 314. Price 5 c.; U.S. Government Master Specification No. 432 for Sodium Carbonate, Granular (Monohydrate Crystals). Circular No. 317. Price 5 c.; Weights and Measures. Nineteenth National Conference of Representatives from Various States held at the Bureau of Standards, Washington, D.C., May 25-28, 1926. Miscellaneous Paper No. 74. Pp. xv + 172. Price 60 c.; U.S. Government Master Specification No. 46 c. for Hose, Tender (Corrugated). Circular No. 288. Price 5 c.; Gas-Measuring Instruments. Circular No. 309. Pp. 109. Price 40 c.; Recommended Building Code Requirements for Working Stresses in Building Materials. Report of the Building Code Committee, June 1, 1926. Elimination of Waste Series. Pp. iv + 53. Price 10 c.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

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SERIES

LONDON, APRIL 29, 1927

EDITORIAL

Canada

CANADA is as near to us in Great Britain now as Edinburgh was to London three hundred years ago, and there is a far greater community of interest and affection. Personally, it is our misfortune that we have spent only a few hours in that great Dominion, a bright sunny day in November eight years ago; we saw nothing of her great cities, but shall remember how we sat by the shore of a secluded lake and saw the vivid autumn foliage, beautiful beyond conception, the calm waters, and a bright little chipmunk darting about in a tree. That is all we know of Canada at first hand, but like all the rest of us here we have many other links with that country. We have, as all of us, many friends and near relations who have visited Canada and know it well, several friends and near relations who live there permanently. It is this bond which keeps Canada so fresh in our minds, so near to us. We love the country, not for the spoils it gives, great and rich as these are, but because the Canadians are ourselves. True there is a great French population there, but this also, in many ways, and especially now, is very close to us. The Canadians have many advantages over us; the people who settled originally in that country, grown green with many trackless years, were the sturdier and bolder of men and women; there is a smaller proportion there of the froth and also of the dregs. So it happens that when we meet Canadians in Britain they are not only ourselves, but the best of us. Canada is no longer a mere pastoral country; it is amazingly rich in minerals and ores, in water power, in salt deposits of various kinds, in raw materials generally. It has great forests, harbours, railways, cities and towns; it has all our modern civilization without the *débris* which accumulates after a few centuries of careless and unprovident existence. We cannot, therefore, expect anything else than a well-established and flourishing chemical industry in Canada. Canadian scientific education and research is of no second-rate character; it attains to the highest level. When we consider the achievements of Canadian pure chemistry during the last ten or twelve years we think of several instances of genius which cannot be excelled in this or any other country. The chemical industry in Canada was naturally slow in growth, but was already becoming of importance at the end of the nineteenth century; since then it has made very rapid progress. So far as the Society of Chemical Industry is concerned, the original Canadian Section was formed five and twenty years ago. In 1920 the Canadian Section was found to be so large and

covered so wide an area that three separate Canadian Sections were formed, those of Montreal, Ottawa, and Toronto. Shortly afterwards the Shawinigan Falls Section was formed, and somewhat later the British Columbia Section. The various Canadian Sections have organised their own overhead Council to take charge of those matters in which joint consideration is desirable. The Society of Chemical Industry has had problems and difficulties of its own to face during the lean years which followed the war. Parsimony has been forced upon it simultaneously with expansion: its parsimonious habits will continue a little longer, but they will become less and less necessary, and we may look forward to a time, continually getting nearer, when the Society can afford measures of expansion which will be of even greater service to its many members in many countries, not scattered over the world, as if they were small islands sprinkled out of a can, but forming huge continents and dominions all interested in advancing the knowledge of chemistry, in publishing the knowledge, and in applying it for the benefit of mankind. This is the ambition of the Society of Chemical Industry; in realising this ambition the Canadian Sections have rendered yeoman service.

Canada's Resources

Few, indeed, cannot but be familiar with the riches which Nature has lavished on Canada: abundance of developable water power, vast areas of forest land, a singularly fortunate array of valuable minerals, and a soil which yields products of an excellence with which the humblest in the land is kept in daily familiarity. Much as we may know about Canadian resources, but few of us can possess so close a knowledge of them that we can dispense with the need to broaden and deepen our information. It is, therefore, singularly happy that, in this issue, which is devoted to the chemical and allied industries of Canada, we are able to print a number of communications written by representative Canadian authorities who review the resources which the Dominion offers to chemical industry, and indicate the remarkable progress which it has made. We are also indebted to Mr. C. F. Cross, F.R.S., who has written on the Canadian pulp and paper industry. The history of the development of chemical industry in Canada makes a romantic story, but important as past developments have been, it is certain that the future holds within its lap still more romance, that kind of romance which always accompanies pioneer work, and is never entirely absent from the onward march of industry. To remind ourselves of the vast possibilities of the Dominion, we have to realise—no easy matter for those who dwell in

our own tight little, bright little island—the immense space of land, three and a half million square miles, 'twixt Atlantic and Pacific, and then we must remember that though the mineral industry takes third place amongst Canadian industries, yet, as Dr. Macintyre observes in his article, "the prospective mineral wealth of Canada is unknown, as a large area of the country is as yet uninvestigated." Even now Canada ranks as the world's largest producer of newsprint, of nickel, cobalt—every chemist knows the names of the districts of Sudbury and Cobalt—and, of course, asbestos. Then, again, we recall the pioneering development of hydro-electric power which forms the foundation upon which a great part of the industrial fabric has been built during the past twenty-five years. In the Shawinigan area alone nearly six hundred thousand horse-power is available, but already installations capable of producing four and a half million horse-power are working in Canada, and still some 28 million horse-power in "white coal" awaits the yoke of the turbine. It will give some idea of the importance of hydroelectric development in Canada if we quote, from an illustrated booklet published by the Shawinigan Water and Power Company, figures relating to the electrical power supplied by the company to various local industries. Thus the local pulp and paper industry consumes 125,000 h.p., the asbestos mines and factories consume 20,000 h.p., the Aluminium Co. of Canada uses 50,000 h.p. for the manufacture of aluminium; whilst its subsidiary, the Canada Carbide Co., utilises over 30,000 h.p. in the manufacture of carbide, part of which is converted into acetylene and used by another subsidiary, the Canadian Electro-Products Co., for the manufacture of acetaldehyde, acetic acid and other important industrial chemicals. Further, the Canadian Carborundum Co. operates electric furnaces consuming 12,000 h.p. for the manufacture of carborundum, aloxite, and ferro-silicon. Another factor in industrial development which should be considered in addition to this lavish wealth of water power is the coal of Canada, the deposits of which are estimated to represent about 16% of the total reserves of coal in the world. Indeed, the coalfields of Nova Scotia represent the only deposits of coal on the Atlantic Coast of America. An interesting document recently sent by the courtesy of the High Commissioner of Canada tells us that, in the seventeenth-century Journal of Admiral Hovenden Walker, it is recorded about Cape Breton that "The Island had always in time of peace been used in common both by the English and the French for loading coals, which are extraordinarily good here, and taken out of the cliffs with iron crow-bars only, and no other labour." The story of Canada's resources tempts us to go on and on, but the tale is told with an authority to which we have no claim by the special contributions in this issue. The resources are there, whether in power, whether in organic or inorganic materials, and the achievements which have been accomplished prove that the technical skill to utilise them is also at hand. We are proud of the prowess of the Dominion, and we are confident that in the future there will be still greater developments to excite our admiration.

The Honorary Treasurer

Mr. E. V. Evans having served the Society well and faithfully for several years, now finds that he can no longer spare the time which that responsible post requires, and he announces his forthcoming resignation, to the great regret of the Society, and especially the Council, and probably with some measure of regret on his own part. Men, especially able men, do not like to leave a difficult task to which they have devoted many years of anxious thought and acute judgment. We do not, naturally, propose to discuss the personality of Mr. Evans; those of us who have met him on holidays, have faced him at lawn-tennis, have retired beaten but still desirous of facing him, have heard him play sundry musical instruments, have watched him play Mark Hambourg at billiards, have sat opposite to him when he has raised our weak no-trump to three no-trumps, and observed his expression when our opponents gleefully doubled us, we know him as a man. Not that we ourselves are critical or skilful at card games; we usually play nursery bridge, *pons asinorum*, as it were, and inscribe on the card table: *post mortem nulla voluptas*. Mr. Peter Jackson, the famous cigar merchant, said that you knew no man unless you had drunk port with him and played poker with him. In this sense, and in this sense only, we do not know Mr. Evans. We think Christmas Eve or Christmas Day is the best time to see the real man, but we are not considering him personally, we are merely concerned with his work as Honorary Treasurer. We prefer to forget the occasions when he and older and even graver men have donned the paper caps extracted from crackers, and flown with insolence and wine, have indulged in some primitive type of community singing. Though unmelodious was the song, it was a hearty note and strong, as Sir Walter hath it. Even Apollo unbends the bow at times. Now when Mr. Evans was yet young as an honorary treasurer, just cutting his milk-teeth in a financial sense, he was faced with a considerable problem, a weekly journal with unknown possibilities and unknown expenses, to be edited by one who had never done a day's editing in his life. This prospect would have appalled many a man, and we think even Mr. Evans had his anxious moments during the first two or three years, but he kept a tight hand on the purse strings, never paid half-a-sovereign if half-a-crown would do, curbed the extravagances of the editor, steadily reduced the loss, made both ends meet, and, finally, last year showed an excess of income over expenditure amounting to a few hundred pounds. He and his colleagues on the Council made other arrangements last year for cutting down unnecessary expenditure, and now that Mr. Evans is ready to retire he can hand over to his successor a position in which the income of the Society should exceed the expenditure by a sum which in the course of a very few years will recoup the Society the whole of the loss—if you can call it loss—which the Society has made since the war. This is an achievement of which Mr. Evans and the Society may legitimately be proud. We congratulate Mr. Evans on sticking to the ship until he had steered it into smooth water. He has had a hard task and done it well; his successor ought to have an easier one.

THE DEVELOPMENT OF CHEMISTRY AND CHEMICAL INDUSTRY IN CANADA

By DR. A. E. MACINTYRE

It is opportune and eminently appropriate that the Society of Chemical Industry should devote, at this time, a special issue of the JOURNAL to Canadian chemistry and chemical industry. Some six years ago the Society sponsored the first general organisation of Canadian chemists, and has continued to support and extend its beneficent influence in promoting the welfare and advancement of chemists and chemical science. The annual conventions of Canadian chemists were developed, and have been largely maintained, through the efforts of the Canadian Sections.

It is the intention in this issue to convey, in a general way, the progress and position of chemical science in the Dominion. It is obvious that the contributions cannot be expected to give a full and adequate presentation of the development and extent of Canadian chemistry and its correlative industries; nevertheless sufficient will be offered to indicate some of the progress which has been achieved since confederation, and future opportunities and possibilities.

The diamond jubilee of the Dominion, which will be celebrated this year, indicates that it is a comparatively young country. If it be young in years, a mere stripling, it is strong in possessing great natural resources, which, if correctly conserved, developed and utilised, will entitle it to be classed as a land of unlimited possibilities.

In 1867 the most sanguine and imaginative of the fathers of confederation had but a very slight conception of the great undeveloped resources of the country, because advancements in science and technology in the past half century have made possible potential resources which were not conceivable sixty years ago.

Notwithstanding the dictum that youth must always look onward and upward, it might be of interest to review some features of the condition of Canadian chemistry and chemical and allied industries during the first decade of confederation, and their gradual development to their present status. Therefore the oracular admonition will be disregarded, and some reminiscences presented in the form of a retrospective epitome.

More than half a century ago the 3,600,000 square miles of Canada was populated by less than 3,500,000 people, whereas to-day the number is approximately 10,000,000. It was a country of magnificent distances extending 4000 miles from the Atlantic to the Pacific, and, at the time of confederation, there were not more than 2300 miles of steam railway, whereas at present there is a mileage of 40,000. These two features are quite sufficient to explain some of the differences in industrial conditions of the past and the present, because there existed, except in two instances, no interprovincial railway communication, an essential for reciprocal trade and commerce.

Prior to confederation the chief industrial activities were lumbering, agriculture, fishing, and wooden ship-building, with small accessory industries appertaining to them. In some respects the position of chemical industry, at this time, presented features which were not much in advance of those in Britain at the middle of the

eighteenth century. It is true there were gas-works in the larger and more important towns, some paint manufacturers grinding principally imported oils and pigments, white phosphorus matches on combs of wood, and a few other minor chemical industries, but in the majority of instances operations were conducted by primitive methods, such as the collection of hardwood ashes from the stoves of the homes, leaching them in barrels and evaporation into crude potash salts. Soap making was more or less, like the ash industry, a household matter. The export of the surplus potash to Britain became unprofitable through competition from the Stassfurt salts. About 1855 the manufacture of petroleum was commenced in New Brunswick by distillation from the so-called coal schists (oil shale), and later the richer oil-producing mineral albertite, but the advent and competition of oils from the Pennsylvanian fields soon made oil recovery unprofitable. For many years, in places more or less remote from ocean or railway transportation, where salt springs existed, the water derived from these was evaporated in open pans for the recovery of the salt, but the amount produced was insignificant in comparison with the demand, which was largely supplied from Britain and Turk's Island. The evolution of Canadian industry from what might be termed the household type to the factory, synchronised approximately with confederation, and, as will be observed, the growth was very gradual, the impetus of development coinciding with the beginning of the present century. Thus the Dominion of Canada practically commenced its official career without any important chemical industry. At this early stage in the history of Canada, instruction in chemistry was not, in general, of a very high standard. Practical instruction in chemical laboratories had not received general recognition, and graduates desirous of fuller knowledge studied in Europe. Some of the larger universities had a chair of chemistry, but in the smaller institutions the instructor was, in many instances, also lecturer upon physics, general biology, geology, mineralogy, and on occasions some branch of theology, occupying the pulpit on Sunday. These last-named conditions even existed for thirty years after confederation at some institutions of learning. The analytical chemists in Canada were chiefly attached to the geological surveys or mines, being engaged in the analysis of minerals.

The influence of the extension of railway communication brought about interprovincial intercourse, and about 1880 there followed the establishment of a few chemical and allied industries. Some of these early enterprises ended disastrously. The demand for chemists, and interest in chemistry, was stimulated by the passing of legislation upon food adulteration, and the appointment of at least one Dominion (public) analyst in each province, and further augmented by the establishment of an experimental farm, with chemists employed upon the staff. About the same period the larger universities instituted and devoted more attention to instruction in practical chemistry. Simultaneous with these movements, chemical and allied industries developed, and analytical and consulting chemists were to be found in the larger cities, where they engaged in commercial analytical practice.

The spectacular development of Canada has occurred within the past thirty years, and the progress made is attributable, in no small degree, to its agricultural development. In fact, the general impulse in industrial evolution was contemporaneous with the settling of the agricultural territory of the middle west, which opened up new markets to the manufacturer and promoted railway construction. This stimulus almost coincided with the formation of the first Canadian section of the Society of Chemical Industry. It is unnecessary to describe in detail the advancement of Canada, as the data presented will be sufficiently illustrative of the growth of chemical industry and concurrently the demand for chemists.

The war had a pronounced influence upon Canadian industry. The demands made upon it changed, in many respects, the whole trend of management. Better factory equipment, greater mechanical efficiency, improved methods of manufacture and systems of cost accountancy, stricter attention to economic operation, labour-saving devices necessitated by reason of the scarcity and high price of labour, and other features which had been neglected or were not previously attainable. Just as in some other countries the great public awakening to the importance of chemistry to industry came with the requirements of the Great War, not only in regard to munitions, but also to other necessities. Only those familiar with the situation at the time can appreciate the imperfect conception which even influential and prominent industrialists possessed of resources available in Canada to assist the Allies in the great struggle, and the distrust and scepticism expressed of the ability of the Canadian chemist and engineer to cope with the new problems and difficulties which would arise. Technical men were faced with conditions which were more or less foreign to them. It is true that much of the information required, in the early stages, was available in Canada, both in respect to manufacture and inspection, and as the war progressed information, which was invaluable to Canadian scientists, was forthcoming from British sources. Nevertheless, the burden of working out the most rapid and efficient methods, the application of appliances and materials to unusual products, requirements for control in manufacture and inspection then fell upon the shoulders of Canadian chemists, metallurgists and associated technicians. Though difficulties were encountered, these, in time, were successfully overcome, and Canadian technical men maintained the reputation of their country as ably and nobly as did the men who served in France.

Reference to several achievements by chemists in Canada during the war may not be out of place in this recital of Canadian industry. How little did the Canadian chemists who attended the International Congress of Applied Chemistry in New York in 1912, and listened to the memorable address of W. H. Perkin, Jr., on "Rubber and its synthesis," wherein reference was made to the Fernbach-Mathews fermentation of starch with production of butyl alcohol and acetone, imagine that within five years a modification of this process would be successfully developed and operated in Toronto, on a large scale, producing thousands of gallons of Perkin's by-product—acetone employed in the manufacture

of cordite for small arm and artillery ammunition. Another instance was the equally successful synthetic production, on a large scale, of acetone from calcium carbide by processes evolved by the chemists of the Canadian Electro-Products Co., Ltd., at Shawinigan Falls, P.Q. The production of acetone was discontinued at the termination of the war, but the manufacture, commercially, of acetaldehyde, acetic acid, acetic anhydride, butyl alcohol, and the acetic esters of butyl and ethyl alcohol has been further developed. The electrochemical production of 99.9 % metallic zinc from the complex and refractory lead-zinc ores of the Kootenay district of Southern British Columbia, at the plant of the Consolidated Mining and Smelting Co., Ltd., Trail, B.C., was another achievement worthy of mention.

The dependency of agriculture upon chemistry, and the application of the latter to all branches of it and its products, is very generally recognized. There are those who openly maintain, and probably rightly, that agriculture "will never develop to its fullest extent until it is regarded as a chemical industry." Husbandry, when properly conducted and maintained, is a permanent source of wealth. It has already been stated that the great transition period in Canadian industrial development occurred about a quarter of a century ago, and for the purpose of comparative progress it may be pointed out that in 1901 the total value of agricultural products was \$362,000,000, whereas in 1925 the value was \$1,700,000,000.

The miner is dependent upon chemical industry for his explosives—the most important tool which he employs. The chemist takes a commanding position in the entire process of the recovery of the metal from the ore to the finished product. The prospective mineral wealth of Canada is unknown, as a large area of the country is, as yet, uninvestigated. The mineral industry takes third place among those of the country. Canada is the world's largest producer of nickel, cobalt and asbestos with, respectively, 80%, 85% and 94% of these substances, and it ranks third in silver and fourth in gold. The mine and its products give employment to a large number of chemists. A very good conception of the development of the mineral industry is obtained from the following data of values: 1886, \$10,221,255; 1901, \$65,797,911; 1926, \$242,855,000.

An influential factor of recent years in the industrial development of this country has been the partial utilization of the potential energy available from water power. A complete survey of the country has not yet been made, but so far as determined the power, at minimum flow, is estimated at 18,255,000 h.p. The capital invested in all plants using "white coal" for the production of power in 1891 was approximately \$4,000,000, whereas in 1926 it was \$840,000,000. The water power installation in 1926 was capable, normally, of producing 4,556,000 h.p. The present year will witness the completion of further large increases amounting to hundreds of thousands of horse power. A considerable portion of this power is utilised by chemical industries, such as pulp, paper, cyanamide, carbide, cyanide, phosphorus, aluminium, electro-metallurgical products and mining.

A small paper industry existed in Canada in pre-confederation days. It is only within the past thirty

years that the pulp and paper industry has assumed great importance. In 1925 the value was \$193,092,937. Canada to-day is the world's largest producer of newsprint. The production in 1910 was 215,000 tons, and in 1926 it had increased to 1,881,737 tons, which will be greatly exceeded when a number of large mills, under construction, commence operating this year.

The foregoing are a few general examples illustrative of Canadian industrial expansion. With few exceptions the chemical and allied industries have exhibited the same progressive development. It is impossible to obtain reliable data regarding these industries for the years prior to the formation of the Dominion Bureau of Statistics in 1920, and even the returns issued by the Bureau as "Chemical Industries" do not include all industrial establishments properly coming within that category, as many are contained in other statistical groups, such as pulp and paper, starch, etc. The capital invested in 1925, in all chemical industries, in Canada, is estimated at considerably over \$1,000,000,000; employees number about 110,000; wages and salaries in the vicinity of \$115,000,000; cost of material used \$400,000,000; and value of products \$750,000,000. These figures would indicate that the chemical industries occupy an important position in the industrial life of Canada.

Brief reference has been made to chemical education in the immediate post-confederation period. The position to-day is quite different. Educational facilities and opportunities have greatly increased. There are some 22 universities having an approximate teaching staff of 3500, and an attendance of 25,000 regular students. The lands, buildings, equipment, and scientific instruments are valued at \$45,000,000. Chemistry occupies an important place in the curricula of these institutions, and the majority of the chemical buildings and equipment compares well with similar institutes in Europe and America. Canada, through its universities, offers every opportunity for a complete education in all branches of chemical science.

Besides the sections of the Society of Chemical Industry, which have played such an important part in the development of chemistry in Canada, there is a Canadian section of the Société de Chimie Industrielle de France, which is an active factor in the promotion of science in the province of Quebec. A number of smaller chemical associations exist. These are chiefly located in university cities, and frequently in connexion with the university, but include chemists who are not attached to it. These bodies are all doing their share in promoting the advancement of chemistry. In 1920 the Canadian Institute of Chemistry was formed. This is a professional association of chemists, incorporated by letters patent, and corresponding in position to that of the Institute of Chemistry of Great Britain and Ireland. The Institute has provincial sections in Ontario, Quebec, Manitoba and the Maritime Provinces, with local branches in several cities. The Association of Professional Chemists of the Province of Quebec was incorporated by the Legislature of that province last year, and has been organised. Its objects, in the main, are similar to those of the Canadian Institute of Chemistry.

The world-wide competition for trade has had its

influence upon the Canadian industrialist, who, eager to maintain his position at home and abroad, has not hesitated to employ scientific men, and, as a result, industries formerly not employing chemists have turned to them for assistance in controlling the quality of materials and operations involving chemical or correlative science. The importance of chemistry in trade and commerce has been recognised. These conditions have opened a larger field of activity for chemists, with a correspondingly greater demand.

In considering the future prospects and possibilities of chemical industry in Canada a survey and examination of the natural resources must be made, because these will be in the future even greater dominating factors than they have been in the past. The sources of most of the material utilised by the chemist are largely derived from agriculture, mines and forests. It has been pointed out that Canada might claim to be considered a land of unlimited possibilities provided its natural resources are properly conserved, developed and utilised. The past history of Canada's natural resources is not bright, being darkened by many pages of neglect, waste and destruction. Some twenty-five years ago these conditions attracted the attention of the Dominion government, which, being impressed with the necessity of immediate action to conserve the public domain, created a conservation commission which made a survey of the natural resources, and at the same time initiated measures for their conservation. This ultimately developed into the Natural Resources Intelligence Service and Water Power Branch, departments of the government which are doing excellent service in promoting and directing attention to the resources of the country, their possibilities, utilisation and proper conservation. Brief consideration will be given to these natural resources, so necessary to chemical industry.

The basic industry for many years to come will be agriculture. There exists already a broad foundation upon which it can be advantageously extended. H. Hibbert recently stated that "Canadian agriculture" "would never be developed to its fullest extent until it is regarded as a chemical industry." There is good ground for this contention. The creative chemist, by applied methods, can greatly enhance the value of the husbandman's product, and can also assist in increasing the productivity of his labour by supervision of his soil and supplying plant foods for his crops, which would improve not only the quality and increase quantity, but also resistance to disease and pests; supply means for eradication of insects and disease, and utilisation of by-products and such like. The art of true conservation has not been developed among the Canadian agriculturalists to an appreciable extent. The future of this great industry should be one of the responsibilities of Canadian chemists.

At confederation it was considered that Canada possessed unlimited forest resources, which would endure for many generations. They were believed to be inexhaustible, and their conservation did not attract attention. Much ruthless waste was perpetrated in forest operations, involving the loss of large quantities of invaluable growing raw material. These sins of

omission and commission are recognised to-day. There still exist immense areas of timber limits which are being operated, utilised and conserved in a measure far superior to that in the past. The forest is daily supplying the chemist with thousands of tons of raw material, and pulp and paper is one of the most important industries, yet only about 50% of the wood is being utilised by conversion into paper, and very much less than that figure when calculated on the tree basis. The salvage of this waste material is one of the perennial problems which confront chemists, and the Canadian chemist who develops an economic method for its utilisation will be a benefactor of his country and chemical industry. There is another problem which may be presented to the pulp and paper chemist at no very distant day, viz., either some other source of sulphur or an economic method, other than the sulphite process, for pulp making. There are possibilities of the replacement of elemental sulphur by certain sulphur compounds existing among the Canadian natural resources but in a large number of cases transportation and other difficulties might bar their application, and thus, except in special adjacent locations, their use would not become general. The life of this great chemical industry depends upon the conservation of the forests. It therefore behoves the chemist to do everything in his power to conserve them, and perpetuate an important industry.

Whilst the forest, by growth, can, in time, be reproduced, such is not the case in regard to certain of the mineral resources. Depletion is a prominent feature in the mining industry which must be considered in reviewing resources of this class. The position of the chemist in relation to this industry is to devise and develop economical methods of recovery, removing all the metal, and at the same time controlling all operations. The mineral resources of Canada are very large, and the reserve existing will serve the demands of chemical industry for many years.

Of great interest to chemical industry is the development of cheap water power, making possible cheap energy for utilisation in all departments of industry, particularly in the electrochemical industry. Canada has an abundance of power, available at points close to established water and rail transportation. Hydro-electric power already is an important feature of Canadian industry, and, as it is ever increasing, it may well become the most important factor in the future industrial development of the country.

From an examination and review of the available data upon the natural resources of the Dominion, it is quite evident there is an ample visible supply for many years, but nevertheless endeavour will be made to reduce the wastage to a minimum by improved or new methods in industry, thus increasing efficiency and the wealth of the country, and at the same time conserving the resources.

The future success of chemistry and chemical industry in Canada depends on the chemist himself. The chemist engaged in the onward march of industry must not work in watertight compartments. He must possess a broad creative outlook, capable of calling to his assistance all branches of chemistry, and co-operating with associates of the borderland sciences. It will not suffice merely to

revamp processes and materials made in other countries. He must have sufficient imagination, ability and ingenuity to create and develop new processes and products, as well as originate new methods for well-known commodities and discover new applications for both the old and new.

The daily press of Canada has recently devoted editorial comment on the co-operation existing between certain governmental departments of Great Britain and the United States in the solution of common scientific problems, pointing to the "mere waste of effort and money on the part of two governments to set up separate and independent establishments to investigate the same questions, when co-operation might easily bring earlier results at smaller costs," and showing that such co-operation in the past "has proven of value." It is true that in some Canadian departments there is an unofficial exchange of information, and a certain degree of co-operation, still it might well be extended and official co-operation recognised and developed. There are many chemical problems which are common to Canada and other parts of the Empire, and by co-operation their solution might be accomplished more expeditiously and at less cost. To a certain degree such collaboration existed during the war, proving to be very valuable to certain Canadian industries. Whilst the Society of Chemical Industry, through its publications, keeps the chemist informed on the advancement and progress of chemistry, still it might be possible for the Society, which is closely affiliated and federated with all branches of the science, to act as a clearing house for matters appertaining to chemistry, particularly applied chemistry, thereby becoming a medium for collaboration, and thus accomplishing a degree of co-operation not yet attained.

CANADA'S RESOURCES IN RELATION TO CHEMICAL INDUSTRIES

By G. G. OMMANNEY

The chemical industry has been defined as embracing those industrial activities concerned with the preparation of products from raw materials by the process or means of chemical change. Such a broad classification necessarily embraces a wide range of manufactures, and to an important extent the industrial possibilities either present or future of a country may be gauged by its resources of materials and the conditions which it can offer favourable to the economic support of chemical industries. Canada is fortunate in this respect, and having in view the tendencies of modern production to develop along the lines of chemical processes it may be said that, in many directions, no country to-day offers a better field for such developments.

Let us therefore consider briefly Canada's situation in this respect, though within the limits of a brief review it will not be possible to do more than touch on some general aspects of this wide subject.

Electrochemical processes are the foundation of many most important chemical industries. These usually require an abundant supply of cheap power. Geological conditions in Canada have combined with the geography of the country to create a combination

which places at our disposal the largest and cheapest supplies of hydro-electric power that the world can offer in reasonably close proximity to established centres of population, developed land and sea transportation and accessible markets. In the provinces of Ontario and Quebec vast drainage areas from high table lands tributary to watersheds whose rivers flow into great water ways such as the Ottawa and St. Lawrence or into the sea, usually reach these outlets through abrupt and considerable falls in elevation. Such conditions have created water powers at sites so suitably located for cheap development that for large blocks of power the capital charge per horse-power created has been the lowest in the world.

Usually these rivers and their tributaries either take their source from or flow through abundant and large

resource may be given. On the Saguenay River, which flows out of Lake St. John in the province of Quebec, into the St. Lawrence, two developments are now in hand, which will create 1,300,000 h.p. The chief use of this power will be by a plant for the manufacture of aluminium. In addition to the power development, there is involved the construction of a large plant for this product, the building of a railroad and the establishment of a new town all in a country up till now absolute wilderness. Bauxite—the principal raw material used in making aluminium—has not as yet been found in Canada, and must be imported, so the water-power situation gets the credit for bringing us this most important chemical industry.

Canada's mineral resources form an important contribution to its list of assets for chemical industries.



FIG. 1

General View of the Plant of the Canadian Electro-Products Co., Limited, Shawinigan Falls, Que.

lakes located in the uplands, thus providing a ready means to regulate flow at the power sites, which is further controlled by the vast forests covering the drainage areas.

Similar favourable conditions exist in the provinces of Manitoba, northern Saskatchewan, Alberta and British Columbia, though in the three latter provinces, as in the case of the maritime provinces, abundant supplies of coal supplement the industrial use of the water powers.

The general position may be summarized by the statement that of 32 million available horse-power which has been measured on rivers within reasonable transmission distance of settled areas, only some 4,500,000 h.p. has been developed to date.

Canada has, then, as a first asset for the type of industry under consideration these water powers. One concrete example of the immense value of this single

We may exclude from this topic metallurgy, though really this science embraces the recovery of metals by chemical means, and it might properly be claimed that Canada's known and probable reserves of ores of gold, silver, nickel, copper, zinc, lead and other minerals are the raw materials for chemical industries in this respect. But, in addition, we have other minerals in use or available for use more directly connected with the subject of this article.

It will be noted that in 1926 Canada produced over 16 million tons of coal, of which perhaps 30% came from the Maritime provinces of Nova Scotia and New Brunswick and the balance from Saskatchewan, Alberta and British Columbia. Much of this coal is of good coking quality, and its distillation may be made the basis of industries for the production of dyestuffs, tars and tar products, fertilisers, etc.

The production of petroleum in Canada, though not at present large (339,000 barrels in 1926), comes from Ontario and Alberta. In the latter province, as well as in other parts of the west, the search for commercial petroleum fields is being vigorously prosecuted. The great success recently encountered in the Turner Valley (south-west of Calgary, Alta), where several wells with heavy flows of gas carrying a high percentage of naphtha have been brought in, as well as other favourable features elsewhere, give rise to expectations of greatly increased production in the near future. The refining of petroleum yields products including light and heavy oils, paraffin waxes and other products used in many industries.

We have not yet touched on one of Canada's most important industries—that of the production of paper and pulp. Here it may be truly said is a vast chemical (and mechanical) enterprise whose foundation rests upon the basic resources of the country. The story of

An important raw material in this industry is limestone—both calcitic and dolomitic, and it is fortunate that adequate supplies of suitable material lie handy to the principal points of use.

Another Canadian resource which may yet assist this industry includes large deposits of pyrites ore which, in view of the present crude sulphur situation in the southern United States, may in the not distant future become the Canadian source of supply of this important element.

It is also interesting to note that the large deposits of sodium sulphate which occur in the form of dog lakes of crystalline Glauber's salts in the western province of Saskatchewan are now being successfully worked to yield natural salt cake needed by the sulphate pulp mills. Even the refractory linings of the furnaces of these mills are being largely supplied from Canadian soapstone deposits.

Old country readers not familiar with Canada can



FIG. 2.

General View of the Plant of the Canada Carhide Company, Shawinigan Falls, Que.

the Canadian pulp and paper industry is a romance of commerce. The development has been as rapid as it has been amazing. The chief factors have been Canada's water power resources already referred to, her abundant water ways, and her great heritage of forests of spruce and other suitable woods, which, under proper management and conservation, will yield sufficient raw material for the needs of the industry and its probable expansions for as long as may be required.

Pulp and paper mills have been erected at suitable points throughout the country, particularly in Quebec, Ontario, the Maritime Provinces and British Columbia. Manitoba also has developments in hand.

In 1925 Canada produced 2,772,507 tons of wood pulp, 1,884,705 tons of newsprint and other paper, and the aggregate value of all the products of the industry was \$202,783,017.00.

We have in Canada to-day 69 mills making newsprint and other paper and 80 mills making pulp—including sulphite, sulphate and ground wood

scarcely visualise or credit the story of her pulp and paper industry. Towns, thriving centres of population and activity with every modern convenience that cheap electricity and up-to-date construction can give, have come into being with astonishing rapidity in the heart of wilderness countries. Such places as Grand'mere and Shawinigan in Quebec, and Iroquis Falls in Ontario are examples.

Intensive organisation in production and marketing, chemical, mechanical, and botanical research have gone hand-in-hand with the forward march of the industry. Transportation companies such as the Canadian Pacific Railway have played their part. Not minor factors have been the supply of contented and industrious labour, and the winter climate of Canada greatly facilitates the cutting and first movements of the pulp wood.

In a country with such wealth of forest resources as is possessed by Canada, wood naturally plays an important part in construction of all kinds, including houses. This condition gives rise to a very large demand for

paint, and the production of paint forms one of the major chemical industries. Here again Canada is not without the requisite resources. Iron oxides and paints from Quebec, Ontario, Alberta, and British Columbia are in use, and deposits in Nova Scotia are likely also to be developed. The manufacture of blanc fixe and other pigments from large deposits of titanium ores near Montreal, Quebec, is now projected, whilst barytes deposits in certain parts of the country, though not as yet producing, furnish an opportunity for making lithopone. Ores of zinc and lead extensively mined in British Columbia and Quebec also furnish pigment materials.

Besides their possible use in metallurgy, the chromite

spodumene, which are the ores of lithia—a material used in the glass industry in order to reduce the viscosity of the melted glass, more especially in the manufacture of lamp bulbs and also in special kinds of glass. Lithium compounds are also used in the extraction of aniline dyes from coal tars, in certain medicines, and in at least one type of storage battery. These deposits are now under development.

In this brief review we have not touched on many important matters connected with the subject which offer opportunities, present or future, for the manufacture of chemical products to meet the needs of this rapidly expanding Dominion.

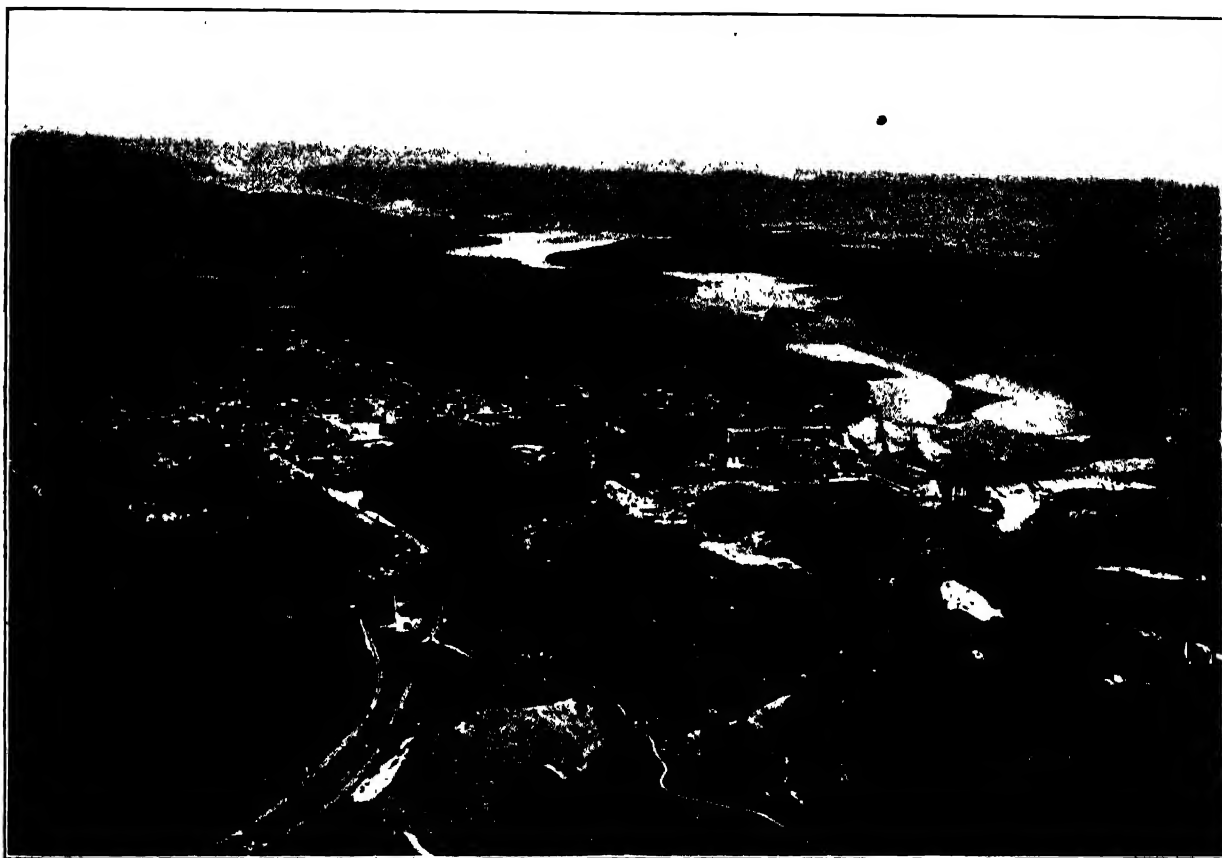


FIG. 3

Photograph of Grand'mere by the Fairchild Aerial Survey Co. of Canada, Ltd.

ores of Quebec present possibilities for the manufacture of dyes and tanning. The cobalt ores from the district of that name in Ontario give the largest supplies of that famous pigment material in the world. It is also used in the enamelling, porcelain, coloured glass, and earthenware trades. The enamelling and pottery trades may, perhaps, be classed as chemical industries, and for these Canada contributes from her rich store-house of minerals one of the highest grade felspar on the American continent, as well as a variety of kinds of clay suitable for many uses.

Great interest has recently been aroused by the discovery in Manitoba of large deposits of lepidolite and

Agriculture is Canada's first and most important industry. Fertilisers are needed and in use in certain sections of the country or for certain crops. But the vast fertile plains of the West do not yet require artificial fertilisation, and it would be difficult to predict when, if ever, the need will become at all general. Still the fertiliser industry is becoming of importance, and, with an eye to the future, it is interesting to consider Canada's position in regard to the supply of the basic elements of plant food. Nitrogen we may yet obtain from the atmosphere by use of our hydro-electric power resources: Cyanamide is already manufactured at Niagara Falls; ammonium sulphate will supply it.

and it is already produced by distillation of our coals. Fish-refuse plants on the Atlantic and Pacific Coasts furnish both nitrogen and phosphorus, and more such plants can be developed. These offer an opportunity for the export market, as well as for domestic use. Potash and phosphate will probably continue to be imported, but it is important to note that Canada's felspathic rocks contain high percentages of the former, and the apatite rocks of Quebec have a higher phosphate content than is found in the deposits of southern United States. These latter have been used in the past, but are not at present worked. Kelp seaweed on the Pacific Coast has been used to supply potash.

Before concluding, two important industries should be mentioned—chlorine products from salt deposits, and a carbide industry with world markets using Canadian limestone and water power.

The list is far from complete. We would suggest that those interested should study the Canadian Government Statistics of production of minerals and raw materials. Combined with an intelligent appreciation of Canada's other assets, her water powers, her forests, her coals, her agriculture and some study of her imports, they suggest many opportunities for industrial developments along chemical lines which are worth investigation. The Development Branch of the Canadian Pacific Railway issues from its Montreal office very convenient and concise summaries on all these resources which are available to all who ask for them.

CANADA'S HEAVY CHEMICAL INDUSTRY

By S. J. COOK

Although Canada's total area is given as 3,797,123 square miles, the industrial section comprises only about 16% of this area; occupied farm lands represent approximately 6% of the Dominion, so that there remains only about 10% of the total on which there are established all the other entities which go to make domestic and commercial Canada. This 10% is spread out in a section 3000 miles long from east to west, having an average width of about 120 miles from north to south—a total area of 360,000 square miles.

Appreciation of these facts is necessary to a proper understanding of industrial conditions and developments in Canada. Settlement has proceeded from the Atlantic coast westward, and later along the Pacific coast, and inland.

In the great central plains agriculture is the leading industry; the farms there are very large: community centres are far apart, and factories are few. In Ontario and Quebec, and to a less extent in British Columbia and in the provinces of Nova Scotia, New Brunswick, and Prince Edward Island on the Atlantic seaboard, mixed farming on smaller farms has kept the people more closely together, and has encouraged the development of centres where industries have grown up to supply the immediate needs, and later to provide more fully for the requirements of those whose livelihood is derived from the factory and shop system. This theme might be pursued through all the phases of the developments characteristic of a new land, particularly one of such great length from east to west, and relative narrowness from

north to south, but perhaps sufficient has been said to give the reader who has not had the privilege of travelling in Canada some concept of the peculiarities of the country from a geographical point of view.

Heavy chemicals, in every land, find their market as raw materials in other industries; production, therefore, to save transportation costs, and thereby to keep prices at as low a level as possible, is usually carried on in close proximity to the locality in which most of the output can be sold. For this reason the heavy chemical industry in Canada is chiefly centred in the provinces of Ontario and Quebec, although, because of the cost of transportation over long distances, there are representative plants at strategic points across the Dominion from Nova Scotia on the east to British Columbia on the west.

Production of industrial chemicals, such as sulphuric, hydrochloric and nitric acids, caustic soda, salt cake, calcium carbide, cyanamide, phosphorus, and compressed gases such as oxygen, hydrogen, carbon dioxide and acetylene, is the most important of the chemical industries in Canada. In 1925 the 40 plants in this industrial group, representing a capital investment of \$35,656,528, furnished employment to 2,409 workers during the year, and converted \$12,843,256 worth of raw materials into finished products valued at \$27,183,395, an advance of more than a million dollars over the corresponding figure for 1924. Of the total output in 1925, acids, alkalis and salts amounted in value to \$25,396,782, and compressed gases were worth \$2,086,613.

Sulphuric acid was manufactured in 8 separate plants; 2 plants produced acid for the manufacture of ammonium sulphate as a by-product in connexion with the operation of by-product coke installations; 4 made sulphuric acid for commercial distribution; 1 plant in British Columbia made acid for use in metallurgical processes in the treatment of zinc ores, and 1 other company in that province made its own sulphuric for use in the manufacture of fertiliser. Hydrochloric acid was made in 3 plants, nitric acid in 2 different plants, and phosphoric acid in only 1 plant. Calcium carbide for sale was produced in 2 establishments, while 1 other plant made this commodity for its own use in the manufacture of cyanamide. Bleaching powder, soda ash, liquid chlorine, caustic soda, glacial acetic acid, acetaldehyde, paraldehyde, phosphorus, cyanamide and sodium cyanide were, in each case, the product of a single plant.

Output from the 20 heavy chemical plants in operation during 1925 reached a total value of \$25,396,782, and as raw materials cost \$12,472,687, the value added by manufacturing processes amounted to \$12,924,095. Capital employed stood at \$32,236,424, and employment was given to 2,084 persons, to whom £2,992,695 was paid in salaries and wages. The 20 plants were located as follows: 10 in Ontario, 6 in Quebec, 3 in British Columbia, and 1 in Nova Scotia.

Production of compressed gases in 1925 totalled \$2,086,613 in value as compared with \$2,051,448 in the preceding year. Capital employed amounted to 3.4 million dollars, employment was given to 325 persons, and expenditures in salaries and wages amounted to \$481,595. Of the 20 plants in operation, 2 were located

in Nova Scotia, 4 in Quebec, 8 in Ontario, 3 in Manitoba, 1 in Alberta, and 2 in British Columbia. Acetylene was made in 12 different plants, carbon dioxide in 6 plants, oxygen in 9 plants, and aqueous and anhydrous ammonia in 1 plant only.

In addition to the plants just enumerated there are 3 plants producing hydrogen for the hydrogenation of oils in their own works, and 1 other plant extracting nitrogen from the air for the manufacture of cyanamide. Oxygen is obtained as a by-product at each of these plants.

Electrochemical products, including carbide, cyanide, cyanamide, artificial abrasives and artificial graphite, phosphorus, caustic soda, bleaching powder and chlorine, are produced in large quantities at various points in Canada, where hydro-electric power is cheap. Data compiled from various sources indicate that the investment in electrochemical plants in Canada is in the neighbourhood of \$35,000,000, whilst the value of products from these plants reaches a total of about \$40,000,000 annually. Development of hydro-electric power in large volume and at a low distribution cost has been followed by the building of plants to use electrochemical processes, and the output of such products has added appreciably to the value and volume of Canada's export trade.

In this connexion, interest in recent development centres in work being done at Arvida in the Lake St. John area, Quebec, where an enormous sum of money is being spent for the construction of hydro-electric power plants and for the building of a smelter to produce metallic aluminium from bauxite ore, imported from the United States; it is proposed to bring ore from British Guiana, but this step has not yet been taken. Canada's magnificent endowment of water-power sites suitable for commercial development constitutes one of the great natural resources of the Dominion; progress in this field in recent years has merely pointed the way to the achievement of greater things, and the near future will see advances made in this field, which are not likely to be excelled in any part of the world. Electric steam generation is already an established feature in many localities; at least one of the pulp mills in the province of Quebec obtains all the heat required for the cooking processes throughout the plant from this source.

Niagara Falls, in Ontario, and Shawinigan Falls, in Quebec, are the pioneer centres in the utilisation of hydro-electric power for chemical purposes.

Cyanamide and cyanide production at Niagara Falls continues on a great scale, a large part of the output going into the export trade with various countries.

The work done at Shawinigan Falls, during the late war and since, is too well known to need any further description here; the manufacture of acetic acid, acetaldehyde, paraldehyde, and other products from acetylene generated from carbide made in an adjoining plant was, and is, one of the finest achievements in the history of chemical science in Canada.

Carbide, for acetylene gas lighting, has been made for many years at Shawinigan Falls, Quebec, and Welland, Ontario; some of the output is used in Canadian mines and other industries, but by far the greater part is exported.

Bleaching powder, chlorine and caustic soda, made by

the electrolysis of brine pumped from wells on the property at the Sandwich plant of the Canadian Salt Company, are being produced in greater quantities year by year; the story of the successes won in the development of the processes now in use is one of the most interesting in the annals of Canadian chemical history. An excellent description of this plant and its products appeared recently in *CHEMISTRY AND INDUSTRY*.

These achievements are but the forerunners of a series of accomplishments that will continue to direct the interest of the keen business minds in the scientific world to the innumerable opportunities that Canada affords to those who have the vision to foresee the immense possibilities of properly selected enterprises.

Interest in the manufacture of sulphuric acid in Canada was stimulated in 1925, when the Mond Nickel Company built a plant at Coniston, Ontario, where the company operates a nickel-copper smelter, for the manufacture of high-grade sulphuric acid from the Bessemer converter sulphur-bearing gases that, for years, had been allowed to burn to waste in the air, to the detriment of the neighbourhood. Operations at this plant proved so successful and profitable that the capacity of the plant was doubled towards the end of 1926, in an attempt to meet the demand for acid. Formerly all the sulphuric acid made in Canada was obtained by the treatment of pyrites or sulphur. In 1926 the production of sulphuric acid amounted to about 210,000,000 lb. of 66° B_e acid. Exports of this commodity to the United States have grown appreciably in the past three years; in 1926 about 50 million lb. found its way into the export trade.

The principal users of sulphuric acid in Canada, in order of their average requirements, are petroleum refineries using about 40%; by-product coking plants taking 15%; the explosives industry and the wire and wire goods industry, each of which buys about 12% of the supply; and various others, such as the manufacturers of fertilisers, the makers of electrical apparatus and supplies, etc.

Limitations in the matter of fuel supply in Central Canada have promoted a demand for the establishment of additional by-product coking plants; the by-products will contribute to Canada's output of ammonia, ammonium sulphate, and tar, and there may be other products recovered or produced in these new plants.

Ammonium sulphate to the extent of nearly 20,000 tons per annum is made in Canada as a by-product from the plants producing coke or gas as their principal product. It is not, therefore, truly a product of the "heavy chemical" industry as generally described. There are many other such examples of chemicals or chemical products made in other industries, as, for instance, the making of intermediates in the explosives industry, and in the manufacture of superphosphate for use as an ingredient in mixed fertilisers; other examples may be found in the preparation of paints and varnishes, soaps and pharmaceutical preparations.

Canada's heavy chemical industry has been built up primarily to supply the domestic market with those products that are not readily obtainable elsewhere, either because of the inconvenience involved in the handling of shipments over long distances or by reason of the greater costs thus incurred.

A feature in the development of the heavy chemical industry in Canada, and, indeed, in the application of chemical science in any branch of industry in the Dominion, that is often overlooked by the zealous exponent of conservation and efficiency, is that the natural limitations of the market, due to geographical conditions, sometimes makes it advisable to forego the high efficiencies so desired by chemists, in order to produce, at a reasonable cost, those commodities for which there is a profitable and ready market. Changing conditions, brought about by the advances in chemical knowledge, or by the growth of population and industries, necessitate more frequent adaptations of the industry to its environment in Canada than is ever the case in an older land where industrial and commercial changes are less pronounced.

As the country grows, factory enterprises gradually become more profitable, and as reserves are built up the means are provided to promote research, and to increase the efficiencies of plant operations. There is admittedly less need for saving in the earlier stages of a country's industrial life, when natural resources supply an abundance, and often an excess, of raw materials, than there is when limitation of supplies tends to advance prices and to restrict output. So it is that in many of Canada's industries efficiencies of operation may not compare favourably with those obtained in European plants; but when the need arises the initiative and resourcefulness of the operators of Canadian plants always prove equal to the task in hand, as the records of the industry show beyond question.

Canada's chemical industries as a whole contribute in no small measure to the diversification of Canadian manufactures, and add very appreciably to the volume of production each year. If the larger view of chemical industry be taken, and the definition expanded to include all industries using chemical processes, the field represents not less than one-fifth of the aggregate value of Canadian manufactures.

In 1925, the latest year for which complete data are at hand, concerns using chemical processes made products valued in the aggregate at \$655,000,000, the grand total value of all manufactures in Canada in that year was \$2,678,000,000. The 28 industries using chemical processes included upwards of 1400 plants in which 87,000 persons found employment and earned nearly \$110,000,000 during the year.

The heavy chemical industry, as considered in this article, is one of the 28 industries referred to above, and in point of production values is the most important industry in a group of 10 usually selected as the representative "chemical" industries in Canada. In order of production values, these 10 rank as follows: (1) Acids, alkalis, salts and compressed gases; (2) paints, pigments and varnishes; (3) soaps, washing compounds and toilet preparations; (4) medicinal and pharmaceutical preparations; (5) explosives, ammunition, fireworks and matches; (6) inks, dyes, and colours; (7) coal tar and its products; (8) wood distillates and extracts; (9) fertilizers; (10) a miscellaneous group of industries, making chemical products not specified under any of the foregoing headings.

Some of the more important "heavy chemicals" produced by the industries just mentioned are itemised

in the following table. In this case production data are drawn from the entire chemical group, and not only from the producers of "Acids, alkalis, salts and compressed gases," heretofore regarded as the "heavy chemical" industry. This explanation seems necessary, because of the statistics previously given regarding capital investment, employment, distribution of plants by provinces, etc., all of which referred only to the 20 producers of acids, alkalis and salts and to the 20 plants making compressed gases.

Production of certain chemicals in Canada, 1925

	Quantity	Value
Acetate of lime (grey) 80°	lb. 4,851,270	391,329
Acetone	" 346,478	65,821
Acetylene	cub. ft. 178,163,651	1,384,020
Acid, hydrochloric (20° B ϵ)	lb. 7,128,821	101,859
" nitric	" 8,282,497	671,850
" sulphuric (66° B ϵ)	" 100,850,200	1,360,411
Calcium compounds (includes arsenate, carbide, cyanamide, bisulphite, hypochlorite and hydroxide)	"	13,580,050
Carbon dioxide	lb. 3,650,547	372,060
Chlorine, liquid	" 12,454,070	388,307
Formaldehyde	" 1,157,700	173,655
Methyl hydrate, pure	" 434,040	420,837
Oxygen	cub. ft. 68,085,163	897,912
Baking powder	lb. 6,669,031	1,663,031
Sodium compounds (includes arsenate, bisulphite, carbonate, cyanide, hy. dioxide, and silicate)	"	5,605,636

AGRICULTURAL CHEMISTRY IN CANADA

By FRANK T. SHUTT, M.A., D.Sc., F.I.C.

Dominion Chemist and Assistant Director Dominion Experimental Farms

The application of chemistry to the solution of Canadian agricultural problems may be said to date from the establishment of the Dominion Experimental Farm system by the Federal Government in 1886-'7, though for some years previous to this time a provincial agricultural college had been in existence in Ontario—a teaching institution which in recent years has enlarged and extended its sphere of usefulness by undertaking investigational work in agricultural science. To-day practically every province in the Dominion has its agricultural college, at which in addition to the teaching work, more or less attention is given to experiment and research in agricultural matters.

In referring more particularly to the chemical work of the Dominion Experimental Farm System, it may be said at the outset that side by side with purely investigational work, the Division of Chemistry has carried on, chiefly through correspondence, an educational and advisory service for the "man on the land." This is a phase of the Division's activities which has grown with the years and become increasingly popular. This "bureau of information" to which all may freely apply—correspondence with the Division not even requiring postage—now furnishes advice to many hundreds of farmers in every province of the Dominion. By letter, printed matter and to some degree by analytical work, it seeks to supply reliable information, based on the science of agricultural chemistry, on soils—their nature and treatment—fertilisers and manures—their composition and use—fodder crops and feeding stuffs—their nutritional value and economic use—farm water supplies, the nature and application of insecticides and fungicides, and so on. Indeed, many years of this service have shown that there are few matters on the farm which do not call, at one time or another, for chemical aid. It is generally conceded that this means of disseminating information,

based on the results of chemical research and practical in its nature, is playing an important part towards making Canadian farming a rational and profitable vocation.

INVESTIGATIONAL AND RESEARCH WORK

Constant effort is made to assist by experiment and investigatory chemical research work all phases of farming—grain growing, mixed farming, stock raising, dairying, orcharding, etc., and accordingly the Division finds a very wide and varied field for its labours. With this in mind, it will be readily understood that in the space allotted for this account it will be possible only briefly to outline the salient features of a few of the more important or prominent lines of investigation which have received the attention of the Division.

Soils.—Since the profitable pursuit of farming must depend in the first place on the fertility of the soil, naturally, much attention has been given to a study of Canadian soils, and more particularly to those of virgin areas and of districts newly opened up for settlement in the Western prairie provinces. Although mixed farming and dairying are now becoming important features in Western agriculture, grain growing has been, and undoubtedly will continue to be, the predominating phase in Manitoba, Saskatchewan and Alberta. Consequently, the influence of continuous grain growing on the plant food, and more particularly the nitrogen and humus content, has been studied. As an illustration of this work and its results, it was found that in a period of 38 years the loss of nitrogen from virgin soil was approximately 40%, of which roughly 17% was removed by crops and 23% by cultivating, including the practice of summer-fallowing. The main data are as follows:

Depletion of nitrogen, 1884-1922	
Virgin and cultivated soils—Indian Head, Sask.	
	Nitrogen per acre, to a depth of 8 in.
Virgin soil	1 lb. 8,580
Cultivated soil, 38 years (1884-1922)	5,180
Difference or loss, due to removal in crops and to cultural operations	3,400
Removed by grain crops	1,465
Difference or amount dissipated by fallowing and other cultural operations	1,935
	3,400

Parallel with this work, experiments extending over considerable periods have shown that the adoption of a rotation in which the growing of grasses and legumes was included serves to maintain the soil's nitrogen and humus. It was also evident that this practice tends to preserve good tilth and the moisture-holding capacity of the soil, and to arrest to a large degree the loss of valuable soil by drifting—an inevitable result in the semi-arid districts of the prairie provinces following the constant breaking up of the soil's fibre by cultivation and summer fallowing.

Further interesting and valuable data in this question of the nitrogen upkeep of soils are presented from a plot upon which the legume (clover) was dug in and re-sown every second season for a period of 10 years.

In connexion with investigatory work with soils and fertilisers in Eastern Canada (Ontario, Quebec, and the Maritime provinces), soil-fertility problems have been studied chiefly in connexion with long-cultivated and partially exhausted areas. Encouraging results respect-

Nitrogen-enrichment of soil due to the growth of clover

	Nitrogen Percentage in water- free soil.	Lb. per acre to a depth of 4 in.
Before experiment	0.0437	538
After two years	0.0580	708
four years	0.0608	742
five years	0.0689	841
six years	0.0744	908
seven years	0.0750	916
nine years	0.0824	1,005
ten years	0.0858	1,044
Increase in nitrogen due to ten years' growth	0.0419	511

ing the economic use of manures, fertilisers, and crop rotations have been obtained. As an illustration the following practical results may be cited.

Potato growing is a specialised branch of agriculture in many districts of the Maritime provinces. This crop, it has been found, responds markedly to the application of commercial fertilisers, the data showing that a "complete" fertilising mixture will, as a rule, give the most profitable results. Generally, a mixture of sulphate of ammonia and nitrate of soda as sources of nitrogen in the mixture has given a better return than if the nitrogen is supplied from one of these chemicals only.

Experimental work in the apple-growing districts of Nova Scotia has demonstrated that profitable results follow the application of fertilisers. The question more particularly studied at the present time is the furnishing of available nitrogen during the early spring. Indications are that this practice may be generally adopted with satisfactory results.

In connexion with the question of liming, now a prominent one in Canada, a somewhat comprehensive survey has emphasised the importance of this practice for many districts in Quebec and the Maritime Provinces—Nova Scotia, New Brunswick, and Prince Edward Island. Remarkable responses have been obtained from the application of ground limestone and other forms of lime, particularly for the growth of clovers.

Investigation of Irrigable Lands in Southern Alberta and South-Western Saskatchewan. Certain of these lands are impregnated with "white alkali," and for ten years their examination formed a large and important part of the Division's investigatory work. The soils of all suspected areas were carefully analysed to a depth of 5 feet, and no quarter section was released for cultivation unless the evidence as regards saline content was satisfactory, i.e. that the impregnation was either nil or negligible. Incidental to this classificatory work, certain special investigations were necessary, and the problems studied have been reported in papers and bulletins, entitled "The vertical movement of alkali in heavy clay soils," "The 'alkali' content of soils as related to crop growth," "The nature of burn-outs," and "Alkali soils—their nature and reclamation."

The Chemistry of the Cereals.—Chemical work has gone hand-in-hand in the wheat-breeding investigations instituted by the late Dr. Wm. Saunders in the earliest days of the Experimental farms. These culminated successfully in the origin of the now famous Marquis wheat and its establishment as the premier wheat of North America. In this work numerous problems relating to the nature and composition of flours and their bread-making qualities have been studied. The results obtained have greatly assisted in the identification and isolation of new varieties of wheat with high

milling qualities, and, what is of almost equal importance, the elimination of those found to be inferior.

The high milling quality of Canadian north-western wheat and the outstanding "strength" of the flour therefrom are facts generally recognised in the wheat and flour markets of the world. The character or quality of gluten is essentially an inherited factor, but a systematic study of the question has shown that seasonal and soil factors have a marked influence on both the quantity and quality of this important constituent. The data from an investigation to determine the influence of environment carried on at a number of points throughout the Dominion indicate that a rapid development and maturation of the berry tend to produce a grain of high protein content and of excellent milling quality. Moisture and temperature conditions during the filling out of the grain markedly affect its composition. If there is a sufficiency of moisture in the early part of the season to bring the crop to a good growth, then a fairly dry soil and high temperature during the later weeks of the season hasten maturity and conduce to a hard berry with a high protein (gluten) content. These conditions usually obtain over the larger portion of the wheat belt of the great North-west. It may therefore be concluded that the high quality of the wheat of the prairie provinces is not merely a result of heredity and a rich soil, but in a large measure is due to the favourable meteorological conditions which, as a rule, characterise the growing and ripening seasons in North-western Canada.

The Beet Sugar Industry.—The influence of seasonal and soil conditions on the quality of sugar beets grown in various parts of the Dominion has been systematically investigated since 1902. Seed of high sugar varieties—imported and Canadian grown—is being annually sown on 21 of the farms and stations of the Experimental Farms System situated in the several provinces and representative roots from the harvested crop are analysed. Leaving out the data from the points in the northern parts of the prairie provinces where the autumn temperatures are too low for a proper ripening of the beet—the averages for last year are: sugar in juice 17.5%, with a coefficient of purity of 86.0.

This inquiry has afforded satisfactory evidence of the possibility of growing in many widely distant districts of the Dominion beets of excellent quality and eminently suitable for sugar extraction. It has also shown that Canadian grown seed can produce beets fully equal in sugar content and purity to those from imported seed of the most approved European varieties.

There are to-day in Canada two beet sugar factories—one in South-Western Ontario, the other in Southern Alberta—both operating successfully and profitably alike to grower and manufacturer.

Soft Pork: Its Character, Causes and Prevention.—Among the qualities necessary for first-class bacon for the English market none is of greater importance than that of "firmness." A tendency to softness will rate the bacon at second-class prices; a pronounced softness makes it unsaleable at a profit.

An investigation to learn the nature and cause or causes of softness and to suggest preventative measures three years and involved the feeding of more than 300 and the chemical examination of the fats therefrom. It was found that the fat of "soft" bacon contains

a much larger proportion of olein than that of "firm" bacon; in the former the ratio of palmitin plus stearin to olein is 1 : 4; in the latter about 1 : 1.75.

The experiment was planned to ascertain the effect on quality of the pork of such factors as maturity of animal, character and supply of food, exercise and lack of exercise. From the results of the experiment it was concluded that the fat of young pigs and animals of unthrifty growth is softer than that of finished pigs. Immaturity from whatever cause is a salient factor in the laying down of "soft" fat. The character of the food is an important factor. Indian corn and beans fed injudiciously tend to produce soft pork. Fed in conjunction with skim milk a considerable proportion of corn may be used without injurious effect. A grain ration, in equal parts of oats, peas and barley, gave firm pork. Skim milk promotes thriftiness and rapid growth with consequent firmness of pork.

Insecticides and Fungicides.—In addition to the examination of insecticidal and fungicidal sprays, dusts and allied materials found on the market, for the purpose of determining their purity, strength and suitability, a considerable amount of research work has been carried on in close co-operation with members of the Entomological Service with a view to correlating laboratory results with practical experience in the orchard. This work has been most fruitful: a marked improvement in many brands of arsenicals has resulted. The danger of leaf scorching has been practically eliminated. The search for insect poisons other than arsenicals is in progress, and has already met with some success.

The degree of persistency of arsenic, from sprays and dusts to foliage and fruit is being investigated. Results are proving helpful in drawing up directions to orchardists in the use of these materials whereby the danger from this source will be greatly lessened.

A variety of oils is now being used in spraying preparations, and through the co-operation referred to, the relation between chemical and physical properties and their practical effect in the orchard is being ascertained.

The Fertilising Value of Rain and Snow.—For seventeen years continuously a research was conducted, analysing every fall of rain and snow, to determine the amount of nitrogen in free and albuminoid ammonia and in nitrates and nitrites, washed out of the atmosphere by the precipitation. The average annual rainfall at Ottawa, Canada, is 24 in., snowfall 96 in., a total precipitation of 33.6 in.

This inquiry has shown that snow is decidedly poorer in nitrogen compounds than rain, the total nitrogen content of snow being practically one half that of rain. The average amount of nitrogen, at the point of collection, furnished annually was found to be 6.9 lb. per acre—an amount equivalent to an application of approximately 44 lb. of commercial nitrate of soda.

The allotted space is filled, and mention of many important lines of research in agricultural chemistry must necessarily be omitted. In this brief sketch it has only been possible to touch here and there on this work in the Dominion, but it is hoped that sufficient has been written to indicate its character and scope and also to show that Canadian governmental authorities are alive to the value of scientific research as applied to Canada's fundamental industry of agriculture.



Plant that's three-times sound

FIRSTLY whether the process is the sulphonation of β -Naphthol, the refining of Mineral Oil, the evaporation of Tomato Juice or the sorting of Feathers—designed soundly for the work it has to do.

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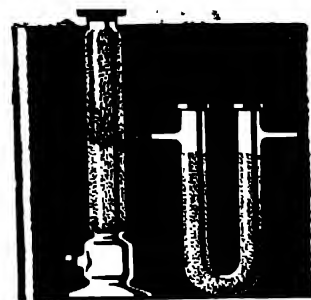
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THE PULP**PAPER INDUSTRY
ADA****OSS, B.Sc., F.R.S.**

In the Canadian pulp and paper trade we have an industrial development as great as any within the boundaries of the Empire, which, in total capital invested, is second only to that of the electric light and power plants of the dominion, and in respect of labour involved second only to that of the saw mills. Canada has not been so prodigal as the United States in respect of its indigenous supplies of raw material, mainly coniferous woods, and the Dominion Bureau of Statistics in their publications make it evident that the forest supplies are under systematic control by a trained service of competent experts, such as will ensure a continuous and methodical exploitation of this vast wealth. At the same time, no definite Government afforestation system has been adopted. So far, it is in the hands of the large owning companies to work the best-known systems in their own interests and in replacement of the old exhaustion practice under which the smaller companies moved their mills as they exhausted the wood supply of the areas occupied. Clearly there is no virtue in this degree of afforestation other than that of mere necessity. But it may be anticipated that, before long, public opinion will initiate a compulsory national system of afforestation which will be on a wider and more systematic basis: there is, in fact, no essential reason why conifer forests on a system of scientific forestry should not actually increase as fast as, or faster than, the demand increases. In this connexion it is of interest to record a report that Canada has been very recently enjoying a national festival designated "Forest Week," the celebration of which indicates to the discerning spectator the rise of a tide of public interest that will assuredly have an enormous and permanently beneficial effect on the future development of the industries here in consideration. Another interesting sidelight is presented by the rapidly increasing use of aeroplane patrols for reconnaissance duties of fire prevention.

A special publication of first importance is a serial record in the form of a Census of Industry, and the volume for 1925 is an exhaustive and concise account of the industrial developments connoted by the title: *The Pulp and Paper Industry (1925)*, Ottawa, Government Publication, 1927.

A few examples of growth may be selected. The most prominent name in the industry is, perhaps, Riordon. Members of this family were amongst the pioneers of the ground wood pulp industry, as of the bisulphite (cellulose) industry, Charles Riordon having installed the first mill at Merriton, Ontario. Following this lead, five mills are reported, in 1881, with a capital of \$92,000, and an output valued at \$63,300 per annum. Since then growth has been rapid; in 1891 to 24 pulp mills; at the present time to 45 mills with 35 combined pulp and paper mills.

The net value of production and increases are shown by the following figures:—

1921	84,523,283
1922	93,508,104
1923	113,091,953
1924	107,025,628
1925	116,577,947

It must be remembered, in pursuance of statistical results, that the constituent provinces of the dominion are of very unequal importance in the industry. Thus, of 115 total mills, Quebec and Ontario claim 95: Nova Scotia, New Brunswick, and British Columbia are of only fractional importance. In a statement such as the present, however, it would be gratuitous to attempt to cover the ground of the excellent publication cited. For the expenditure of 25 cents, this means of well-ordered statistical information is to be acquired and the concentration of matter is such that the whole subject is dealt with in some 60 pages.

It is of more interest to present-day workers to follow particular lines of development. In the perspective of the industry, the inter-Canadian-American trading figures are important, for they have obviously a further and political significance. The United States are the largest customers of the Dominion, and the following figures give an impression of the dimensions of this trade.

	1925	1926
Paper, total	\$ 95,000,000	103,000,000
Newsprint cwt.	26,500,000	32,500,000
Paper board	\$ 1,900,000	1,600,000
Wrapping papers cwt.	768	3,858
Pulp wood, in cords	1,400,000	1,400,000
Pulp wood mechanical	5,600,000	5,100,000

It is important to know, in elucidation of these figures, that a very large capital is invested from the United States, American firms finding it advantageous to produce their raw and half-manufactured materials over the border and import them to their factories in the States, to be there manufactured into paper boards, and other commercial forms of the multifold "cellulose" industry. Thus the Brown Co. of Berlin, N.H., one of the most powerful firms in the industry, are conspicuous in exploiting this border trading, drawing their supplies (which are stated to be some 400 tons a day) of cellulose and ground wood or "mechanical" pulps) from this source. In the field of the more specialised cellulose industries the Brown Co. have devoted their research equipment to the special refinement of the pulps produced by the bisulphite processes to meet the requirements of artificial silk manufacture: they have produced an "alpha pulp" which in composition and characteristics is an approximation to those of bleached cotton. This pulp is steadily advancing in replacement of competing sulphite pulps on the basis mainly of its high percentage of the alpha cellulose, which is some 7-8% above the highest alpha content of the pulps directly produced for the paper industry.

The Riordon Co. the lineal successors of the early pioneers of the Canadian industry—have more specially studied the qualities of pulps in regard to paper making, and have been specially successful in standardising

a number of brands which are recognised and accepted as giving papers of special qualities. This company also has perfected special makes of pulp adapted to the requirements of the artificial silk industry.

These are only particular instances of developments which have been "latent" or potential ever since the first production of the "sulphite pulps" in 1878-82. It is evident that the bisulphite process during these 50 years of massive production has been rigorously standardised in respect of the dependence of the qualities of the product upon the condition of the process; it is a special example of the enormous range of variations of quality of a natural raw material that are realisable under methodical study—the combined study of observation chiefly of external qualities, by factory workers and the deeper observations of the research staff in studying the material in relation to first principles. As might be expected, the greatest portion of the total output to-day is sulphite pulp containing up to 80% of ground wood pulp (so-called mechanical pulp) for newsprint. The output of this product has grown very rapidly: the first ground wood mill at Valleyfield, Canada, had a turnover of 2 tons a day: the large mill of to-day will turn out 490 tons a day. In about 10 years this product has quadrupled in output, and it is to-day about 2 million tons per annum. Its future growth is bound to be also very great, and to reach ultimate dimensions which cannot be visualised, though it is discernible that successful afforestation is going to be an ever-increasing condition of success in this branch of the industry. Spruce is, of course, the wood most particularly concerned in this output, and the quantity of it consumed is now three-quarters of the quantity of wood consumed in the whole of the cellulose industry of Canada. The figures for 1924 and 1925 are:

	1924	1925
All wood cords	3,316,951	3,668,959
Spruce.. "	2,284,230	2,608,723

The bisulphite process dominates the newsprint output, and must, therefore, continue to be the process most largely in use. Its other field of interest, now exciting much attention, is the production of high grade pulp for the viscose silk industry, and in this connexion it will be recalled that the Chairman of Courtaulds at their recent Annual General Meeting announced that the new mill of that company at Cornwall, Ontario, has now been working for 12 months on full output and with very satisfactory results. It may be anticipated that future developments in this field will be of great importance and interest: some day, no doubt, the production of alpha pulp may come to be classified as a separate item in the statistics of the future to accord with the then importance that may be expected for this grade of material, though as yet it amounts to only a small percentage of the total sulphite output, and has not yet attained rank as a special statistical item.

The soda process, the oldest of the pulping processes, was also the first to be employed in Canada: its importance is now, of course, subordinate and perhaps comparable with that of the esparto pulp industry of

Great Britain in the provision of soft bulky papers. The sulphate process is of comparatively recent importance in Canada, the first mill being that at East Angus in Quebec opened in 1907. A number of woods are treated by this process: for the production of Kraft papers more particularly. But the output of the soda process and the sulphate process taken together are no more than about 10% of the whole pulp output; the following are the figures:—

	1924	1925
	Cords	Cords
All processes	3,316,951	3,668,959
Mechanical	1,448,280	1,619,159
Sulphite	1,520,319	1,642,324
Soda and sulphate	348,352	407,491

A good deal might be said about the change of condition produced by modern developments of machinery: thus the size and speed of the machines turning pulp into newsprint has increased enormously; the greatly increased daily output as compared with early days is, of course, closely related to these improvements of machinery. Amazingly effective as these improvements of machinery undoubtedly are, it would be hazardous to suggest that even still greater improvements are improbable in the future. However that may be, it appears fairly safe to prophesy that the future of this industry is going to be related to developments of machinery, to scientific control of the forests and the provision of capital for afforestation, and above all to the ever continuous research work of the laboratory, developing and elaborating new methods and new uses, which must, in the final analysis as it always has been, be based on deeper and deeper study of all the materials concerned.

FINE CHEMICALS IN CANADA

By T. H. WARDLEWORTH

Whilst there are considerable developments in heavy chemicals in the Dominion, there is comparatively small advance in the production of fine chemicals.

Salts of iodine and bismuth are still being made of fine quality, and at prices which enable the manufacturers to compete fairly well with the imported goods. There are, however, sporadic outbreaks of cutting from outside which disturb the market.

Hydrogen peroxide used to be a product of some importance, but since the introduction of the concentrated solution the manufacture in Canada has languished.

Acetylsalicylic acid and hexamethylenetetramine, largely made in the country during the war, have succumbed to the pressure from outside, and do not now figure largely on the list of products, if at all.

Ethyl chloride, ethers and chloroform are produced by one firm still, but the output is crippled by the restrictions of the Excise Department, which demands a tax of 33 c. per proof gallon on alcohol used for the manufacture of these products. This raises the costs to such an extent that competition from foreign countries which do not tax such alcohol does not permit of any great expansion in the output.

Diarsenol, neodiarsenol and sodium diarsenol are still being produced successfully by a Toronto firm, which is adding to its products gradually.

Insulin is also being produced, very naturally, in Toronto, under the supervision of the University authorities, and its distribution is controlled by them in such a way that it may reach the sufferers at the lowest cost.

Naturally the country looks to the Canadian Electro-Products Co., of Shawinigan Falls, for the leading developments in connexion with new chemical compounds. It is now manufacturing ethyl acetate from acetaldehyde. This process has been well known for some time from a scientific standpoint, but a commercial process has been worked out by the company, and it is now able to supply practically all the Canadian demands. The reaction is carried out in the presence of aluminium chloride and two molecules of acetaldehyde are condensed to give one molecule of ethyl acetate in accordance with the following equation:—



The Canadian Electro-Products Co. is also producing butanol and butyraldehyde from crotonaldehyde by the hydrogenation of the last named. These products are of prime importance as solvents for the lacquer now so much in demand. We may with confidence look for further advances by this company in the furnishing of new products at an early date, as its able chemists are constantly seeking new methods for extending the field of their work, either in creating new combinations or improving old ones.

Malic acid has been put forward as an article which could be manufactured in Canada as a by-product resulting from the making of maple sugar, but there seems to be no demand at present, so the interest in it has flagged so far. Some day probably a use may be found for it, and then its production may be commercially profitable.

Casein is made in various centres, and is being employed in the paint, paper and other trades with advantage. A fine grade is also being used in diabetic foods—a plant has just been established in the Dominion for the purpose of preparing a flour with this basis.

The quantity of sugar of milk made in Canada is becoming larger as time goes on—the makers handling this article are sending forth an excellent grade. There is every prospect of a wider market for this industry in Canada and possibly for export.

For a time the German fine chemicals had the benefit of the depreciated currency ruling in Germany, but that is not so apparent now, and the balance has gone more in favour of Great Britain and the U.S.A. The advantage the Teutons possess now seems to be in the lower freights from their country compared with the high ocean rates from the United Kingdom to Canada. Owing to the general keen competition, this factor frequently turns the scale in favour of Germany or some other Continental country.

Aniline dyes are now being made in Canada, and there is a prospect that the growth in this direction will be speedy.

Industrial alcohol is being distilled in larger quantities

as new avenues are being opened for its use—especially in making combinations for lacquer solvents.

Medicinal and pharmaceutical preparations are following largely the usual lines, and the Department of Health is watching carefully that the modern standards are rigidly observed. Upon the whole, it may be said that high-grade preparations are the rule all over the country.

CHEMICAL ENGINEERING IN CANADA

By PROFESSOR L. F. GOODWIN

To survey the chemical engineering activities of Canada in a short article presents considerable difficulties, since these range from the crude attempts to distil bitumen and oil from the tar sands of Alberta to the modern and efficient plants of the East. Some of the biggest and most modern plants in Ontario and Quebec are subsidiaries of English or American companies, such as Brunner Mond's and Courtauld's, or represent enormous sulphite mills, such as the Laurentide Co. and Price Brothers. Their methods and constructional details are familiar to English readers, and the writer therefore proposes to give as general a survey as he can of more typically Canadian activities.

PLANT DEVELOPMENT

The present and future field lies in the application of physics, physical chemistry and engineering to plant design; that is, chemical engineering. Existing processes have to be improved, waste products—including more especially waste heat—have to be utilised, and new processes translated to plant scale. With the high and increasing labour costs on this side, the tendency is more and more towards mechanisation and automatic control.

An adequate survey being impossible, one or two industries will be chosen as illustrations. Few better examples of first-rate chemical engineering can be found than the new plant of the Canadian Cellulose Company at Cornwall, Ontario, which the writer visited a few weeks ago. Designed, erected, and now being put into operation by Mr. G. H. Tomlinson, all within a year, it is a model of design. It is intended to demonstrate that with modern methods and equipment soda pulp can be made so as to compete with sulphite. And since scientific method is lacking in many sulphite mills success will lie with the chemical engineer.

Two digesters of 50 tons daily capacity are installed and equipped with external heating by the Morterud system. A special feature here and elsewhere is the use of hydraulically-operated valves. Oliver filters are used to separate the black liquor from the pulp, which is then again diluted and carried to a special set of screens, consisting of a drum rotating within an octagonal chamber, this combination imparting a peculiar pulsating motion to the stock. There are the usual additional screens and devices for rejects during the chipping, washing and screening operations.

Bleaching is carried out in three vats lined with white tiles, provided with screw conveyors for the pulp and with ingeniously controlled valves. An electrolytic soda and chlorine plant is installed, but with the anticipated efficiency in soda recovery in the calciners, little

make up soda should be required. A new type of dryer is in use, designed to economise in steam consumption. This is effected by subjecting the pulp web to pressure between heavy corrugated rolls, squeezing out as much water as possible before passing it on to the drying rolls. All pulp produced in the digesters is thus treated irrespective of its subsequent destination, thereby effecting great economy of labour and handling throughout the plant.

The soda recovery system is of the modern type, with many improvements. The black liquor and washings, part of which circulate in the causticising cycle, are taken to quadruple effect evaporators and evaporated to the utmost practical consistency. The concentrated black liquor is then sprayed into a modern type of calcining furnace, where it is burnt and the molten soda ash tapped off at the bottom and sent to the green liquor tanks. The waste heat gases go through a tunnel where they impart a final concentration to the incoming black liquor, and pass on to two waste heat boilers, and then through a scrubber into the atmosphere. In efficient mills the heat thus generated more than suffices to run all operations. A large rotary kiln is used to burn the calcium carbonate sludge. The green liquor is causticised by means of lime in a continuous and automatic fashion, the white liquor and sludge passing through two Dorr thickeners, and then through special tanks where its specific gravity, head, and quantity are automatically controlled. Oliver filters handle the calcium carbonate sludge. The plant sprang, like Minerva, finished from the head of its designer, necessitating no changes of plan, and resulting in great economy of space and erection costs. It is to be hoped that the Howard Smith Paper Company will continue to avail themselves of research in the running of this mill.

The plant of the Aluminium Company of Canada at Arvida is an example of production on an enormous scale. Electric current being the chief requisite, the parent company at St. Louis decided to ship its purified raw material, aluminium hydroxide, to the source of supply, the new electric development at Chute-a-Caron, where upwards of a million horse-power are being developed. As it is only a twenty-mile railway haul to Port Alfred at tide-water, ultimate shipment by water of foreign bauxite for the manufacture of pure aluminium hydroxide is a future possibility. The site was undeveloped farm land, but within a year a whole town and factory have sprung into being.

The process used is the electrolysis of alumina dissolved in a molten bath of cryolite. The aluminium hydroxide is made in the requisite degree of purity by the Bayer process, and the individual electric furnaces or pots consist of a baked carbon lining supported by an outside steel shell. Forty furnace rooms are contemplated, each containing one hundred pots. The company make their own electrodes from pitch, petroleum coke and electrode scrap, and the electrode baking furnaces, according to a recent statement in *Chemical and Metallurgical Engineering*, measure 10 by 10 by 200 ft. In order to handle the enormous quantities of raw materials, the works-railway both in and out doors is of standard gauge using full size cars. The crushing, grinding and conveying plants are on a corresponding

scale; thus the storage building for petroleum coke measures about 150 by 400 ft. No precise information is available as to the plant's output, but this could readily cover the world's production of aluminium, at present estimated at 150,000 tons annually.

In this example of modern chemical engineering we find raw or partially manufactured materials transported thousands of miles to the source of cheap electric energy, from whence the finished aluminium is again sent out to the various countries of the world—of course chiefly to Canada and the United States—to be manufactured into various articles.

An older but none the less famous example is to be found in the manufacture of acetic acid and acetone from calcium carbide at Shawinigan Falls. Born during the stress of the war years, this process was pushed to its present large production almost from the start, Mr. H. W. Matheson realising that the exigencies of war could not wait for the usual semi-plant scale experiments of the laboratory. Taking risks and incurring explosions, the conversion of acetylene to acetaldehyde was carried out in large aluminium and other vessels, and proved successful. The plant is now facing the post-war adaptation period so well known to works in England.

NEW PROCESSES

It is not only in the development of known processes that chemical engineering has played its part in the Dominion. Two new processes based on chemical and electrochemical research are worthy of notice. One is the production in the electric furnace of sodium sulphide, worked out on a manufacturing scale by Mr. H. Freeman at Shawinigan, and the other the production of titanium oxide from ilmenite by Mr. R. H. Monk and associates. A large production is contemplated for the latter process. It is with regret that the writer must forbear to mention other instances.

ELECTRIC STEAM BOILERS

This typically Canadian development must not be overlooked. Many works, particularly pulp and paper mills, contract for large blocks of electric power on a 365 days a year basis. If, for any reason, part of the plant is temporarily shut down, the electric energy thus laid waste is now utilised in an electric steam boiler developed by the Shawinigan Company. Units of 4000 kw. and over are in regular and satisfactory use, require little space and less attention, and contribute their quota of steam to the works power plant, resulting in a saving of coal.

NEW PROBLEMS AWAITING SOLUTION

Mention should be made of two, both of which will require chemistry and engineering for their solution. The lignite or brown coals of Alberta present an urgent problem, and await a satisfactory process of carbonising and briquetting. Intensive work has been done with large scale retorts and voluminous reports published of the progress made, but an adequate solution is still to be desired.

The bituminous tar sands of Alberta, containing up to 15% of bitumen, and comprising hundreds of million-

of tons, still await a chemical engineering wizard, in spite of the fact that at least one simple and adequate physical-chemical method of separation has been invented. In this instance, as is the case with the large western deposits of Glauber's salts, transportation costs are a main obstacle to utilisation.

UNIVERSITY DEVELOPMENT

The three big universities of McGill, Toronto and Queen's have for many years given courses leading to the B.Sc. degree in chemical engineering. The fundamentals common to all three are courses in chemistry, physics, mathematics, thermodynamics, structural and mechanical engineering, hydraulics, metallurgy, industrial chemistry, chemical engineering, both as regards processes and plant design, and engineering economics. All three universities have recognised that training in engineering must be taken *together* with training in chemistry to avoid specialisation in chemical subjects only. A graduate in pure chemistry only is generally unable to adapt himself to engineering thought and calculations when subsequently attempting a fifth or sixth year in engineering, and trying to become a chemical engineer. The lecture and laboratory work are of a uniformly high order, but only Queen's University has a laboratory specially devoted to chemical engineering. It may be added that the writer is opposed to the waste of time and money caused by the installation of too large units, and believes that chemical engineering plant at Universities should be of the minimum size necessary to teach the fundamental principles involved. Large-scale operations are taught best in works, the principles must be studied in the laboratory. The greatest developments in the future must be in the improving of yields and of new and existing processes. The chemical engineering students turned out by these universities have no difficulty in holding their own in works, and unfortunately too large a number find ready employment in the United States.

PROFESSIONAL SOCIETIES

Mention must be made of these. In Canada, too, the chemists and chemical engineers have felt it necessary to organise in order to establish their professional and public status. But, as in other countries, order has still to be evolved out of the chaos of conflicting societies. The problem is particularly serious in this far-flung Dominion, where you may travel eight hundred miles by rail, and know there are only two chemists in that section.

The Canadian Institute of Chemistry, established for nearly eight years, has a membership of over three hundred, and the majority of chemical engineers belong to it. The Engineering Institute of Canada or its affiliated branches, such as the Professional Engineers of the Provinces of Quebec and Ontario, attract a smaller number. Many, of course, belong to the Society of Chemical Industry, but are not numerous enough, nor do they deem it expedient to form a chemical engineering group. Others, again, belong to the Pulp and Paper Association and kindred societies. The present duty of the chemical engineer seems to lie in contributing to as many chemical and engineering societies as his purse will permit. Possibly a general Canadian chemical

association, which is now being discussed, can link the various conflicting elements together.

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CANADIAN INDUSTRIAL NOTES

A syndicate formed of Americans, who formerly operated distilleries before the Volstead Act became law will erect a large distillery for the manufacture of Canadian and American whiskies, alcohol and by-products, at Sarnia, Ontario, opposite Port Huron, Michigan, on the St. Clair River.

The Manitoba Pulp and Paper Co., Ltd., has begun the construction of a new 250-ton paper mill at Pine Falls, Man.

McGill University has decided to establish a department of industrial medicine, with which will be associated a clinic for industrial diseases at the Montreal General Hospital.

The Canadian Salt Co., Ltd., in its financial statement for 1926, shows operating profits at \$342,905, compared with \$346,411 in the previous year. After allowing deductions for bond interest, patent rights, depreciation and income-tax, the balance left available for dividends was \$161,460. Profit and loss account stands at \$305,463.

Port Alfred Pulp & Paper Co., in its financial statement for the year ending December 31, 1926, shows gross operating profits of \$1,260,929, as compared with \$921,935. After allowances for depreciation, depletion and payment of preferred dividends there remained available for company stock the sum of \$276,629, equivalent to \$2.30 per share on 120,000 shares of no par value common stock.

The International Nickel financial report for calendar year 1926 gives net profits as \$5,556,267 after necessary deductions, equivalent to \$3.00 a share (par \$25.00). The previous report was equal to \$2.29.

The annual financial statement for year, ending December 31, 1926, of the Abitibi Pulp & Power Co. shows profits, after payment of preferred dividend, equal to \$11.56 per share on the common stock, as compared with \$11.19 in 1925.

The earnings of the Howard Smith Paper Mills, Ltd., showed an improvement for the year 1926. Net profits for the period were equal to 7.62% on common stock as compared with 4.74% in 1925. Operating profits for the year were the highest since 1920. The depreciation reserve reflects substantial additions made during the past few years, now being shown at \$2,423,620.

Canadian Cannery, Ltd., show a moderate increase in gross and net earning during the calendar year 1926. The net profit, after all deductions, was \$539,401, compared with \$480,271 in 1925. Dividends at 4% absorbed \$364,568.

In its financial report for 1926, the British Columbia Fishing & Packing Co., Ltd., showed net profits of \$499,294, after making usual deductions and ample provision for reserve. This is equivalent to \$10.02 per share on the issued capital stock.

THE MANUFACTURE OF NICKEL BY THE MOND NICKEL COMPANY, LTD.

INTRODUCTORY

When we consider the manufacture of nickel and the many alloys and compounds of nickel, and the innumerable articles of which nickel forms some portion, we realise how large a part the British Empire plays in this industry, and how modern, how necessarily modern, is the industry. Nickel and its alloys have a number of qualities of hardness, toughness, brightness that does not tarnish, and so on, which make them of use in an extraordinary variety of cases. The condition in which the metal exists in its ores makes its extraction not at all an easy matter; and it is only in quite recent times that

its name; we are informed that the word "nickel" means "obstinate devil," and that the saving in space justifies us all in making use of a German word of six letters instead of English words of many more. The ore is mined in Canada, and partially treated there; the extraction of the metal is completed in Wales; the alloys are made in Birmingham; the malleable pure nickel is made there, and there also are made the rods, wires, plates, and sheets of nickel itself and many alloys. This great British industry is very largely due to the vision of the late Dr. Ludwig Mond, F.R.S., and Dr. Carl Langer, who devised the process and made it a commercial success; we confess that we are hardly surprised that, when the scientific skill of Dr. Langer had indicated a method the obstinacy of the

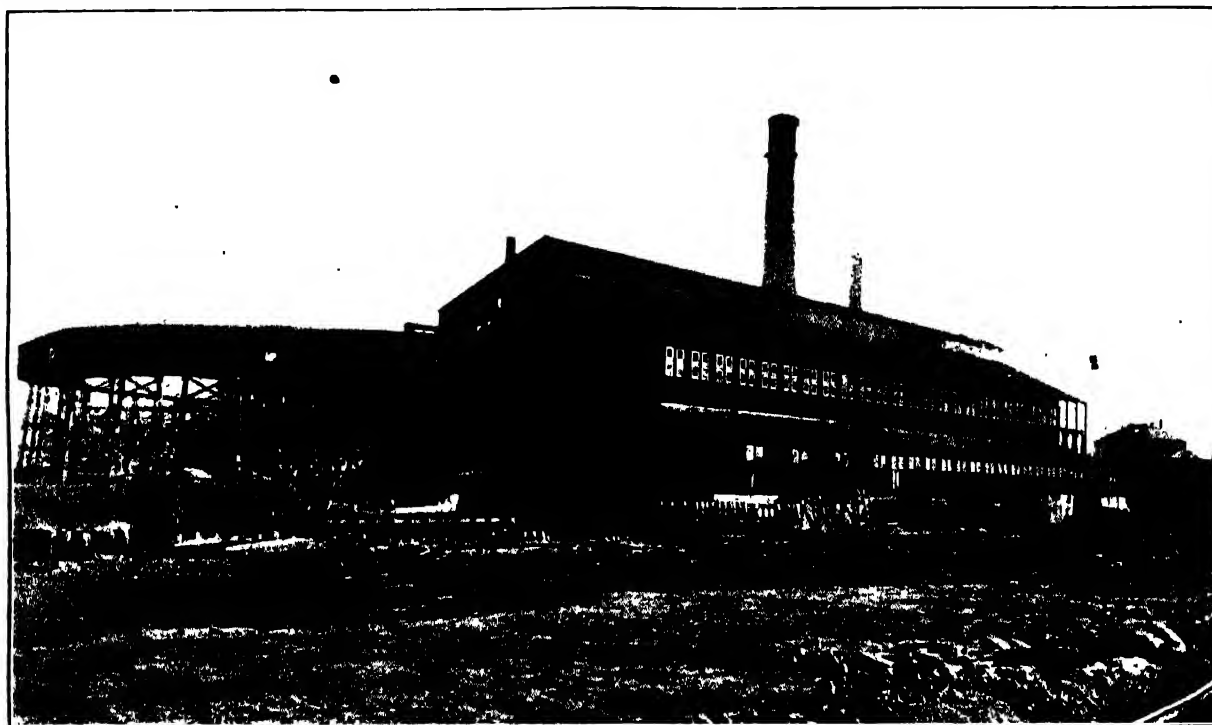


FIG. 1

Furnace and Converter Building, Coniston Smelter, Ontario, Canada

such an extraction has been economically possible. Moreover, its resistance, and that of its alloys, to corrosion, to fatigue, to temperature, and to general wear and tear, is so great that it is only the stress of the present time which requires the frequent use of so remarkable a metal. Even had it been far more abundant it would not have been of importance until the age of electricity, high-speed tools, armoured ships, motor-cars, and wireless. It is no metal for the primitive, the mediaeval, or the old-fashioned man. It is a metal for the modern man, but until we visited the works of The Mond Nickel Company, Ltd., at Clydach, and those of its associated company, Henry Wiggin & Company, in Birmingham, we confess we very imperfectly realised how many are its uses.

The nickel we saw has nothing foreign about it except

nickel had to yield to the persistence of Dr. Mond, for he was a very determined man, not unduly tolerant to men or metals who tried to oppose his will. It was in 1889 that he and Dr. Langer found out that carbonic oxide will combine with finely divided nickel to form the gaseous nickel carbonyl $\text{Ni}(\text{CO})_4$, which readily decomposes on moderate heating to form pure nickel and carbonic oxide. It took ten years to make the process a commercial success, secure the raw materials, and create The Mond Nickel Company, Ltd. The time and money thus spent have been most fully justified. The development of modern technical methods is a task for those who have abundant time, money, patience, and determination; those who criticise our British manufacturers for their timidity in handling new inventions should bear this fact in mind. The ores come from a

small number of mines near Sudbury, Ontario; they undergo a preliminary treatment at Coniston, near Sudbury, and the plant there was begun in 1912 and finished in 1913, though operations on a less ambitious scale had previously taken place at one of the mines. The product of this preliminary smelting is a matte containing about 41% of copper, about 41% of nickel, about 17% of sulphur, and less than 1% of iron: this matte is shipped to Swansea, and the pure nickel is prepared from it at Clydach.

CLYDACH

The works at Clydach are pleasantly situated just outside Swansea; they are well planned, on modern lines, with ample room for even further additions and extensions.

this reduces the nickel oxide to the state of metal, and the finely divided material is then passed through conveyors to "volatilisers," maintained at a temperature below 80° C. Carbonic oxide is led through the "volatilisers"; it combines with the nickel and the gaseous nickel carbonyl, thus formed, passes into tall cylinders partly filled with pellets of nickel of varying sizes. These cylinders, or "decomposers," are kept at a temperature of 180° C., and the nickel carbonyl breaks up, depositing pure nickel in thin films on the pellets already in position. The pellets gradually grow in size, and when they are about as large as peas they are automatically removed. It is no rapid process, this deposition, for it takes several months to grow a pellet as large as a pea. The carbonic oxide released in the

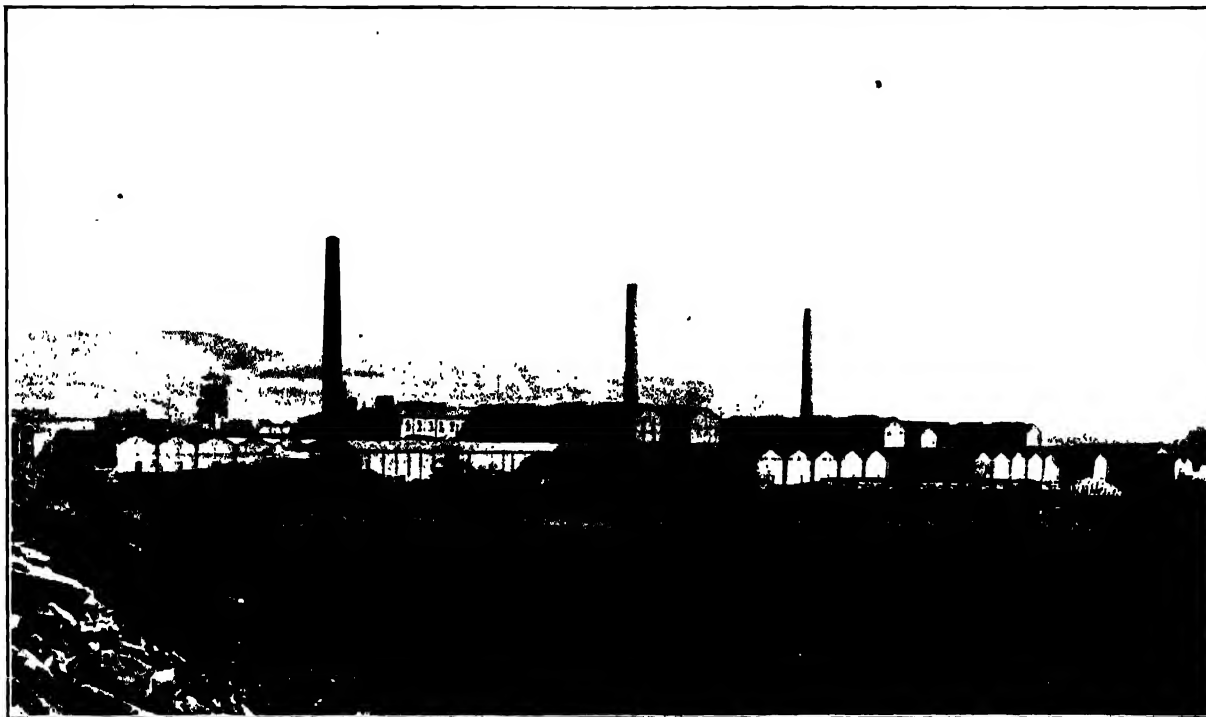


FIG. 2

General view (looking north) of the Works of the Mond Nickel Co. at Clydach, S. Wales

in the immediate vicinity are convenient and pleasant-looking houses, many of which have been built by the Mond Nickel Company for the accommodation of those employed in the works.

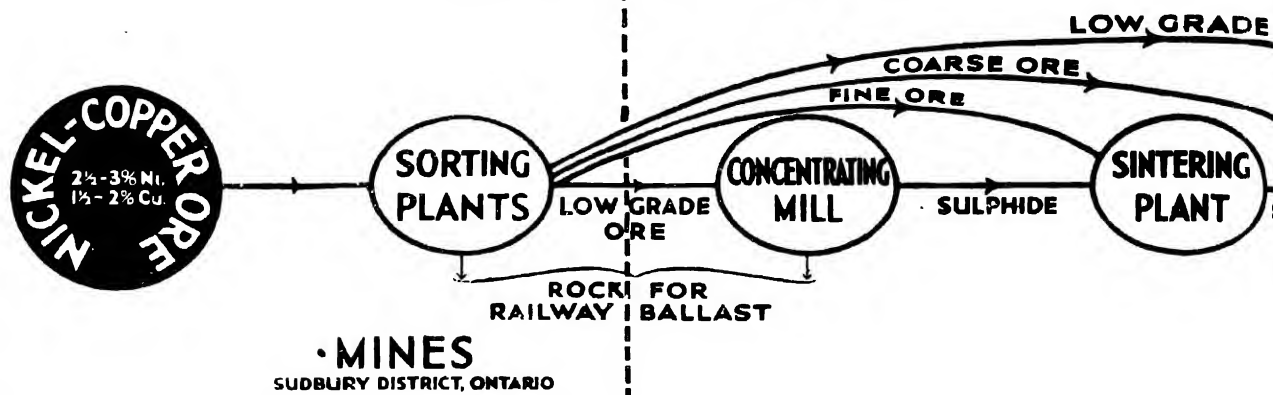
The process used is comparatively simple in the laboratory, but its amplification into an economical works operation is a matter of considerable difficulty. The matte, a mixture of nickel sulphide and copper sulphide, is crushed and roasted, yielding a mixture of impure oxides; this mixture is treated with sulphuric acid sufficient to dissolve the greater part of the copper but leave the nickel unaffected. The copper-sulphate solution is filtered off and allowed to crystallise, the process working continuously and almost automatically. The solid matter left after treatment with sulphuric acid is washed and dried and then treated with water-gas rich in hydrogen; at a temperature rather under 400° C.

"decomposer" travels again and again in the cycle. The residue left in the volatilisers, consisting of nickel and copper, is mixed with the original matte and returned into the process, so that there is very little waste; in fact, the only waste is the loss of the sulphur in the matte and the hydrogen in the water-gas.

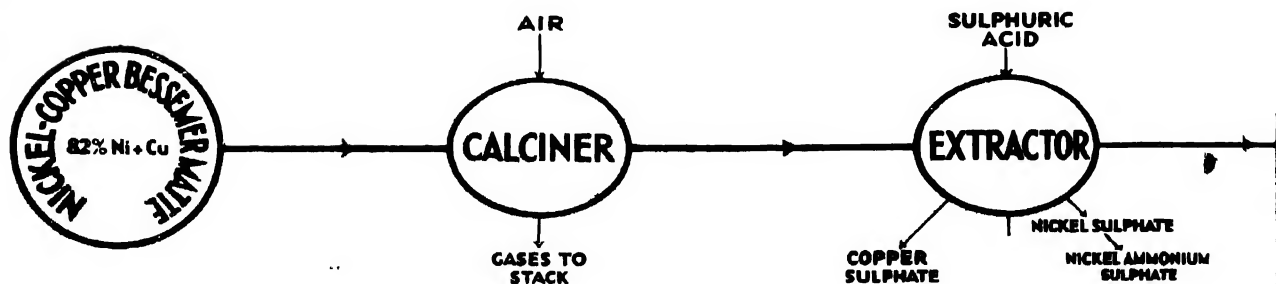
South Wales contains towns, which, like other towns in Great Britain, were built in the days of ignorance, when people imagined that because a few people can cheerfully sleep in hovels in a country where they work all day in the fresh air, therefore many thousands of people can live in hovels in a town and work all day in a pit or factory. The works at Clydach was built in a more enlightened age. Most parts of it are bright, airy and healthy, while there is evidence, in the shape of club-rooms, bands, athletic-sports, and such things, that the Mond Nickel Works is not, in any sense,

COPYRIGHT

MOND PRODUCTION OPERATIC



OPERATIONS CONDI



FERROUS NICKEL ALLOYS

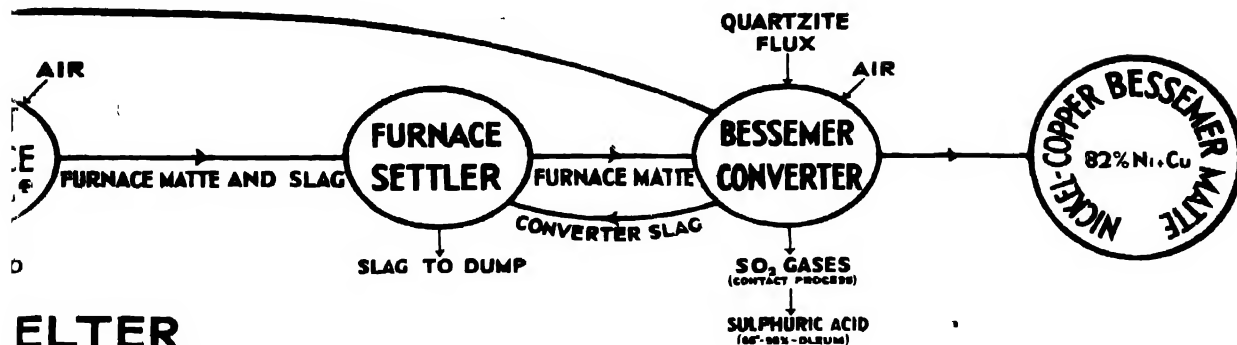
Type of alloy	General properties	Uses
Nickel-Nickel-Chromium, Nickel-Chromium-Molybdenum, Nickel-Chromium-Tungsten, and other alloy Steels (31-5% Ni)	Great mechanical strength	(Automobile and aeroplane parts, bridge members, high speed steel armor plates and munitions, etc.)
Special Nickel and Nickel- Chromium Steels (14-30% Ni)	Anti-corrosive and anti-scaling properties, combined with considerable mechanical strength at ordinary and elevated temperatures	(Chemical and foodstuff plant, high temperature working parts, etc.)
High Nickel-Iron Alloys (50-80% Ni including Invar and related Alloys)	Special thermal, electrical and magnetic properties	(Engine parts, regulators, precision and radio-electrical instruments, etc.)
(60-80% Ni)	High magnetic permeability alloys	(Cable leads, wireless and telephone parts, etc.)

PURE NICKEL (MALLEABLE)

Form of product	General properties	Uses
Sheets, strips, tapes, tubes, rods and wires (99-100% Ni)	Resistance to corrosion High resistance to abrasion Magnetic properties High melting point Hygienic properties Catalytic properties	(Coinage, chemical plant, coating ultrasonic valves, sparking plugs, electrical connections, catalytic uses, etc.)

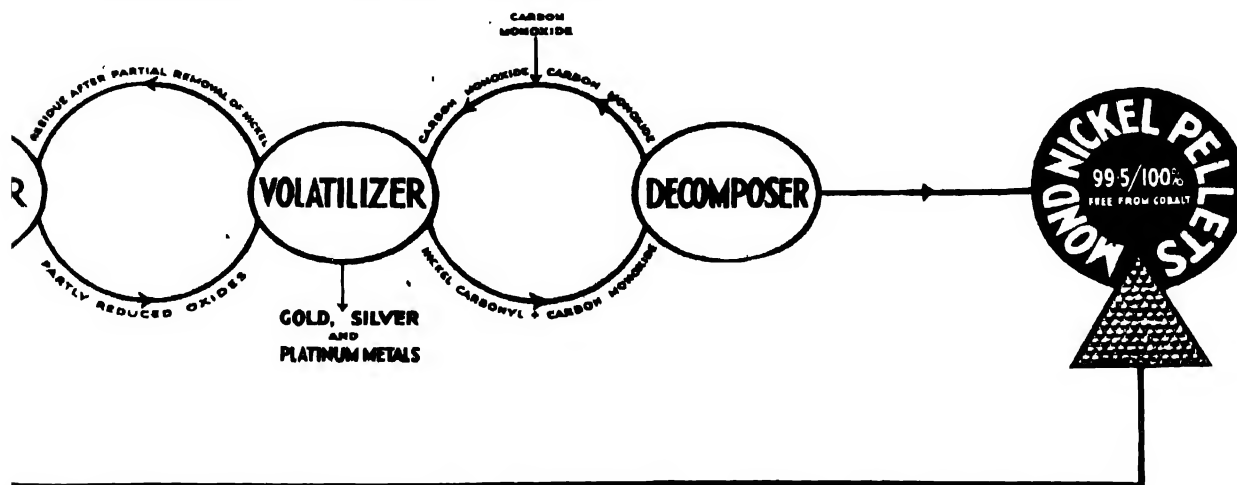
Form of product
Nickel Sulphate
Nickel Ammonium Sulphate
Other salts

CKEL INDUCTED IN CANADA



ELTER
N. ONTARIO.

IN GREAT BRITAIN



NICKEL ELECTRODEPOSITION

Form of product	General properties	Uses
Nickel and at Anodes (98-100% Ni)	Protection from corrosion Decorative appearance Suitability for thick adhesive hard and non-corrodible deposits	(Automobile and other parts exposed to weather household fittings, building as of machinery parts, etc.)

NON-FERROUS NICKEL ALLOYS

Type of alloy	General properties	Uses
Nickel-Copper-Zinc (Nickel Silver) (7-35% Ni)	White colour Brilliant polish Moderate tensile strength High ductility Resistance to corrosion Electrical resistance materials	(E.P.N.B. articles, spoons and forks, automobile radiator shells and fittings, ship fast fittings, telephone parts, electrical resistance, etc.)
Nickel-Copper (2-70% Ni)	High ductility Toughness Retention of strength at elevated temperatures Resistance to corrosion Special electrical properties White colour Brilliant, polish	(Bullet covers, spoons and forks, automobile radiator shells and fittings, condenser, tubes, marine fittings, catheters and similar uses, chemical plant, electrical resistance, etc.)
Nickel-Chromium (60-80% Ni)	Great strength at high temperatures Abnormal resistance to corrosion High electrical and thermal resistance Non-aging	
Foundry Alloys	Improved mechanical properties (Aerospace and automobile engineering)	(Electric wire and other electrical equipment, furnace equipment, structural materials, precision tools, etc.)

a mere collection of works managers and workers, making profits for directors and shareholders, who have no interest in their employees' well-being. There is a corporate existence and a spirit of community which we have noticed in other chemical factories, and the absence of which in many other industries we have deplored as a cause of discontent, suspicion and unrest. The chemical industry has so far a good record in this respect, it is to be hoped that it will maintain this record. The Mond Nickel Works at Clydach employs about a thousand men, and its capacity is about 10,000 to 12,000 tons of nickel a year in the form of pellets. It also turns out about 30,000 tons of copper sulphate crystals, chiefly used to spray the vines in the wine-growing districts of Europe, and a much smaller quantity of nickel sulphate and nickel ammonium sulphate crystals.

The Canadian nickel ores contain small quantities of the precious metals—silver, gold, platinum, palladium and the other metals of the platinum group. The method of extracting the nickel and of preparing the crystals of copper sulphate is such as to effect a concentration of these precious metals, and in the fulness of time they are separated and individually recovered. The process of making nickel appears, on the surface, possibly a simple one. The disposal of the nickel when it is made is far more complicated, and the Mond Nickel Company prudently entered into an arrangement with Messrs. Henry Wiggin & Co., Ltd., in Birmingham, who have for nearly a hundred years been accustomed to make up nickel alloys of various kinds.

NICKEL

In addition to the use of nickel for making ferrous alloys, copper alloys and chromium alloys, the pure metal is required in considerable quantity. To make nickel malleable or capable of being fabricated it is necessary to add to the molten metal a small proportion of magnesium metal, which removes the last traces of the deleterious oxygen and sulphur.

Many countries have nickel coins, for instance, Canada, Italy, Switzerland, Belgium, Poland, and Siam. There is a great demand for nickel in the form of anodes for electro-plating, and these are made in large numbers at one of Messrs. Wiggin's works. Pure nickel is also used considerably in wireless valves and to a limited extent for cooking utensils.

NICKEL-COPPER ALLOYS

Nickel-copper alloys have been known from time immemorial, and how the ancient Bactrians and the ancient Chinese made nickel copper coins more than two hundred years B.C. is still a matter for speculation. At the present time the majority of the civilised countries use nickel-copper coins containing 75% of copper and the rest nickel; among these are included Austria, Bulgaria, Denmark, France, Holland, Roumania, Japan, Egypt, Brazil and the United States. The envelope of the modern bullet is made of a nickel-copper alloy, and there is apparently a steady demand for these even in peace time. For electrical resistances a copper-nickel alloy, containing about 40% to 45% nickel, has been very largely used, and is known as "Ferry." Messrs. Wiggin make as well an alloy, of similar composition, which is

sold under the name of "Silveroid"; it consists of 45% nickel, 1% of manganese, and 54% of copper. This material is rolled into sheets and stamped into spoons and forks, fish-knives, and all kinds of table accessories. When you travel by train to Liverpool, watch the American summon her progeny to shredded cereal: it has been prepared on "Silveroid," and the progeny makes use of "Silveroid" for the disposal of the cereal; go to Paris and sample what a modern poet calls Foyot's sizzling *crêpes*; they are served on a nickel-copper alloy dish; the champagne from Jero-boams is distilling its argent spume upon the salted ice in a "Silveroid" cooler; you motor to the—shall we say Opera? in a car with many nickel-copper parts. Finally, *compère* and *commère* make their parting bow, the curtain drops upon the packed *coulisses*; the footlights darken suddenly, and now attendants claim their petit bénéfice, paid with good grace and paid in nickel-copper. Hotels, restaurants, kitchens, motor-cars, theatres, these consume quantities of nickel-copper, and we could, we think, write about these at considerable length. Does not Frankau say, "Science! not all your long research avails to staunch the flux of literary ranter."

"Corronil" is another nickel-copper alloy containing 70% of nickel, about 30% of copper and a trace of manganese. It is non-corrosive, and retains its strength at high temperatures. An alloy of this type has long been imported into this country under a well-known name. Now at last an entirely British product is available for the many chemical and other purposes for which this composition is so well suited.

NICKEL-COPPER-ZINC ALLOYS OR "NICKEL-SILVERS"

There are many of these, some of which are used for making silver-plated ware, spoons and forks, etc., but we fear to enlarge on the appliances for cooking, eating and drinking; there is an unending supply of verse on these topics, and we might be tempted.

NICKEL-CHROMIUM ALLOYS

We are glad to think that there is nothing frivolous or flippant about these; they call up no recollections of Gaby or Mistinguette; they are steady, well-behaved, purposeful alloys, just and tenacious. There is "Brightway," 20% chromium and 80% nickel; which with our own eyes we have seen cast and forged and drawn into wire. It is material of this type which is exclusively used for the heating elements of our domestic electric fires, ovens, irons, furnaces of various types, etc.; while for electrical resistances, for a number of special purposes, this alloy is finding a rapidly extending field of usefulness. The alloy is the strongest known at temperatures above 700° C. There is another alloy called "Redray" which contains 85% of nickel, and there are others yet, each with its own special mechanical, electrical and thermal properties. If you have a fancy for any particular number of microhms per centimetre cube as specific resistance you can, *exceptis excipienda*, be accommodated by Messrs. Henry Wiggin.

NICKEL-IRON ALLOYS

These alloys are also made in Birmingham. The 30% nickel alloy is used when strength combined with

non-magnetic properties are required; that containing 36% has the remarkable property of being practically non-expandable when heated up to 350° C., and it is also used in sensitive electrical relays etc., owing to certain of its magnetic properties. Other alloys containing higher quantities of nickel are used because of their exceptional magnetic and mechanical properties.

It might be recalled, in passing, that the steels most resistant to chemical and high temperature attack, referred to in the issue of this JOURNAL for March 11, contain nickel as an essential constituent, while it is unnecessary to remind readers that our present-day motor-car and aeroplane engines are only made possible by the strength and toughness of nickel and nickel-chromium steels.

We are glad we have visited Clydach and seen the various Wiggin Works at Birmingham; we were interested to see so much and learn so much. We have to thank the technical staff for the information they gave us. It is pleasant to meet men who can not only explain scleroscope tests and tell you how many pounds per 100 ft. is represented by 4 S.W.G., but who know also the details of the many and varied uses to which the alloys they are producing can be put.

CONVENTION OF CANADIAN CHEMISTS

Quebec, June 6—9, 1927

Preliminary Programme

Dr. A. E. Macintyre has very kindly furnished the following preliminary programme of the important Convention of Canadian Chemists, which will be held in Quebec from June 6—9:

MONDAY, June 6

9 a.m. Registration Laval University, Central building

10.15 a.m. Technical meeting, Large Hall. Chairman, Dr. A. E. Macintyre.

Report of Secretary, Canadian Council of Society of Chemical Industry.

Address: Chairman Canadian Council.

11.15 a.m. Papers.

1 p.m. Luncheon.—Chairman: Sir George Garneau.

Dr. V. Martin, Mayor of Quebec:—Address of welcome.

An address will also be given on a chemical subject.

3.30 p.m. Garden party at Spencer Wood. Guests of Hon. N. Pérodeau, Lieut. Governor, Quebec.

8 p.m. Public meeting. Chairman, Right Rev. C. Roy, Rector Laval University.

An address is to be arranged.

TUESDAY, June 7.

9.30 a.m. Technical meetings.—Chairman: Dr. George Baril. "Papers."

2.30 p.m. Technical meeting.—Chairman: Dr. Lash Miller. "Papers."

7 p.m. Sail on St. Lawrence to Island of Orleans, Quebec bridge, and view harbour facilities.

WEDNESDAY, June 8.

9.30 a.m. Technical meeting.—Chairman: Dr. Harold Hibbert. "Papers."

1 p.m. Luncheon. Chairman: Hon. George E. Amyot. Address: Chemical subject.

3 p.m. Visit by auto cars to Battlefield Park and points of interest in Quebec, with visit to Montmorency, Ste Anne de Beaupré.

7.30 p.m. Banquet at Chateau Frontenac. Chairman: Mr. J. M. McCarthy.

Guests: Hon. N. Pérodeau, Hon. L. A. Taschereau, Premier of Quebec; Monsignor C. Roy; Hon. E. Lapointe, M.P., Minister of Justice; Hon. L. Cannon, M.P., Solicitor-General; and others.

THURSDAY, June 9.

9.30 a.m. Technical meeting. Chairman: Dr. John S. Bates. "Papers."

Ladies' entertainment.—Monday. Garden party, Spencer Wood.

Tuesday. Tea at Quebec Golf Club.

Tuesday evening. Sail on St. Lawrence.

Wednesday. Auto tour, Quebec to Ste Anne de Beaupré.

Members of the Society of Chemical Industry, American Chemical Societies, and other chemical associations are cordially invited to attend.

CANADIAN PULP AND PAPER INDUSTRY

The Provincial Paper Mills, Ltd., having five plants operating at Port Arthur, Thorold, Mille Roches and Georgetown, Ont., and, until recently, controlled by U.S.A. capitalists, has passed into the hands of Canadian interests. This involves a cash transaction of about \$8,000,000. The majority of the common stock has been purchased for \$135 per share. The company was incorporated in 1920, and the financial report for 1926 showed earnings of 17.4% on common shares, which compares with 13.35% in 1925, and 9.11% in 1924. The company paid dividends amounting to 6% per annum during the past five years, and in 1923 it paid an extra dividend of 1%. The company has extensive timber-limits north of Lake Superior.

The New Brunswick International Paper Company, Ltd. (Subsidiary International of U.S.A.) will commence the erection of a paper mill at Dalhousie, N.B., having an initial daily capacity of 250 tons newsprint, with arrangements for increasing to 500 tons. The company has several mills in New Brunswick, and very large timber-limits in the province and adjacent territory in Quebec. The company is developing the large Grand Falls water power, on the St. John River, and a portion of this will be utilised at Dalhousie.

The first annual report of the St. Maurice Valley Corporation, which covers the thirteen-month period ending December 31, 1926, shows a gross operating profit of \$4,735,856, which is almost four times the amount required for interest charges. Bond, bank and other interest charges totalling \$1,267,833 were deducted, leaving a profit of \$3,468,022. The disposal of the profit was as follows:—Depreciation and depletion reserves, \$1,065,708; preferred dividends, including 7% on St. Maurice Valley Corp., \$563,801; 7% on Belgo-Canadian Paper Company, Ltd., \$572,758; 7% on Canada Paper Company, \$87,500; common dividends to Belgo-Canadian minority stockholders, \$22,836; and \$325,000 transferred to contingent account, left a surplus of \$1,030,418. Fixed assets are valued at \$44,269,227.

SOCIETY OF CHEMICAL INDUSTRY

Annual Meeting, Edinburgh, 1927

PROGRAMME

MONDAY, July 4.

8-10 p.m. The North British Station Hotel—Informal Reception by the Chairman and Committee of the Edinburgh and East of Scotland Section, followed by *Conversazione*.

TUESDAY, July 5.

9.30 a.m. Committee Room, University Union—Council Meeting.

10 a.m. Debating Hall, University Union—Civic Welcome by the Lord Provost of the City of Edinburgh: Welcome on behalf of Edinburgh University by the Vice-Chancellor.

Annual General Meeting of the Society of Chemical Industry (for Members only).

Presentation of the Society's Medal to Lieut.-Col. G. P. Pollitt, D.S.O.

11 a.m. Debating Hall, University Union—Address by the President—Francis H. Carr, Esq., C.B.E.

A panoramic photograph will be taken in the quadrangle of the Medical Buildings, The University, immediately after the President's address.

1.15 p.m. The North British Station Hotel—Luncheon by invitation of the Edinburgh and East of Scotland Section. Representatives of the Edinburgh Town Council, and of the Universities of Edinburgh, St. Andrews, and Aberdeen will be present.

3.30 p.m. Garden Party in the Zoological Park.

8.30 p.m. Palais de Danse—Reception by the President, and Dance.

WEDNESDAY, July 6.

10 a.m. Medical Chemistry Classroom, Medical Buildings, The University.

Joint Meeting with the Bio-Chemical Society—Subject of discussion, "The Physiological and Industrial Aspects of the Chemistry of Carbohydrates."

Papers will be read by:—

(1) Prof. W. N. Haworth, D.Sc., Ph.D. "Structural Relationships in the Carbohydrate Group."

(2) Prof. A. R. Ling, M.Sc., F.I.C. "Recent Advances in our Knowledge of the Polysaccharides."

(3) Mr. C. G. Lambie, M.B., Ch.B., F.R.C.P.E. "The Intermediary Metabolism of Carbohydrates."

(4) Probable paper on "Cellulose from the Industrial Standpoint."

10 a.m. Midwifery Classroom, Medical Buildings, The University. Meeting of the Chemical Engineering Group.

Paper will be read by:—

Mr. J. L. A. Macdonald, D.S.O., D.Sc. "Some Aspects of the Manufacture of Fibrous Cellulose."

to be followed by discussion.

By the kind permission of William Harrison, Esq., LL.B., Chairman of the Inveresk Paper Co., Ltd., and Associated Companies, a section of the film showing the activities of these Companies will be exhibited. This section shows "The Production

of Esparto Paper from the Raw Material to the finished Product."

2 p.m. Visit to Edinburgh Corporation Gas Works, Granton.

2.15 p.m. Visit to University Chemical Laboratories, King's Buildings, Edinburgh.

4 p.m. Reception by invitation of the University Court in the Upper Library Hall, Old University Buildings.

7.15 for 7.30 p.m. The North British Station Hotel—Annual Dinner of the Society. (Tickets 12s. 6d., exclusive of wine.)

THURSDAY, July 7.

10 a.m. Medical Chemistry Classroom, Medical Buildings, The University.

Lecture by the Society's Medallist—Lieut.-Col. G. P. Pollitt, D.S.O.—on "The Development of the Synthetic Nitrogen Industry in Great Britain."

11 a.m. (Same room). Lecture by M. Ernest Fourneau, Pasteur Institute, Paris, on "Chemotherapy in Relation to Tropical Diseases."

12 noon. (Same room). Lecture by Prof. J. Read, University of St. Andrews, on "Natural Sources of Energy in Australia."

11 a.m. Midwifery Classroom, Medical Buildings, The University. Meeting of Fuel Section of the Society—Subject of discussion, "Coal Cleaning."

List of the papers to be read will be supplied later.

2.15 p.m. Meeting of the Fuel Section (*continued*).

2.15 p.m. Visit to the Paper Mills of Messrs James Brown & Co., Ltd., Penicuik.

2.30 p.m. Visit to Castle Mills, Edinburgh, the Works of the North British Rubber Co., Ltd.

8 p.m. City Chambers, Edinburgh—Reception by the Lord Provost and Magistrates of the City of Edinburgh.

FRIDAY, July 8.

Excursions:—

(1) Whole day Excursion to Melrose, Abbotsford, Dryburgh, and Peebles. Tickets, including lunch and tea, 15s.

(2) Afternoon Excursion to Forth Bridge and Inchcolm. This excursion is limited to 90 Tickets, including tea, 6s.

Evening: If a sufficient number of members apply for tickets (8s. each), a dance will be arranged for 8.30 to 1 a.m.

Conducted tours of Old Edinburgh will be arranged for Thursday and Friday.

SATURDAY, July 9.

The following excursions will be arranged if a sufficient number of members apply for tickets:

(1) Gleneagles Golf Course. Tickets 10s., including green fees.

(2) St. Andrews. Railway fare, 7s. 6d.

ACCOMMODATION

No bedrooms are now available in the North British Station Hotel. A list of other hotels was published in **CHEMISTRY AND INDUSTRY** for February 4, 1927, p. 106.

Single room accommodation for both men and women is still available in the University Hostels. Immediate

application for such should be made to the Hon. Secretary of the Edinburgh and East of Scotland Section—Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

CALENDAR OF FORTHCOMING EVENTS

- May 2. INSTITUTION OF THE RUBBER INDUSTRY. *London and District Section*. Special Meeting at the Engineers' Club, Coventry Street, Piccadilly, W., at 8 p.m. "Specifications for rubber goods and the value of performance tests," by J. M. Bierer. Dr. P. Schidrowitz will preside.]
- May 2. SOCIETY OF CHEMICAL INDUSTRY, *Yorkshire Section*. Great Northern Hotel, Leeds, at 7.30 p.m. Annual General Meeting. "Soil formation processes and the foundation of a new subject," by Prof. N. M. Comber
- May 2. SOCIETY OF CHEMICAL INDUSTRY, *London Section*. Annual Meeting. Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "Recent investigations on contact insecticides," by F. Tattersfield and C. T. Gimingham.
- May 3. INSTITUTION OF CIVIL ENGINEERS, Great George Street, Westminster, S.W.1, at 6 p.m. The 33rd James Forrest Lecture. "Some recent services of metallurgy to engineering," by Prof. H. C. H. Carpenter.
- May 4. SOCIETY OF PUBLIC ANALYSTS, Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. (1) "Investigations into the analytical chemistry of tantalum, niobium and their mineral associates. VII.—The precipitation of tungstic acid by tannin; and VIII.—The separation of tungsten from tantalum and niobium," by Dr. W. R. Schoeller and C. Jahn. (2) "The separation of vanadium and tungsten," by S. G. Clarke. (3) "The determination of moisture by the volatile solvent method," by J. M. Jones and T. McLachlan. (4) "A study of antimony trichloride as a possible quantitative reagent for vitamin A," by F. Wokes and S. G. Willmott. Informal dinner will be held at the Popular Café, 200, Piccadilly, at 6.30 p.m.
- May 4. INSTITUTION OF SANITARY ENGINEERS, Caxton Hall, Westminster, S.W. 1, at 6 p.m. "House refuse collection and disposal," by F. Wilkinson.
- May 5. CHEMICAL SOCIETY. Ordinary Scientific Meeting, Burlington House, Piccadilly, W.1, at 8 p.m. (1) "The nature of the alternating effect in carbon chains. Part XVIII. Mechanism of exhaustive methylation and its relation to anomalous hydrolysis," by W. Hanhart and C. K. Ingold. (2) "The interrelationships of the sulphur acids," by H. Bassett and R. G. Durrant.
- May 6. SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group*. Annual General Meeting. Imperial College of Science and Technology, Kensington, S.W.7. Formal business meeting at 6 p.m. An informal dinner will probably be held at 6.30 p.m., and at about 8 p.m. a paper entitled "Chemical fire extinguishers" will be read by Dr. W. R. Ormandy.
- May 6. SOCIETY OF CHEMICAL INDUSTRY, *Manchester Section*. Joint meeting with the Fellows of the Chemical Society resident in Manchester and district.
- May 10. INSTITUTION OF CIVIL ENGINEERS. Annual General Meeting. Great George Street, Westminster, S.W.1, at 6 p.m.

CORRESPONDENCE

THE STATUS OF SCIENTIFIC WORKERS

SIR,—In common with other chemists I have recently received an appeal from the National Union of Scientific Workers, issued with a view to extending the membership of that body among qualified scientists, and, by means of a questionnaire, to ascertain the attitude of such workers towards the Union in its present or a modified form.

The following paragraph from the appeal disclaims the strike weapon:—

"Possibly one misconception that seems to be existent should be removed: some non-members still ask whether to join the National Union of Scientific Workers would not mean being called out on strike in certain situations. The strike is not a possible weapon for scientific workers, and the Union has never imagined the possibility of its employment," but obviously leaves the presumption that combination is desired because force of numbers has effective application; though it seems to me that some measure of control over the freedom of action of members is essential, if the fact of union is to mean strength.

Do scientific workers want anything unreasonable? Is professional dignity to descend to collective bargaining? In the long run, is such bargaining ever more effective than education in securing legitimate aims?

I venture to submit my opinion that the only sound, dignified and economic means by which scientific practitioners can enforce the recognition of science, and of their own status, is reasoned yet vigorously insistent propaganda. It is a method which is irresistible, and one which leaves the individual unrestricted. The object of union should be to secure the income necessary for such propaganda.

Yours faithfully,

J. B. WARD

PERSONAL AND OTHER ITEMS

A deputation from Imperial Chemical Industries, Ltd., which includes Sir Alfred Mond and Sir Harry MacGowan, is making a tour of investigation in Germany. They have already inspected the Leuna Nitrogen Works.

Dr. R. H. Pickard, F.R.S., Principal of the Battersea Polytechnic and Director of Research for the British Leather Manufacturers' Research Association, has been appointed Director of Research for the British Cotton Research Association, in succession to the late Dr. A. W. Crossley. Dr. Pickard is a vice-president of the Institute of Chemistry, and is a member of Council of the Chemical Society. He is also on the Councils of the Launderers', Boot and Shoe, and Adhesives Research Associations.

Sir John Russell, Director of the Rothamsted Experimental Station, Major Walter Elliot, Parliamentary Under-Secretary of State for Scotland and chairman of the Research Committee of the Empire Marketing Board, and Dr. J. B. Orr, Director of the Rowett Institute for Research in Animal Nutrition, Aberdeen, are on their way to Palestine to inquire into problems of animal husbandry and dry farming.

Dr. Peter G. Carter, of the Chemistry Research Laboratory, United College, University of St. Andrews, has been appointed to a lectureship in organic chemistry in the University of Sydney.

Prof. Nernst, Prof. W. Ostwald, and Prof. R. Willstätter have been elected honorary members of the American Chemical Society.

We regret to announce the death of Dr. A. Simon, a well-known metallurgist, who had much to do with the practical work of perfecting the use of the cyanide process in South Africa. He had been a member of the Society of Chemical Industry since 1898.

The late Dr. A. W. Crossley, F.R.S., late director of the British Cotton Industry Research Association, left £28,432 with net personalty £25,247.

The Supply of Metallurgists

A shortage of scientifically trained metallurgists would be a very serious matter to our metallurgical industries directly, and indirectly to industry at large. In the *Manchester Guardian Commercial* of April 21, Prof. F. C. Thompson, who occupies the Chair of Metallurgy in Manchester University, discusses the possibility of such a shortage. "The slump in entries of honours courses in metallurgy still persists throughout the country, and it does not require very acute prevision to predict that in three or four years' time, when those now entering will be completing their courses there will be fewer honours graduates than can be placed in positions. . . . In an attempt to discover what is the exact position with regard to the supply of honours metallurgists, a questionnaire was sent round to all the universities of England, Scotland, and Wales, which have honours schools in the subject, together with a certain number of technical colleges of approximately university standing. To those heads of departments who so kindly furnished the information required the writer's cordial thanks are due. All the universities replied to the request. The first point of interest which emerged from a consideration of the replies was the surprisingly large extent to which the surplus resulting from the large immediate post-war entries had been absorbed. A certain number of graduates are engaged on work other than metallurgical, but the number still without posts is almost nil. The supply of really well-trained men is inadequate to the obvious needs of the country. For their own sakes intending students of a scientific turn of mind and preferably, though not necessarily, interested in practical matters, might well consider metallurgy as a possible line of work. The matter is, however, of far more than personal importance. With the continuous diffusion of the metal producing and working industries in all parts of the world, it is inevitable that competition should become ever keener. Countries once importers are now able to supply their own needs, and are even in a position to compete with us. Only the most economic methods of production and the highest attainable class of product are able to withstand this intense competitive pressure, and neither of these will come by instinct. It has not been without interest to note during the past few years the resistance of some firms to the trade conditions, and their ability to do more than keep their heads above water. The development of the aluminium and the

nickel industries in this country, to mention two examples only, have resulted in the employment of relatively very high proportions of university graduates, and it is not a coincidence that severe economic conditions are least felt where highly-trained men are the essential element in the staff."

Gow Lectures

Owing to unforeseen circumstances, the Gow lectures on "The colloid chemistry of the rubber industry," arranged to be given by Dr. E. A. Hauser, at University College, London, in May next, have been postponed. It is hoped to arrange for the lectures to be given towards the end of the year.

Liquid Chlorine in Canada

Recently we published an article, "Liquid Chlorine: Its Manufacture and Uses," by Messrs. J. H. Hubel and D. A. Pritchard (*CHEM. & IND.*, March 18, 1927). In this article it is stated that 65% of the chlorine manufactured in U.S.A. and Canada is consumed by the pulp and paper industry, 22% in the textile industry, 10% in sanitation, and the remaining 3% for all other uses. From further information which has come to hand, we now learn that a considerable change has taken place in the consumption of chlorine, due primarily to the increased production of amyl acetate and ethylene glycol—the former used as a lacquer solvent and the latter as a radiator refrigerant and after nitration for the formation of a non-freezing dynamite.

Due to recent developments, therefore, the above percentage consumption appears as follows:—Pulp and paper industry, 50%; textile industry, 15%; sanitation, 16%; and 19% to all other uses. Of this 19% about 3% is used for chlorobenzene, carbon tetrachloride, hydrochloric acid, etc., the rest being used for amyl acetate, amyl alcohol, and ethylene glycol.

Sodium Sulphate in Canada

Sodium sulphate of Western Canada, its occurrence, uses, and technology, is the title of a report under the authorship of L. Heber Cole, recently issued by the Mines Branch of the Canadian Department of Mines.

Although the occurrence of saline lakes in Western Canada has been known for many years, it was a search for potash during the great war that directed serious attention to their commercial possibilities and led to their examination in detail. These lakes occur in depressions in the morainic drift of Manitoba, Saskatchewan, Alberta, and British Columbia. These deposits consist chiefly of hydrous sodium sulphate (Glauber's salt) with small percentages of magnesium sulphate, sodium chloride, and related salts. Investigations by the Mines Branch show the presence in the 21 deposits examined in detail of over 115,000,000 tons of hydrous salts, mainly sodium sulphate.

In Canada, sodium sulphate, in the form of salt cake, finds its largest use in the pulp and paper industry, and is also employed in the metallurgical, glass, dye, textile and other industries. Upwards of 40,000 tons, mostly imported, is used per annum. Until recently most of the salt cake used in commerce has been produced as a by-product in the manufacture of hydrochloric acid from common salt.

A map of Western Canada accompanying the report shows the location of some 83 occurrences of these

natural deposits. The mineralogical, physical, and chemical characteristics of the several salts are described in separate chapters. The probable mode of origin of the deposits is also discussed. The industrial uses of sodium sulphate in the several industries and the technology of its manufacture are described. A method of examining the extent of individual deposits has been demonstrated, the character of the deposits shown, and the basis laid for the future development of extensive industries. This report (No. 646) is a comprehensive volume of 155 pages, fully illustrated with photographs, drawings and maps. Copies may be obtained by application to the Director, Mines Branch, Department of Mines, Ottawa, Canada.

Soda Lakes in Canada

Natron, natural crystal soda, occurs in considerable quantity in British Columbia, in small, undrained lakes which occupy shallow depressions over the southern portion of the Green Timber plateau, just to the north of Clinton, one of the integral plateaux forming the great interior plateau situated in the south of British Columbia.

According to present knowledge, practically all the 11 soda lakes of commercial importance are situated within an area of about 30 sq. miles. This area is about 10 miles north of Clinton, and is traversed by the Pacific Great Eastern Railway. Most of the lakes are within 1 mile of the railroad, and all except two are within 13 miles. The lakes are small, ranging from 5 to 35 acres in area. The depth of brine in the lakes containing the greater amounts of soda does not exceed $3\frac{1}{2}$ ft. The available tonnage of natron in nine of the lakes examined is, on a preliminary estimate, about 200,000 tons. The largest single deposit contains about 70,000 tons.

In all except two of the lakes the soda is in solution during the greater part of the year, but when the concentrated brine is chilled by the cool autumn weather the soda crystallises out in the form of natron. If the brine were not chilled and concentration by solar evaporation were to continue, the resulting deposit would be the mineral trona, a mixture of the carbonate and bicarbonate. This is the usual form in which soda occurs in natural deposits throughout the world.

The natron deposited each autumn forms in a bed from 3 to 10 in. in thickness over practically the whole of the lake in most cases. It contains as a rule less than 1% of impurities, and is suitable for marketing as sal soda or washing soda. It must be harvested during the autumn or winter, preferably the autumn, for then it is not contaminated with other salts that are deposited later from the brine. With the coming of spring this natron crystal redissolves.

Analyses and further details regarding the material in these lakes are given, under the title "Sodium carbonate in British Columbia," in Section V of Mines Branch Report on Investigations of Mineral Resources, 1921 (No. 642), issued in 1926 by the Department of Mines, Ottawa, Canada.

COMPANY NEWS

LEVER BROTHERS, LTD.

The thirty-third annual general meeting was held on April 21, Mr. Francis D'Arcy Cooper (chairman) presiding. The chairman expressed regret at the losses

through death of Mr. J. H. Barrington, a director of John Barrington & Sons, Ltd., Dublin; Mr. J. Purcell, managing director of Wm. Taylor & Co., Ltd., Edinburgh; Mr. T. J. Davey, a director of J. Kitchen & Sons, Ltd., Australia; and Dr. von Waldkirch, vice-president of the Savonnerie Sunlight. He then briefly reviewed one or two of the associated companies. British Oil & Cake Mills, Ltd., in which the company owned all the ordinary shares, was unable, on account of the coal strike, to give any return on the investment, but conditions had improved, and current trading was showing a satisfactory profit. Results of trading in margarine were satisfactory during last year. Referring to the recent Government report on the marketing of Empire foodstuffs, which contained the following passage: "The question of improving the food value of margarine by the inclusion of ingredients rich in vitamins is one of considerable importance from the point of view of national health. This is a matter to which research could very profitably be directed," the chairman said that research in this direction had been going on in Lever Brothers' laboratories for several years past, and had resulted in the production of a vitamin concentrate which could be readily incorporated in other foodstuffs. The immediate practical result of this discovery had been the placing on the market by their associated company, Planters Foods, Ltd., of a new brand of margarine called "Viking Margarine," which had the nutritive value of the best butter but cost considerably less. The company's turnover for the year was £70,441,000, the decrease from the previous year being due to reduced sales in oils, nuts, or kernels crushed, pressed, or extracted. It represented 1,720,865 tons of goods manufactured or produced by the company and its associated companies. If conditions of trade in this country and all over the world did not become any worse, the profits were likely to show expansion for the current year.

[For the accounts, see CHEMISTRY & INDUSTRY, April 15, 1927, p. 344.]

SOUTH METROPOLITAN GAS CO., LTD.

The agreement between this company and the South Suburban Gas Co., under which the latter company will obtain a bulk supply of gas etc., has received the official approval of the Board of Trade. At an early date stockholders of the South Suburban Gas Co. will be invited to exchange their holding for 6% preference stock of the South Metropolitan Gas Co. For the last three years ordinary stockholders in the South Suburban Co. have received an annual dividend of $6\frac{1}{2}$ %, the statutory dividend being 5%, any addition being dependent upon the sliding scale based on the price of gas; whereas the preference stock of the South Metropolitan Co. pays a fixed dividend of 6%.

ANTON JURGENS' UNITED (MARGARINE) WORKS

A dividend has been recommended on the ordinary shares of 10%. A sum of 1,000,000 guilders is again transferred to reserve for redemption of 6% debentures, 1,566,571 guilders, against nil, is transferred to reserve fund, and 229,873 guilders, against nil, is appropriated for depreciation of factories etc., leaving 8,791,812 guilders to be carried forward, compared with 8,730,065 guilders brought in.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

(Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.)

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London. 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb., according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—1s. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s.—4s. 3d. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 10s. per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals.—9½d. per lb. Crude 60's, 2s. 6d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 6d.—2s. 8d. per gal. Steady 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 11d.—2s. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 10d. to 1s. 11d. per gal. Firm. Pure, 1s. 11d.—2s. per gal.
 Xylol.—2s. per gal. Pure, 3s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/160, 1s. 10d.—1s. 11d. per gal. Solvent 95/160, 1s. 6d.—1s. 7d. per gal. Solvent 90/190.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—75s.—80s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—8s. 6d.—9s. per gal. Nominal. 90/180.—5s. per gal. Heavy.—5s.—8s. per gal.

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In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

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 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d. per lb. Fair enquiry.
 m-Cresol 98/100%.—2s. 8½d. per lb. Only limited enquiry.
 p-Cresol 32/34° C.—2s. 8½d. per lb. Only limited enquiry.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d.—8d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb. ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Firm and brisk.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 5½d.—1s. 6d. per lb. Less 5%. Firm.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 4d.—1s. 5d. per lb. Technical 11½d.—1s. per lb. Both in good demand.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 2½d. per lb. Less 5%. Firm market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 2½d.—2s. 4d. per lb. Potassium.—1s. 9½d.—2s. per lb. Sodium.—2s. 0½d.—2s. 2d. per lb. All spot.
 Calcium Lactate.—1s. 3½d.—1s. 4½d. per lb.
 Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 5d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £33 per ton net.
 Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.L. recryst., B.P., 18s. 3d. per lb. net. Synthetic, 11s.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb. Detached cryst., 14s. 6d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—11s. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. per lb.
 Phenazone.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 97s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s. per lb. spot.
 Saccharin.—55s. per lb. Very limited enquiry.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d. 2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 6s. per ton, d/d consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.
Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
Sulphonal.—7s. 6d. per lb.
Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.
Thymol, Puriss.—11s. 6d.—12s. per lb., according to quantity.
 Natural.—14s. 9d. per lb.

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Acetophenone.—7s. 3d. per lb.
Aubepine (ex Anethole).—10s. 6d. per lb.
Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
Cinnamic Aldehyde.—Natural, 17s. per lb.
Coumarin.—10s. 6d. per lb.
Citronellol.—14s. 6d. per lb.
Citral.—8s. 3d. per lb.
Ethyl Cinnamate.—10s. per lb.
Ethyl Phthalate.—2s. 9d. per lb.
Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. per lb.—(ex Shui Oil) 14s. 6d. per lb.
Methyl Anthranilate.—8s. 6d. per lb.
Methyl Benzoate.—4s. 6d. per lb.
Musk Ketone.—35s. per lb.
Musk Xylol.—8s. 6d. per lb.
Nerolin.—3s. 9d. per lb.
Phenyl Ethyl Acetate.—12s. per lb.
Phenyl Ethyl Alcohol.—10s. 6d. per lb.
Rhodinol.—27s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb. Good demand.

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Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—12s. per lb.
Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%, 8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 1d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.
Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—10s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 17s. 6d. per lb. Japanese, 8s. 3d. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than June 28th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on May 6th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Bogdandy and Polanyi. Producing finely-distributed mixtures of mutually-insoluble bodies. 10,343. Apr. 14. (Ger., 16.4.26.)

Bohler. Vertical heating furnace. 10,020. Apr. 12. (Fr., 12.4.26.)

Bojner and Pehrson. Apparatus for introducing air etc. into rotary furnaces. 10,034. Apr. 12. (Sweden, 24.4.26.)

British Dyestuffs Corp., Ltd., Hailwood, and Shepherdson. Preparation of finely-divided solids. 9960. Apr. 11.

Calico Printers' Assoc., and Reekie. Steam-heated drying etc. cylinders. 9940. Apr. 11.

Cooper, Henshaw, and Holmes & Co. Treatment of mixtures of vapours etc. 10,224. Apr. 13.

Hartley. Fire extinguishing. 10,360. Apr. 14.

L.-G. Farbenind. Transforming pulverulent substances into small pieces. 9890. Apr. 11. (Ger., 10.4.26.)

Lassen. Producing grinding elements. 10,344. Apr. 14.

McIntyre. Grinding, refining, and mixing machines. 10,230. Apr. 14.

Marks (Polysius). Tube etc. mills. 10,217. Apr. 13.

Reber, Smith, and Woodall Duckham, Ltd. Shaft furnaces etc. 10,193. Apr. 13.

Tcherniac. Joint for apparatus made of glass etc. 10,189. Apr. 13.

I.—Complete Specifications

25,509 (1925). Filtrators, Ltd., and Saks. Emulsion for removing scale from boilers etc. (268,665.)

7897 (1926). Bailey. Furnaces. (249,560.)

12,725 (1926). Maschinenfabr. Simon. Exchange of heat between gases or liquids (252,373.)

22,771 (1926). Schmalenbach. Separating the most volatile constituents of a mixture of liquids. (269,052.)

23,715 (1926). Syracuse Pulveriser Corp. Pulverisers. (258,896.)

24,190 (1926). Wood and Heymann. Drying, heating, or the like apparatus. (269,064.)

25,989 (1926). Muller. Separation of crystals from solutions. (269,068.)

26,592 (1926). Heskamp. Working shaft furnaces. (269,071.)

29,620 (1926). Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd., and Chadder. Fractional distillation. (269,090.)

31,679 (1926). Campbell (Humberston) Roller crushing or grinding mills or machines. (269,104.)

4220 (1927). Scherbaum. Grinding mill (266,009.)

*9636 (1927). Soc. Gen. D'Evaporation. Rotary decanting apparatus. (269,193.)

*9890 (1927). L.-G. Farbenind. Transforming pulverulent substances into uniform small pieces for reaction with gases. (269,209.)

II.—Applications

Barjot. 1300. See VII.

Bataafsche Petroleum Maatsch. Treatment of sludge residues. 10,178. Apr. 13. (Holland, 27.4.26.)

L.-G. Farbenind. Production of unsaturated gaseous hydrocarbons etc. 10,040. Apr. 12. (Ger., 15.4.26.)

Johnson (L.-G. Farbenind.). Preparation of ferric oxide purifiers for gases. 9904. Apr. 11.

Salerni. Distillation of carbonaceous materials. 10,064. Apr. 12.

Sims. Fuels for internal-combustion engines. 10,351. Apr. 14.

Swan, Hunter, & W. Richardson, Ltd., and Young. Treatment of oils or spirits. 10,065. Apr. 12.

II.—Complete Specifications

25,339 (1925). Koppers Co. Gas purification and regenerating sulphided alkaline solutions. (241,221.)

30,814 (1925). Kohlenveredlung Ges. Low-temperature distillation of bituminous substances. (244,456.)

1320 (1926). Hackford, and Hakol, Ltd. Generation of combustible gas. (268,899.)

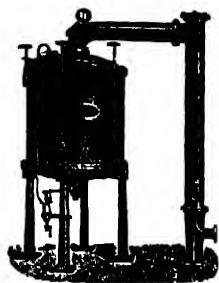
1699 (1926). Comp. des Mines de Vicoigne, Noeux, et Drocourt. Distillation of coal at low temperatures. (255,411.)

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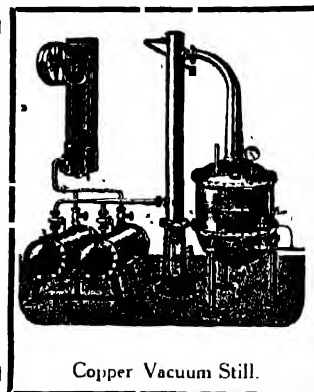
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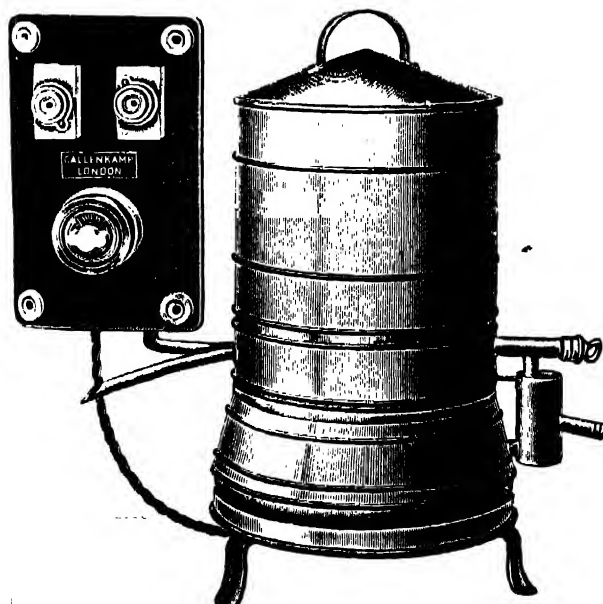
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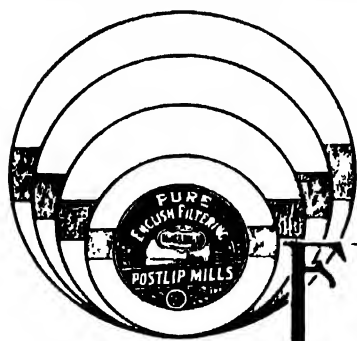
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14,870 (1926). Bean. Producing gas. (269,004.)
25,514 (1926). Silica en Ovenbouw Mij. Coke ovens. (259,968.)

*12,462 (1926). Allgem. Ges. f. Chem. Industrie. Apparatus for continuously expelling sulphurous acid from mixtures with oil. (269,118.)

*30,442 (1926). U.S. Industrial Alcohol Co. Non-corrosive alcohol composition. (269,135.)

*9606 (1927). Silica en Ovenbouw Mij. Regenerative coke ovens. (269,188.)

III.—Complete Specification

7946 (1926). Child. Tar or tarry compositions for roadways etc. (268,950.)

IV.—Applications

British Dyestuffs Corp., Ltd., Evans, Hailwood, Harrison, and Jackson. Manufacture of dry preparations of pigment dyes. 9059. Apr. 11.

British Dyestuffs Corp., Ltd., and Hailwood. Manufacture of N-diarylsulphonyl derivatives of arylaminesulphonic acids. 10,090. Apr. 12.

I.-G. Farbenind. Manufacture of diazo-salts etc. 9922. Apr. 11. (Ger., 19.1.25.) Manufacture of diazosulphamic acids of cyclic series. 10,318. Apr. 14. (Ger., 15.4.26.) Manufacture of compounds of aromatic para-diamines with sulphur dioxide. 10,319. Apr. 14. (Ger., 17.4.26.)

Imray (I.-G. Farbenind.). Manufacture of anthrahydroquinone derivatives. 10,190. Apr. 13.

IV. Complete Specifications

21,699 (1925). Woodcock, Drescher, Beckett, Thomas, and Scottish Dyers, Ltd. Dyestuffs. (268,537.)

515 (1926). British Synthetics, Ltd., and Higgins. Manufacture of arylides of orthohydroxy-carboxylic acids and of intermediate products suitable for the preparation of azo dyestuffs. (268,877.)

788 (1926). Brit. Dyestuffs Corp. Ltd., and Tatum. Manufacture of anthraquinone intermediates. (268,891.)

*8146 (1927). I.-G. Farbenind. Manufacture of substituted aromatic sulphonic acids. (269,155.)

*9922 (1927). I.-G. Farbenind. Manufacture of diazo-salts (269,212.)

V.—Applications

British Celanese, Ltd. Products obtained with cellulose derivatives. 10,341. Apr. 14. (U.S., 21.5.26.)

British Celanese, Ltd., Ellis, and Mann. Treatment of cellulose derivatives. 10,342. Apr. 14.

Drepper. Manufacture of cellulose acetate etc. 10,285. Apr. 14.

Kindermann. Filters for production of artificial textile threads. 10,068. Apr. 12.

Nobel's Explosives Co., Ltd., Patterson, and Wilson. Cellulose derivatives. 10,079. Apr. 12.

Oby. 9910. See XIX.

Singer and Wolff. 9903. See XIII.

Verein für Chem. Industrie. Treatment of precipitated acetyl cellulose. 10,028. Apr. 12. (Ger., 15.4.26.)

V.—Complete Specifications

8,959 (1926). Lane and Mellor. Carbonising textile materials. (268,959.)

15,592 (1926). Courtaulds, Ltd., and Diamond. Esterification of cellulose. (269,012.)

18,832 (1926). Merrill. Bleaching pulp. (269,031.)

25,247 (1926). Clavel. Treatment of cellulose derivatives. (269,128.)

30,005 (1927). Friesenhahn. Washing, wetting, and bleaching agents. (269,134.)

30,29 (1927). Rinman. Producing cellulose and paper from straw, asparto, etc. (269,164.)

V.—Applications

Michelle Serre, Ltd., Allott, Hammond, Hatfield, and Skeleton. Dyeing or washing fabrics etc. 10,168. Apr. 13.

Henshilwood and Melville. Treating woven fabrics. 10,231. Apr. 14.

Soc. Chim. des Usines du Rhône, and Theumann. Colouring cellulose esters etc. 10,088. Apr. 12.

VI.—Complete Specifications

632 (1926). I.-G. Farbenind. Dyeing cellulose esters and others. (245,790.)

5760 (1926). Brit. Dyestuffs Corp., Shepherdson, and Davidson. Dyeing acetate silk. (268,933.)

8094 (1926). Brit. Dyestuffs Corp., and Horsfall. Dyeing furs. (268,952.)

*9683 (1927). Brit. Celanese, Ltd. Treatment of yarn packages with liquids. (269,195.)

VII.—Applications

Barjot. Apparatus for separation of hydrogen from hydrogenous mixtures. 10,300. Apr. 14.

Carmichael (I.-G. Farbenind.). Manufacture of chromium oxide etc. 10,070. Apr. 12. Manufacture of alkali nitrates. 10,071. Apr. 12.

I.-G. Farbenind. Recovery of sulphur. 10,039. Apr. 12. (Ger., 16.4.26.)

Mond (I.-G. Farbenind.). Separating phosphorus from gases. 9891. Apr. 11.

Parrish, Snelling, Weight, and South Metropolitan Gas Co. Recovering ammonia from ammoniacal liquor. 10,191. Apr. 13.

Volet. Graphite compositions. 10,024. Apr. 12. (Belg., 29.4.26.)

VII.—Complete Specifications

25,339 (1925). Koppers Co. See II.

30,364 (1925). Leger and Esselmann. Continuous purification of crude carbon disulphide. (254,676.)

18,636 (1926). Johnson (I.-G. Farbenind.). Manufacture of chromic chloride. (269,028.)

21,346 (1926). Nogle. Apparatus for ozonising air and converting it into nitric oxide. (269,046.)

*8892 (1927). I.-G. Farbenind. See X.

*9002 (1927). I.-G. Farbenind. Catalytic production of hydrocyanic acid from formamide. (269,166.)

*9227 (1927). Jacobsson. Dissolving aluminiferous raw materials. (269,174.)

VIII.—Complete Specification

*7888 (1927). Hartford-Empire Co. Glass furnaces. (269,153.)

IX.—Application

Portland-Cementwerk Balingen Ges. Manufacture of acid-proof hydraulic binding-agents. 10,047. Apr. 12. (Ger., 13.4.26.)

IX.—Complete Specifications

438 (1926). Fastig. Burning cement. (268,808.)

886 (1926). Billner. Concrete etc. (268,803.)

7946 (1926). Child. See III.

12,572 (1926). Agerup. Magnesite cement. (268,989.)

X.—Applications

Ashcroft. Separation of minerals etc. 10,169. Apr. 13.

Bosse. Cleaning surfaces of metals in vacuums. 10,084. Apr. 12. (Ger., 7.3.27.)

Brackelsberg. Smelting-furnaces. 10,199. Apr. 13.

(Ger., 9.3.27.)

Coley. Manufacture of zinc. 10,044-5. Apr. 12.

Pfanhauser. Coating articles with metal. 10,302. Apr. 14.

Picard and Sulman. Treatment of antimonial ores etc. 10,214. Apr. 13.

X.—Complete Specifications

11,677-8 (1925). Wills. Producing steel. (245,716-7.)

16,842 (1926). Zinwerke Wilhelmsburg. Treating antimonial ores, especially tin ores. (268,278.)

17,379 (1926). Goldschmidt A.-G. Production of aluminium alloys of high silicon-content. (255,103.)

*29,539 (1926). Stern. Obtaining nickel or ferro-nickel. (269,133.)

*8892 (1927). I.-G. Farbenind. Precipitation of heavy metal from ammoniacal solutions. (269,164.)

*9441 (1927). Gustafsson. Producing metals from oxide ores. (269,179.)

XI. Applications

Dicker (Philips' Gloeilampenfabr.). Electrodes for discharge tubes. 9900. Apr. 11.

Goldschmidt A.-G. Production of aluminium conducting material. 10,301. Apr. 14. (Ger., 19.4.26.)

XI. Complete Specifications

13,898 (1926). Casale. Apparatus for the electrolysis of water. (268,998.)

21,346 (1926). Negle. See VII.

*16,281 3 (1926). Everett. Storage batteries. (269,120—2.)

*9366 (1927). Siemens-Elektrowarme Ges. Insulating-stone for electric furnaces. (269,178.)

XII. Complete Specifications

11,675 (1926). Laffer, and Internat. Zeep-Co. Manufacture of soft soaps. (268,980.)

15,709 (1926). Lechler. Production of permanent emulsions. (254,701.)

XIII. Applications

British Dyestuffs Corp., Ltd., Evans, Hailwood, Harrison, and Jackson. 9959. See IV.

Chem. Fabr. vorm. Schering. Printers' ink. 10,210. Apr. 13. (Ger., 5.5.26.)

Singer and Wolff. Production of cellulose varnishes. 9903. Apr. 11.

Soc. Chim. des Usines du Rhône. Manufacture of powdered plastic material. 10,089. Apr. 12. (Fr., 3.8.26.)

XIII. Complete Specifications

236 (1926). Soc. Chem. Ind. Basle. See XX.

9776 (1926). Ludwigsén. Production of printing-inks. (268,966.)

19,852 (1926). Hick and Hick. Hardening phenol aldehyde condensation products. (269,037.)

XIV.—Complete Specifications

31,246 (1925). Teague. Rubber compositions. (268,853.)

*18,533 (1926). Simplex Wire & Cable Co. Rubber compounds. (269,124.)

*23,346 (1926). Danier. Regeneration of rubber. (269,127.)

*8470 (1927). General Rubber Co. Apparatus for drying rubber latex. (269,157.)

XVI.—Complete Specification

*9731 (1927). Preparation Indus. des Combustibles, and Hoffmann. Manufacture of phosphatic fertilisers. (269,199.)

XVII.—Application

Owen and Stead. Preserving sugar-beets. 10,175. Apr. 13.

XIX.—Applications

Feeny (Vitamin Food Co.). Vitamin foodstuffs. 9912. Apr. 11.

Obry. Extraction of nutritive matter from fibrous vegetable materials. 9910. Apr. 11.

Woo. Manufacture of edible substances. 10,292. Apr. 14. (U.S., 15.4.26.)

XIX.—Complete Specifications

3857 (1926). Jena. Obtaining decomposition products from protein-containing materials. (247,944.)

6442 (1926). Birdseye. Preparing fish foods. (257,222.)

XX.—Applications

Etabl. Poulenc Frères, Mar. ^{patented} organic salts of C-C-dialkyl and arylalkyl barbituric acids. 10,322. Apr. 14. (Fr., 25.5.26.)

Rubber Service Laboratories Co. Manufacture of acetaldehyde. 10,085. Apr. 12. (U.S., 12.4.26.)

XX.—Complete Specifications

28,044 (1925). Dreyfus. Manufacture of acetic acid. (268,845.)

236 (1926). Soc. Chem. Ind. Basle. Converting into soluble form insoluble condensation products of urea or a derivative thereof and formaldehyde. (246,127.)

783 (1926). Johnson (I.-G. Farbenind.). Manufacture of alkyl formates. (268,890.)

18,481 (1926). Hirzel. Production of alkyl and aralkyl resorcinols. (256,225.)

XXIII.—Applications

Moser. Treatment of sludge residues. 10,178. Apr. 13. (Holland, 27.4.26.)

Pulsometer Engineering Co., Ltd. Plant for dealing with sewage. 9966. Apr. 11.

Salemi. Means for destroying micro-organisms. 10,365. Apr. 14.

XXIII.—Complete Specification

25,723 (1925). A.-G. f. Anilin-Fabr. Insecticide. (253,065.)

GENERAL NOTES

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News from Advertisements

1. Exclusive connections for eastern Canadian market wanted from producers for industrial chemicals used by manufacturers (p. viii).

2. Boots Pure Drug Co., Ltd., invite applications for vacant positions in their research laboratories (p. viii).

3. The Technical College, Cardiff, advertises for a full-time assistant lecturer in chemistry (p. viii).

4. A chief chemist is wanted for an important woollen firm (p. viii).

5. The Salter's Institute of Industrial Chemistry invite applications for a limited number of fellowships and also for a limited number of grants-in-aid (p. viii).

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW
SERIES**

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No. 18

EDITORIAL

Our Review Number

WHENEVER we have one of those prized spare moments which are so infrequently vouchsafed to editors, it gives us no little pleasure to reflect upon the ways of Providence. Providence is a much-maligned lady—we suppose that it is a lady—but she has been remarkably kind in that she has provided mankind with so infinite a diversity of temperaments. No two persons have exactly the same requirements or exactly the same outlook, and thus is really a great blessing. When education became compulsory and universal, it was prophesied that mankind would soon arrive at a dead and monotonous level of equality. True it is that we do not seem to possess such towering pinnacles of genius as in former days, but that is because the valleys have been filled up and the eminences, to be noticed, have really to be mountains, and not mere hills. Whatever be the opinions of the results of universal education, we are not concerned with them here, for we merely wish to point out that general education has not reduced the requirements of mankind, but has rather complicated and increased them. Nowhere is the diversity of these requirements better illustrated than in the unending stream of new books which come from the publishers' presses. We are glad that we have not the task of dealing with general literature, for the publications which relate to chemistry and its allied subjects are quite numerous and important enough. Anyone who is in constant touch with the activities of publishers cannot but be impressed by the activity with which the principles of our science are being everywhere stated over, explained for the beginner, or developed for the practitioner. We are continually being surprised at the revelation of interesting unexplored corners of chemistry. Not one of the least important conclusions that can be drawn from an examination of the new books is that the demand for elementary books of

instruction in chemistry is apparently insatiable. There are books for schools, books in which first principles are combined with history, guides for the budding analyst, first-aid courses for examinations—there is no end to them. Our reviewers seem to think well, on the whole, of these elementary books and so we are brought to the conclusion that, as publishers are business men, and must consider that such books are in demand, therefore chemistry is at last taking its rightful place in the educational syllabus. But these by no means form the bulk of the publications. Amongst general treatises we have, of course, the great work of Mellor on inorganic chemistry which continues to appear: the new edition of Thorpe's Dictionary has been completed, and there have been a couple of inorganic treatises such as those of Ephraim and of Swarts—both highly spoken of—but we do not remember many organic works, other than those of Prof. Cohen, Prof. Noyes, and Dr. Wade. Most noteworthy is the number of publications by specialists. The chemical engineers, aided greatly by the bold Benn, have filled many gaps in the literature, and are promising still more important contributions. In other branches, the chemistry of lignin and cellulose has been tackled; the physical chemists have worked hard in thermodynamics and related subjects. Alexander, Freundlich, Ostwald and others have added to the literature of colloid chemistry; Smithells has dealt with tungsten; there have been several books dealing with special branches of coal-tar chemistry; Parrish and Ogilvie have produced the first part of their work on fertilisers—and so the tale goes on. Our review number contains notices of a number of important books, and the list of recent and forthcoming books contains announcements which will be read with interest. As before, we desire to express our gratitude to our many reviewers, and to those authors who have not yet blossomed into print we would say, "Gather ye publishers while ye may, for old time is still a-flying."

Industrial Research

It is now possible to obtain from His Majesty's Stationery Office, at a cost of ninepence, a 45-page pamphlet giving an account of the work of research associations under the Department of Scientific and Industrial Research. In a very brief preface Lord Balfour states "In the fundamental discoveries of pure science this country, I believe, has taken its full share. About applied science I am not so sure." We think that if we had been called upon for our candid opinion we should have stated that in the fundamental discoveries of pure science this country has taken more than its full share, but that in the application of these discoveries to industry during the last fifty years we have been surpassed by Germany and America in several important instances, and that this is not in the main due to lack of enterprise or faith on the part of our manufacturers. Thirty years ago, and more, this country was so rich that we allowed many opportunities to slip away. Now we are too poor to cope with many other opportunities. Consider the chemical industry; if a really promising development is made, and it seems capable of being a source of profit, what does it involve? Say five or eight years' hard work and an expenditure of £20,000 to £200,000, and then a return of 10% or 12%, or perhaps not so much, on the capital spent. How many chemical firms in this country can afford to spend such a sum of money? If we exclude the gas companies and the oil companies, and a few others which are not truly chemical manufacturers as we commonly use the phrase, we shall find, since the amalgamation, probably only one firm, the I.C.I., with enough financial resources to undertake such a task. The I.C.I., like other recent amalgamations, has its hands full with internal problems at the moment, and until these have been settled and the new mechanism has been thoroughly tuned up there will not be a great amount of superfluous energy available for such external problems as new developments. Although we differ in the wording of a few phrases from the authors of the preface and the account, in the main we agree with them entirely, and we recommend our readers to read the whole pamphlet and think about it. Many instances are given of savings effected as the result of co-operative or State-aided research. There is an interesting account of research in the leather industry resulting, *inter alia*, in showing that the efficacy of liming is not due to the activity of bacteria or enzymes. The work of the various research associations has resulted in the employment of many more scientific men, principally chemists, in the industries concerned. On the whole, the account we refer to is both interesting and encouraging; there are many industries in which important results can be obtained at comparatively small cost; in the chemical industry the problems are both large and expensive.

The Cambridge University Appointments Board

Several methods have been tried for choosing candidates for a vacant post. The apprenticeship system was almost universal in the Middle Ages, but has now fallen somewhat out of fashion; this system is, perhaps,

really part of an educational system rather than a mechanism of choice. The usual modern methods of choosing likely candidates have been (i) influence, (ii) money, (iii) examinations. None of these is good; probably the examination system, bad as it is, is better than the other two methods. The examination system is bad because, as a rule, it is no indication of the candidate's abilities except his or her ability to give written answers to questions without reference to books—an ability which is not greatly used in after life. It is a test, and probably a fairly reliable test, of the candidate's knowledge of the academic side, rather than the industrial side, of a particular science, art, or study. If we attach undue importance to an examination as a test of a grown-up person's fitness for a particular post, we shall find the examination system dangerous and harmful; if we remember its proper limitations, it should be convenient and even useful. Those people who have not merely examined candidates, but have for three or four years taught them as well, who have seen them at play as well as at work, have watched them stand serene at Fenner's and come forth by twos and threes from the broad tower of Trinity, from the green gate of Caius—those people, at least, have a fairly good opportunity of knowing far more about a candidate's capacity than any mere examiner. We are not surprised that the work of the Cambridge University Appointments Board has been successful, that it has grown in volume and importance, and that its recommendations are esteemed by first-rate judges. The Cambridge Board was established twenty-five years ago; it comprises men chosen by the Senate, men chosen by the colleges, and men chosen from industry and commerce. It has included many well-known Cambridge dons, and such men as Mr. Owen Hugh Smith, Mr. John Hugh Smith, Sir Robert Hadfield, Mr. Roscoe Brunner, Sir Arthur Pease, Lord Ashfield, Sir William Mather, Sir Thomas Wardle, and the Hon. Geoffrey Hope Morley. Chemistry is at the moment rather poorly represented on the Board. The Board's report, just issued, speaks highly of the services of the Secretary, Mr. H. A. Roberts, and gives a number of interesting particulars of the work of the Board during the last twenty-five years. One sentence is specially worthy of note: "While the Board think it of the greatest importance to the prosperity of the country that the right type of graduate should find an opening in industry or commerce, they have never suggested that all, or even most, graduates are suitable for this particular purpose." About 1200 B.A. degrees are taken every year at Cambridge; about 400 appointments are obtained every year through the Board. The report gives us the impression that the Board does good work and does it well. About three-fifths of the graduates who enter their names on the appointments register obtain appointments through the Board. This appears to us to be about a proper proportion for one of the old universities. After all, the true test is not one of statistics, it is this: if you have tried one of the Cambridge Board recommendations, will you repeat the experiment and urge your friends to do the same? The fact that the number of appointments has gone up fairly steadily from 100 a year to 400 a year appears to be satisfactory.

REVIEWS

EXERCISES IN GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. By HORACE G. DEMING and SAUL B. ARENSON. Second edition, revised. Pp. xii + 282. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 9s.

This book conforms in order of subject-matter with the second edition of Deming's *General Chemistry*, but it may be used as a practical companion to any modern text-book. The purpose of the authors is to provide a series of exercises, both qualitative and quantitative, which shall lead the beginner steadily on to the acquirement of a sound knowledge of general principles, rather than of a host of disconnected facts of chemistry.

The table of contents shows simple exercises in the following, among other subjects: manipulation, laws of gases and of chemical combination, water and solutions, acids, bases, and salts, hydrolysis, valency, oxidation and reduction, the ionic theory, reaction velocity, colloids, metals, electro-chemistry, catalysis. Some of the common gases are prepared, but there is no effort at completeness; e.g., sulphur dioxide and the oxides of nitrogen, and even carbon dioxide are prepared only incidentally. There are also a few preparations of inorganic salts, and these are followed by qualitative analysis, the purpose of which "is not to get through a certain number of known and unknowns, but to learn chemistry." Consequently, much attention is paid here to procedure and principles, and there are omissions which are to be made good by reference to more advanced text-books. The phosphate separation, for example, is deliberately omitted, and the treatment of acidic radicals is very brief. At the end of each section of the book there are lists of questions which are provocative of thought.

If the purpose of learning chemistry is to become acquainted with the principles of the science rather than to qualify for an examination, to gain an insight into scientific method rather than a detached knowledge of scientific facts, to learn how to tackle a scientific problem rather than to be versed in analytical routine; then it is difficult to think that any better method of procedure could be devised than that set forth in this book. Therefore, all instructors in chemistry who are not slaves to an examination syllabus should get the book, and then earnestly determine how much of its teaching they can make their own.

R. M. CAVEN

SECOND YEAR COLLEGE CHEMISTRY. By Prof. W. H. CHAPIN. Second edition, revised. Pp. xiii + 366. New York: John Wiley & Sons, Inc.; London: Chapman and Hall, Ltd., 1926. Price 15s.

This book was first published in 1922, and for the second edition the chapter on atomic structure has been entirely re-written, whilst a new chapter on colloids has been added. The subject-matter includes the following topics: atomic and molecular theories, valency, periodic law, radioactivity, atomic structure,

properties of solutions, ionisation, indicators, homogeneous, heterogeneous, and complex equilibrium, electro-chemistry, colloids. Exercises follow each chapter.

"Principles are more important than facts and methods," says the author; hence the whole of the second-year chemistry course is devoted to principles. The book is full of the modern spirit of physical chemistry, and appears to be above detailed criticism; the reviewer, therefore, has the more agreeable task of considering whether its contents are adequate and suitable for a second-year course in chemistry. Here the question arises: if this is the second-year course, what are the first and third-year courses; or otherwise, where, and to what extent, is descriptive chemistry to be dealt with in a student's career? This is a question fundamentally important to the teacher of chemistry to-day. Lecture courses are not capable of indefinite expansion; indeed, owing to the growth of the subject, students are in danger of being lecture-ridden. There can be no doubt in the mind of the philosophic teacher that instruction along the lines of this book is desirable, if not imperative: for this goes farther in satisfying the intellectual desires of the student than the rehearsal of facts about the elements, however skilfully these facts may be woven into a parti-coloured pattern. Yet the chemist must know his elements; so what is to be done? That is the question which results from meditation upon a valuable and stimulating book.

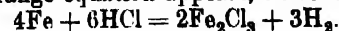
Meanwhile, the book will certainly be used on account of its intrinsic merits.

R. M. C.

AN INTRODUCTION TO CHEMISTRY. By C. G. VERNON, M.A., B.Sc. Pp. 276. London: George Harrap & Co., Ltd., 1926. Price 4s. 6d.

This little book introduces chemistry from an historical standpoint in a way which the author claims has not been used before. All the great things in chemistry, from the beginnings of knowledge to the molecular theory, are quickly sketched; then follow short chapters on sulphur, phosphorus, oxides, peroxides and hydroxides, salts, coal, silica and glass, modern manufactures, and more recent chemistry. This occupies 180 pages, and the rest is devoted to practical work, also set historically. The earlier chapters are entirely historical; then the stream of history dries up, and the reader finds himself browsing on the fertile plains of the modern chemical world. Brief questions follow each chapter, including some, of which the following is typical: "Write an imaginary letter from Priestley, giving an account of the discovery of dephlogisticated air."

The total amount of chemical information in the book is not large, but this is a virtue rather than a fault in an introduction to chemistry. The author's style is clear and attractive, and there are some interesting portraits and other pictures. The information seems accurate, and, in the modern part, up to date. The following strange equation appears, however, on p. 149:



The reviewer has read the book with much pleasure, and congratulates the author on the freshness of his treatment, and the success of his achievement. The book is certainly to be recommended as an attractive and stimulating introduction to chemical science.

R. M. C.

AN ELEMENTARY CHEMISTRY. By E. J. HOLMYARD, M.A., M.Sc. Pp. 424. London: Edward Arnold & Co. Price 5s.

This elementary book is intended for boys and girls who wish to know something about chemistry. It is brightly and pleasantly written, and grown-up people have been known to read it through more than once because they liked it. It contains a sufficient number of facts and relevant explanations to form a useful introduction to the science. As might be expected, the historical side is not ignored. The book is well illustrated. The reviewer has tried hard to think of suggestions for the improvement of the book, but so far in vain. It is the best book of elementary chemistry that has been written of its kind, for its special purpose and with its special character, and the author is to be heartily congratulated on it. Even learned people might read it and find something either new to them or more clearly explained than is usual.

PRACTICAL ORGANIC CHEMISTRY. By I. V. HOPPER, Ph.D., A.R.C.S.I., and W. M. GUMMING, D.Sc. Pp. xii + 115. London: Blackie and Son, Ltd., 1926. Price 4s. net.

This little volume on practical organic chemistry is intended specially for students of pharmacy taking the chemists' and druggists' qualifying examination of the Pharmaceutical Society. Each experiment, which is of a simple character, is prefaced by a brief theoretical discussion of the class of compounds which it is intended to illustrate. The order follows the usual arrangement of most text-books: the aliphatic and aromatic compounds being grouped together. The descriptions and drawings are for the most part clear and concise, but call for no special comment.

There is a chapter near the end which deals with the identification of organic compounds and one containing tests for the commoner organic acids and alkaloids.

I am doubtful if it is desirable to bore a cork half-way from both ends, as advocated by the authors. My own experience is that one rarely forms a straight, smooth hole.

I should also like to suggest that, on the principle of prevention being better than cure, the authors should give, not only a method for loosening tight stoppers, but one for obviating the process by smearing a thin coating of vaseline or grease on the stopper before the apparatus is laid aside.

J. B. COHEN

ORGANIC CHEMISTRY FOR THE LABORATORY. By Prof. W. A. NOYES, Ph.D. Fifth edition, revised and enlarged. Pp. xiv + 329. Easton, Pa.: The Chemical Publishing Co., 1926. Price: \$4.00.

That this is the fifth edition since 1897, and the third since 1916, is a fact which appraises the book. Thirteen of the sixteen chapters of the book are con-

cerned with the preparation of organic compounds, each chapter being devoted to one class of compound. Valuable features of this section are the summary of the methods available for the preparation of each type of compound, and the full references to the literature that appear at the beginning of each chapter. Further, the characteristic reactions of each compound are described after each preparation, so that an intelligent student who has worked through a selected series of preparations will find the short chapter at the end of the book, dealing with the qualitative examination of organic compounds, all that is necessary to enable him to take up what is perhaps the most important part of his training as a student of organic chemistry, namely, the examination of substances with the view of relegating each to its respective class and verifying his report by the preparation of characteristic derivatives.

In the preface to this new edition it is stated that the author has found the determination of carbon with the use of the Parr total carbon apparatus to be both rapid and convenient, and has therefore included the directions for this method. Unfortunately, such directions are rendered quite unintelligible by the fact that the figure (Fig. 6) to which the detailed description is referred depicts only a small part of the whole apparatus, and, moreover, the letters in the figure do not tally with those in the text.

M. A. WHITELEY

HYDROGEN ION CONCENTRATION. By L. MICHAELIS, M.D. Vol. I. Principles of the Theory. Authorised translation from the second revised and enlarged German edition, by Dr. W. A. PERLZWEIG, xiv + 299. London: Baillière, Tindall & 1926. Price 22s. 6d.

In this translation of Dr. Michaelis' well-known monograph (1922), opportunity has been taken to include more recent advances, such as the quinhydrone electrode of Bilhmann and co-workers (1921-1924), and the activity theory of ionisation of G. N. Lewis, Bjerrum and Debye. The object of the book, as indicated in one of the prefaces, is "to present to biological readers the general theoretical principles upon a broad foundation before the details of their application are dealt with."

The first part deals with electrolytic equilibria and ion concentrations, including the cases of amphoteric electrolytes, difficultly soluble acids, hydrolysed salts and "strong" electrolytes. The title of the second part is "the ions, particularly the hydrogen ions, as sources of electric potential differences." This includes, of course, both potentials at electrodes, and those at liquid-liquid and liquid-solid interfaces such as diffusion potentials and adsorption potentials. The latter class has been more fully treated—the author has been tempted to make a somewhat comprehensive survey of such phenomena as electro-endosmosis and electrophoresis.

It would be difficult to maintain that any book of the class can be absolutely "sans tache," as claimed by the publishers (*e.g.*, quinhydrone electrode is indexed at p. 177 instead of p. 171). Still, the misprints are at a minimum. A purist in the English language might object to a few awkward constructions, *e.g.*, "the type of always completely dissociated electrolytes." These are, however, trifles. The book is admirable as an introduction

tion to be read straight through, or as a work of reference for the comprehension of the broad outlines of theories which are becoming every year a more essential part of the equipment of the worker in biochemistry and allied branches. The book has a pleasing appearance, but the pages are rather loosely inserted.

E. B. R. PRIDEAUX

PHYSICO-CHEMICAL GEOLOGY. By R. H. RASTALL, Sc.D., F.G.S. Pp. vii+248. London: Arnold & Co., 1927. Price 15s.

Dr. Rastall set himself a difficult task when he essayed a book which would adequately cover the ground comprised in his title. This is fully realised in the preface; nevertheless he has produced a work full of interest, of undoubted value, and one covering a remarkable amount of ground. The twelve chapters are somewhat unequally balanced, the amount of elementary exposition in the earlier part curtailing the space available for more advanced matter. Thus, colloids in geology are dismissed in eight pages, and in the otherwise excellent chapter on metamorphism the important subject of metasomatism receives less than its due share. There are very good chapters on isomorphism, igneous rocks and rock weathering, but these, like the whole book, would be of greater value were the references to literature augmented, particularly with references to more recent work. This applies especially to the discussion of differentiation in igneous magmas, and to the chapter on ore-deposits. The book is clearly written, printed on comfortable type, remarkably free from errors, and has a good general index.

H. W. GREENWOOD

THE EVOLUTION AND DEVELOPMENT OF THE QUANTUM THEORY. By N. M. BLIGH, A.R.C.Sc., A.I.C. With a foreword by Professor Max Planck. Pp. 112. London: Edward Arnold & Co., 1926. Price 9s.

Natural phenomena, formerly studied by observing the behaviour of matter in bulk, have been found to conform satisfactorily in most cases to general laws founded on statistical mechanics, *e.g.*, the kinetic theory of gases, and the law of mass action. Naturally, with each development of our knowledge of atomic structure, the tendency to refer the properties of matter in bulk to those of the individual atoms has been more and more manifested. Difficulties arose whenever classical mechanics was applied to considerations involving the relationship of energy to matter, the former being too general to apply to matter which is discontinuous. The quantum theory, however, supplies the required restrictions.

The theory was originally conceived to explain the various phenomena of heat radiation, and was, therefore, of greatest interest to physicists; its application now to photo-electric effects, to atomic heats, and to atomic structure compels the interest of chemists.

Chemists who have felt the need of an ordered account of the origin and development of the quantum theory will welcome Mr. Bligh's book on the subject. In it they will find a systematic treatment from the origin of the theory to the radiation experiments to its application in Bohr's interpretation of the chemical elements. The book is lucidly written, and can confidently be recommended to chemists.

Some of the mathematical proofs, however, leave

something to be desired, notably on pp. 21 and 32. Their reading is made the harder by the rather large number of errors that have escaped the proof corrections. A list of those errors which were noted by the reviewer has been forwarded to the publisher; but it might save some confusion on the part of readers of the book if it were here pointed out that the second law of thermodynamics is correctly given by equation 159 on p. 79, and not as given at the beginning of p. 21; that the dimensions of Planck's constant are correctly given on p. 53 and incorrectly on p. 55; that it is the expression $M/(M + m)$ on p. 92 and not M that is slightly greater for helium than it is for hydrogen; and that equation 156, called the minimum work equation, is more correctly called the maximum work equation, as the author has done on the following page.

JOHN A. CRANSTON

CATALYSIS IN THEORY AND PRACTICE. By F. K. RIDEAL and H. S. TAYLOR. Second edition. Pp. xv + 516. London: Macmillan & Co., Ltd., 1926. Price 20s.

The second edition of this standard textbook is presented in the same admirable setting as the original work, the volume being of convenient shape and size, clearly printed on good paper. The chemical formulæ and mathematical symbols are well set out, adding considerably to the ease with which the contents may be assimilated.

The book is only about twenty pages longer than in its first edition, showing that a considerable amount of matter previously contained must have been omitted in order to provide space for the large quantity of new data which have been introduced. This is also reflected in the table of contents: for example, the chapter on ferments and enzymes has disappeared, this subject being treated partly under "Hydration and hydrolysis" and partly in the new chapter on "Colloidal catalysts."

Again, the more exclusively theoretical treatment of the subject, which formerly occupied 74 pages, now takes up 158 pages, including the chapters on "Promoters, mixed, supported and protected catalysts" and on "Catalyst poisons and the inhibition of homogeneous chemical reactions."

The tendency of the volume is therefore in the direction of theory rather than of practice, and this is unavoidable, and indeed desirable, in order to obtain the necessary conspectus of the diverse theoretical investigations carried out in recent years by numerous bands of workers. These have gone far to make clear much of what was formerly obscure and even mysterious in the behaviour of catalytic agents, and the broad, yet detailed and critical, survey of the results and views of the whole group given by Rideal and Taylor is of great value. One might, indeed, go further and point out that an intimate acquaintance with the results of modern theoretical work in this field, as summed up in this book, is indispensable to any technologist who is concerned with the industrial application of a process in which catalysis plays a part.

The chief technical applications of catalysis are included as before, but as already indicated the space available for the practical side of the subject is distinctly less than it was. It is an open question whether, in the circumstances, it might have been as well not to attempt

so complete a survey of this side, and to confine attention to selected instances of the more important industrial employment of catalysts. For example, it seems to the writer that much of the matter in the chapters on catalysis in organic, analytical and electro-chemistry, and some of that in "Catalysis by radiant energy" could better have been spared in order to devote more space to such phases as the production of ammonia, urea, methyl alcohol and the higher alcohols, or the industrial applications of enzyme action. The last-named subject is a matter which, taking a long view, is probably as important as all the other technical aspects of catalytic action put together.

Taylor's picture of the composite catalytic surface (*Proc. Roy. Soc.*, 1925, **108A**, 105), whether completely warranted by the existing data or not, is probably a sufficiently close approximation to have justified its inclusion at greater length on pp. 75-79: it affords a clearer view of the modern theory to the non-mathematical mind, and completes the more general treatment as given in the present volume (in the reference to Rideal's discussion on the same subject, given on p. 115 (footnote) as *Counsel Solcay*, 1926, the date should be 1925).

In the section on technical processes of fat-hydrogenation, no reference is made to the important continuous process and compact nickel catalyst devised by Bolton and Lush.

This second edition of Rideal and Taylor's monograph should receive as warm a welcome as the original, and it is to be hoped that in due course the authors will be called upon to produce a further edition, and that they will then revise the theoretical data available by that time as thoroughly and broadly as in the present volume.

T. P. HILDITCH

THE PROBLEM OF PHYSICO-CHEMICAL PERIODICITY. By E. S. HEDGES, M.Sc., Ph.D., and J. E. MYERS, O.B.E., D.Sc. Pp. 95. London: Edward Arnold & Co., 1926. Price: 7s. 6d.

To the chemically curious this volume will certainly supply many hours of interesting reading, for in it the authors have collected together most industriously the scattered and numerous records of periodicity in chemical and physical actions. To the chemist who deals in molecules in large quantities an ordered rate of change is always expected, but in dealing with individual atoms some species of discontinuity in action is to be anticipated. It would, however, be rash to interpret any periodic action in mass to quantised processes, for in general some simpler explanation is forthcoming. Thus the periodic bands formed by lycopodium in the well-known Kundt's tube experiment and the periodic dissolution in acids of metals which are capable of being rendered passive are readily interpreted on simple physical and chemical considerations.

It is somewhat significant that since Bray's periodic reaction between hydrogen peroxide and iodine has been shown not to be truly periodic in character, there is no established case of periodic reaction in homogeneous systems: they are all confined to interfaces.

The two properties of interfaces which appear to be of special significance in periodic action are, firstly, their

powers of adsorption, which, at any rate, appear to offer a simple interpretation of many periodic properties in space, e.g., the Liesegang rings; and, secondly, that reactions at interfaces in many cases spread out from nuclei or active patches over the whole interface, i.e., at the contact of dissimilar superficial phases, a property which may readily give rise to periodicity in time.

The chief criticism which the reviewer has to make about the volume as a whole is that the authors lean somewhat too heavily on the mystery of periodic actions. The principle of mysterious pulsations as the *fons et origo* of all chemical reaction is one which should not lightly be adopted as a basic hypothesis by those who are desirous of examining the processes of nature in detail. In spite of this, the authors have themselves contributed no small addition to our knowledge of pulsating action, and one hopes that they will continue to do so, so that eventually the various factors may be disentangled, properly labelled, and their relative importance in the sequence of events evaluated. The volume is undoubtedly a stimulating one to read, and is excellently printed and bound.

E. K. R.

KOLLOIDCHEMISCHE TECHNOLOGIE. EIN HANDBUCH KOLLOIDCHEMISCHEN BETRACHTUNGSWEISE IN DER CHEMISCHEN INDUSTRIE UND TECHNIK. Edited by Dr. E. Liesegang, with the assistance of numerous collaborators. Lieferung I. Pp. 80. Lieferung 2. Pp. 81-160. Dresden and Leipzig. Th. Steinkopff, 1926. Price (subscription): 5 g m. each.

As its advertisement says, this work interests all who have to do with colloid material, and to-day their name is legion. The work, of which only the first two parts have been received, is to consist of some 800 to 1000 pages, with numerous illustrations, diagrams, etc., and is divided into a theoretical and a technical part. The first two numbers cover about one-half of the theoretical portion, and deal with the preparation of inorganic colloidal solutions, following the Svedberg's "Methoden" in arrangement, with a few references to literature since the last edition of that work, but well documented as regards patent literature. Then comes a section on the colloid mill and its technical applications, all too short for its purpose, and dealing almost exclusively with the Plauson mill. This is followed by an excellent review of ultrafiltration and dialysis, which manages to cover a large field in but little space. Electro-osmosis next claims attention and the very interesting and suggestive account of its applications will be of value to many colloid workers. The last subject dealt with in the second part is the viscosity of colloidal solutions, and here too much space is devoted to a general discussion of viscosity and instruments, with the result that specific subjects of great technical importance receive but scanty attention. For example, glue and gelatin are dismissed in half a page. This may well foreshadow a general criticism to which books of this class must, almost of necessity, be subject, namely inadequacy. Against this we have the boldness of the attempt to deal with the whole field of colloid technology and theory in 1000 pages. Frankly, the work cannot be exhaustive; it does not claim to be, but it is, so far, eminently readable, exceedingly stimulat-

ing and suggestive, and as a general reference work pointing to original sources definitely valuable. It is well printed, with clear illustrations and good diagrams, and is an exceedingly cheap compendium on colloid technology, and worthy to be received and kept by every colloid chemist.

H. W. GREENWOOD

KOLLOIDCHEMIE. By Dr. E. LIESEGANG. Pp. xii+176.

Wissenschaftliche Forschungsberichte. Naturwissenschaftliche Reihe, edited by Dr. E. Liesegang.

Vol. VI. Second revised and enlarged edition.

Dresden and Leipzig: Theodor Steinkopff, 1926.

Price, paper, 8 m.; bound, 9.50 m.

A previous report on colloid chemistry by the same author covered the period from 1914 to 1922, during the greater part of which German readers were cut off from foreign scientific publications. The present—second—edition surveys, in addition, the literature up to about the middle of the current year. It serves approximately the same purpose as the reports published by the British Association Colloids Committee, but while the latter were compiled by a large number of contributors dealing with different aspects of the subject, Dr. Liesegang takes the whole of it for his province. This is an enterprise which now exceeds the powers of one individual, and differences in competence and in predilections naturally show themselves, even in the brief abstracts to which considerations of space confine the author. Still, they always give a sufficient idea of the contents to enable the student to decide which of them he has to read *in extenso*, and this is no small task to have accomplished for something like 1200 references. Their completeness is also remarkable; in those portions of the subject in which the reviewer can claim an exhaustive knowledge of the literature he has not been able to detect any omissions, and only one or two minor inaccuracies. The volume will be of the greatest use to all who have to consult the ever growing and still widely-scattered literature of colloids.

A satisfactory index is even more important in a work of this description than in most others, and both the subject-matter and the name index are unusually good. An engaging feature of the latter is that a name like "MacBain" appears under "M," whereas most German authors (or index makers) take the patronymic prefix for a Christian name and list this author under "B."

E. HATSCHEK

GAS AND GASES. By Prof. R. M. CAVEN, D.Sc. Pp. viii+256. London: Williams & Norgate, Ltd., 1926. Price 2s.

After a generation or more of science teaching in schools, there ought to be a considerable public interested in the chemical facts of every-day life if these are readably presented. The publishers of the Home University Library—which has an established reputation—evidently share this belief. In the chemistry of "Gas and Gases" they have selected a topic which should appeal to every enquiring reader, because the subject is indeed vital to every living creature. In Prof. Caven they have found an author who evidently has the faculty of presenting the subject in a way likely

to satisfy an interested and intelligent layman. He has, however, given the basic facts of the properties of gases so completely and concisely that the student of chemistry also might read this book with profit. The two chapters on the atmosphere and the rôle of its various constituents in the cycle of life make delightful reading, and portray the true romance of chemistry. It is only when dealing with some applications of chemistry that the book invites criticism. The author would find it difficult to substantiate the statement (p. 136) that a gas fire warms the air by convection. Convection from an ordinary gas fire plays only a minor part. Again, what evidence is there that the stuffiness of an atmosphere is due to "noxious organic emanations" (p. 181)? Statements in the chapter on combustion and explosion would merit discussion, but exhaustive treatment cannot be demanded in such a work. The book, however, remains an excellent popular exposition of chemistry, and well worthy of its place among its companion volumes.

H. J. HODSMAN

EXPLOSIVE REACTIONS IN GASEOUS MEDIA. A GENERAL DISCUSSION HELD BY THE FARADAY SOCIETY. JUNE, 1926. Reprinted from the Transactions of the Faraday Society. Vol. XXII. October, 1926. Pp. 252—375. London: The Faraday Society, 1926. Price 10s.

Few fields of research offer such excellent opportunities for the co-operation of the chemist with the physicist on one hand, and with the engineer on the other, as that which deals with explosive reactions in gaseous media. Their mutual interests are well shown in this report of the general discussion held by the Faraday Society last June. The subject is essentially a chemical one, but the experimental investigation is largely physical, as it deals with the measurement of uniform movement and detonation speeds of flame, of the pressures produced on explosion or temperatures of ignition and with the effect on these of radiation and ionisation, each of which is considered in one or more of the papers read at the meeting. The applications, also considered, appeal most particularly to the engineer concerned with the efficient utilisation of gaseous explosions in internal combustion engines, or with their prevention in coal mines.

An admirable introductory survey of the subject by Dr. Garner gives an idea of its complexity. In particular does this apply to the study of the part played in gaseous explosions by the "chemical kinetics" of the reactions. The possibility that ionisation may play an important part in such reactions is attractive, but receives little support from the papers read, in so far as ignition or the propagation of flame or detonation are concerned.

The question of "pinking" in internal combustion engines and its prevention receives considerable attention, and it is to be regretted that Dr. Midgley's survey of the subject was not available. The explanation of pinking and of the remarkable "anti-pinking" effect of certain compounds is still to be found. It would seem that the general use of the term "detonation" as synonymous with pinking is a questionable one, more especially as Professor Dixon and Messrs. Egerton and Gates have

shown that anti-pinking compounds have no apparent effect on the setting up or on the speed of detonation in gas mixtures.

The report will be found indispensable to those desirous of keeping in touch with the present trend of research on problems of gaseous combustion. W. P.

I.—TREATISE ON THERMODYNAMICS. By DR. MAX PLANCK. Third English edition, translated from the seventh German edition by DR. A. OGG. Pp. xiv + 297. London: Longmans, Green & Co., Ltd., 1927. Price 15s. net.

II.—THERMODYNAMICS AND CHEMISTRY. By F. H. MACDOUGALL, M.A., Ph.D. Second edition. Pp. vii + 414. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 27s. 6d. net.

I.—It is gratifying to find that there is still a definite, if restricted demand for an English translation of this well-known textbook, in spite of the numerous treatises on thermodynamics by other writers who owe it an acknowledged debt. The diversity of applications of the science have, of course, been dealt with in much greater detail elsewhere. The permanent value of Planck's work, however, lies in his lucid method of presentation of the fundamental principles of thermodynamic theory. In re-reading the introduction and "proof" to the Second Law, it is hard to appreciate the distaste which chemists, up till recent years, have evinced for entropy as a thermodynamic tool. Entropy is the fundamental function from which the other thermodynamic functions are derived, and the conception, as introduced by Planck, presents no difficulties. Further, there is no question that the worker in thermodynamics will find his labours greatly lightened if he is not restricted to think in terms of free energy only, but has the ability to choose always the function best suited to the problem in hand.

The present translation differs from its predecessor chiefly in the inclusion of a chapter on "Absolute value of entropy," and of short sections on the theory of the Joule Thomson effect and Ghosh's theory of strong electrolytes. It is a pity that the translator does not indicate that Ghosh's theory, which was very favourably received in Germany, is now discredited, and mention the more satisfactory treatments of Milner and Debye and Hückel, the latter of which appeared after the publication of the last German edition (1922). The translation is on the whole admirable, but the first few chapters contain minor faults (cf. §§10, 32, 67) which might have been rectified in this new edition. It is also unfortunate for the reader who is familiar with the German edition of Planck that his symbols S and ϕ for entropy and characteristic function are here needlessly changed to ϕ and ψ respectively.

II.—This advanced text-book, which offers one of the best intensive courses in chemical thermodynamics at present in circulation, is based in large part on Planck as a model. The fundamentals of the subject are presented in the same clear manner and somewhat more fully. After this, the usual physical and chemical applications are given in detail, in some cases, it must be remarked, with rather more of mathematics and less

of chemistry than will appeal to every reader. Notable features of the book are the relatively extensive treatment of the phase rule, the selection of problems appended to each chapter, and the numerous tables of useful data scattered through the book.

"Since the publication of the first edition of this work, a remarkable contribution to our knowledge of solutions of electrolytes has been made by Debye and Hückel. The author has endeavoured to give an adequate presentation of their views in Chapters XVI and XVII . . ." We expect a critical account of current views on the problem of strong electrolytes in a book of this kind, and it is a pity that considerations of space have apparently restricted the author in some cases to bare statements of results, which of themselves will convey little to the student. The last chapter has been rewritten to give a more balanced account of the Nernst heat theorem and the third law of thermodynamics. If it is necessary here to give even brief mention of Planck's treatment of the equilibrium between radiation and matter, the author might have done better than present it in the form—continuous absorption, discontinuous emission—which physicists never favoured, and which Planck himself has abandoned. The list of errata is rather large, considering that many of these are carried over uncorrected from the first edition. A. McKEOWN

DIE FERMENTE UND IHRE WIRKUNGEN. By PROF. CARL OPPENHEIMER. With a section on Physical Chemistry and Kinetics by DR. R. KUHN. Fifth edition, completely rewritten. Nos. IX—XIII. Leipzig: G. Thieme, 1926. Price: No. IX, 17.40 r.m.; No. X, 17.10 r.m.; No. XI, 17.10 m.; No. XII, 17.45 m.; No. XIII, 19 m.

With the issue of the above-mentioned five parts, this work reaches completion; it covers (including the author and subject-matter index) 2,039 pages. We have already dealt with the first eight numbers (cp. this JOURNAL, 1921, 880 R; 1926, 146 R).

Now that we have the complete treatise before us, it is desirable in the first place to review it as a whole. Although the pagination is continuous, it is divided into two volumes. The first volume (775 pages) deals, in a general manner, with the chemistry of enzymes, the kinetics of their actions, and the biology of the subject. It concludes with a special portion concerned with specific enzymes:—The hydrolases-esterases, carbohydrases, and the nucleases. The subject matter of the second volume deals with amidases and amino-acidases, proteases, including peptidases, tryptases, pepsinases, chymase, thrombase, and anti-thrombase, e.g., hirudin, a hæmolytic enzyme. The saponins are well known to possess hæmolytic properties, but as these have not been definitely traced to an enzyme, that is probably the reason why reference to them is omitted in the book.

In the concluding portion of the treatise, which is that with which we are at present specially concerned, the text is devoted to a description of those enzymes and their action by which oxidations and reductions are effected in the organism. The general name assigned by the author to this group is desmolases. He remarks that they may be regarded as direct metabolic enzymes.

as they promote the special processes whereby the organism is able to obtain energy from ingested food, or from its own tissues.

The first group to be discussed is that comprising the so-called autoxidisable substances which undergo oxidation by giving up hydrogen to an acceptor of that element, or which undergo reduction by accepting hydrogen from a donator of that element. The work carried out in this field is discussed in detail, including that of Traube, Bach, Wieland, Palladin, Kastle, Schulze, Bourquelot on oxidases, dehydrases, and respiratory pigments, as well as that of Hopkins on glutathione.

Under oxidation by atmospheric oxygen, the peroxide theory of Traube and of Engler and Bach is discussed, and in this connexion attention is called to the influence of the presence of heavy metals—some stimulating, some inhibiting. The extensive work which has been carried out on animal and plant respiration, both aerobic and anaerobic, is treated exhaustively. A discussion of the *zymases*, which include the enzyme of alcoholic fermentation, covers 291 pages of text. Some space is devoted to modern views of the structure of the different fermentable sugars, but as this portion of the text was published before the appearance of Haworth's papers, the latest views on the subject are not included. It is treated from the chemical and biological standpoints, and some points concerning vitamins and, notably, insulin, are included. Much space is devoted to the different dehydrases which have been described, as well as to the chromo-dehydrases and chromo-oxydases. The text concludes with a chapter on the chemistry of the catalases. An index of authors, giving the titles of original papers, and an index of subjects, are useful features.

Having now made a survey of the complete treatise, we can reiterate the opinion previously expressed of its great value as the most complete contribution yet published to the literature of a subject of far-reaching importance both to pure and applied science.

ARTHUR R. LING

LEHRBUCH DER ENZYME. CHEMISTRY, PHYSICAL CHEMISTRY AND BIOLOGY. By Prof. CARL OPPENHEIMER in collaboration with Dr. R. KUHN. Pp. ix+660. Leipzig: G. Thieme, 1927. Price, paper 33 m., bound 36 m.

This work is a shortened edition of the authors' treatise "Die Fermente," designed specially as a textbook. On these lines a better connected account of the subject might have been presented than was possible in the more extended work. The subject matter has been brought up to date, but the number of references to original papers has been curtailed considerably. The names of authors responsible for the observations cited in the text are given in some cases without the references.

The first 206 pages deal generally with the chemistry and kinetics of enzymes. The remainder of the work is a special part which is concerned with specific enzymes, the arrangement and nomenclature being the same as adopted in the larger work. There is a very good subject matter index, but an author index is omitted.

Prof. Oppenheimer and Dr. Kuhn have certainly rendered a great service to students of that branch of biochemistry with which their book deals, but we

think, bearing in mind the fact that the larger treatise on the subject has only just reached completion, that the present book would have been more useful had it been reduced to one-third its size and the text (which is identical with that of the larger treatise with the incision of portions) recast.

ARTHUR R. LING

CORROSION OF METALS. By U. R. EVANS, M.A. Second edition. Pp. xvi + 259. London: E. Arnold & Co., 1926. Price 15s. net.

From the time of the first scientific work on corrosion until the older electro-chemical theory was propounded, the theory of this most important subject fluctuated almost from year to year. With the electro-chemical theory, ground appeared to have been touched at last and, in a way, this was true. The difficulties inherent in this simple hypothesis, however, soon became apparent, but the intensive research carried out in recent years has led at last to a theoretical position where the whole subject is presented as one unit which is sufficiently comprehensive to explain a very wide range of fact. The modern electro-chemical theory is, of necessity, more complicated than the older one, but it is, at the same time, sufficiently simple to be presented in some detail, adequate for all practical needs, in a book of 250 pages.

In this development the author himself has played an outstanding part, which clearly fits him to deal authoritatively with his subject, but which, fortunately, has not prevented him from presenting it in a simple and extremely lucid manner. That a second edition should be called for in two years shows at once what interest is taken in corrosion itself and the satisfactory manner in which its present position is dealt with. The new edition, although so soon needed after the appearance of the first, contains a considerable amount of new, or newly presented, matter, and is an achievement of which any author might legitimately be proud. The book has a really practical trend, as well as being a truly scientific treatment of the subject, and can be unreservedly recommended to all those chemists, engineers or metallurgists, who are called upon to deal with the subject.

F. C. T.

LA FABRICATION DES FERRO-ALLIAGES. By AIMÉ COUTAGNE. *Grandes Encyclopédies Industrielles, Encyclopédie Minière et Métallurgique*, published under the direction of L. Guillet. Pp. 650. Paris: Librairie J.-B. Baillière et Fils, 1924. Price 60 fr.

This volume, one of those forming the new *Encyclopédie Minière et Métallurgique*, published under the editorship of M. L. Guillet, deals with ferro-alloys, metallic carbides and silicides, and the "special" metals manganese, chromium, tungsten, vanadium, uranium, titanium, and zirconium.

The author has presented his subject in the following manner:—(1) Raw materials (ores and electrodes). (2) Generalities on the metals, carbides and silicides. Constitution, properties, etc. (3) Process of manufacture in combustion furnaces (blast furnace, crucibles, etc.). (4) Process of manufacture in electric furnaces, including (a) generalities on electric furnaces, (b) processes in which the use of the electric furnace is possible

but not necessary, (c) processes in which the use of the electric furnace is indispensable, and (d) the consumption of electric energy in the manufacture of the chief electro-thermic products. (5) Processes of manufacture based upon reduction other than by means of carbon. (6) Electrolytic processes. (7) Industrial applications.

As is frequently the case in this class of work, the chapters dealing with sources of the raw material are the weakest, much of the information being out of date, and consequently misleading. Generally speaking, the purely technical matter is excellent, and is presented in a readable form, easy for reference.

METALLURGY OF CAST IRON. By J. E. HURST. Pp. xvi + 311. London: Sir I. Pitman & Sons, Ltd., 1926. Price 15s. net.

The author states in his preface that the object of his book is to furnish foundrymen with an account of the features governing the constitution and properties of grey cast iron, and he has attained his object very successfully. His book is a scientific treatise on grey cast iron, and it is significant of the progress that has been made within recent years in the scientific knowledge of the principles of foundry practice that he finds it unnecessary to enter upon any detailed description of metallographic methods or any elaborate definition of metallographic terminology, such as would have been indispensable only relatively few years ago in addressing the average ironfounder.

The work commences with a discussion of the iron-carbon alloys and their constitution, paying special attention to the formation of graphite, and next considers the influence upon the resulting cast iron of the more important accessory constituents—namely, silicon, sulphur, manganese and phosphorus. A chapter is devoted to the effect of the rarer constituents—or, as the author terms them, "special elements"—and another to the influence of dissolved or occluded gases. After going through the more strictly chemical portion of the subject, the physics of cast iron are attacked, and the next few chapters deal with the effect of heat treatment, the volume changes, the growth and the shrinkage of cast iron. Then comes a series of chapters on the mechanical and physical properties of cast iron, and finally, a couple of chapters are devoted to a discussion of special mixtures, including semi-steel, and to the use of metal moulds in the foundry.

It is, perhaps, to be regretted that the author has confined himself so strictly to the subject of grey cast iron, in consequence of which the production of chilled castings in which a portion of the iron is white, receives but scant attention. Upon the whole, the work is well done and the treatment of the subject is adequate; that the chapters on the iron-carbon alloys are not quite as clear as might be wished is due less to the fault of the author than to the extreme complexity of the subject and to the want of agreement amongst the leading authorities as to the interpretation to be assigned to the enormous mass of observed facts. The only really weak chapter in the book is the introductory chapter on the production of pig iron, which is distinctly on a lower level of accuracy than the rest of the work. To quote but one example, the author gives a table of analyses of

typical iron ores, one column of which purports to represent the composition of "Swedish ores"; undoubtedly there does exist some Swedish ore having the analysis there given, but it cannot be said to represent the composition of the bulk of the ore produced in Sweden; it would have been just as reasonable to quote an analysis of a Cumberland hematite under the caption of "English ore"! Fortunately, however, this introductory chapter will not greatly concern the ironfounder, to whom the work is addressed, and who will find in this book a well-compiled mass of information constituting the scientific basis of his important industry.

COAL AND ALLIED SUBJECTS. COMPENDIUM II OF BULLETINS ELEVEN TO SIXTEEN ISSUED BY THE LANCASHIRE AND CHESHIRE COAL RESEARCH ASSOCIATION. By N. SIMPKIN, M.Sc., and F. S. SINNATT, M.B.E., M.Sc., with collaborators. London: H. F. & G. Witherby, 1926. Price 15s.

This is the second volume of these collected bulletins. The first paper, on stone dusting in mines, is a very useful summary of work that has been done in determining the influence, on the explosive power of coal dust and air mixtures, of the fineness of the dust; the volatile content, moisture, ash, and carbonates in the coal; the quantity of dust in the air; the oxygen content of the air; and the velocity of the wave or current necessary to raise the dust into the air. It goes on to summarise information as to the mechanical nature—fineness, sharpness of particle, etc., and composition of the various stone dusts that have been used for admixture, and indicates that, whether in efficiency as a preventive of explosion or in effect on the respiratory organs of those working in the roads, the mechanical nature has much the greater influence, and that the composition is, indeed, almost a matter of indifference.

The second bulletin, on the chemical composition of pyrites from coal, is largely an account of the authors' own investigations into the occurrence of pyrites in coal, and the nature of its oxidation products and course of the oxidation, and forms a small storehouse of facts not easily obtained elsewhere. The bibliography at the end is very full, and those working at this subject will be grateful to the authors for it.

The third bulletin, on the determination of carbon monoxide in vitiated air, is a description of an addition to the ordinary Haldane gas analysis apparatus, of an iodine pentoxide tube and associated steam bath, for the determination of small percentages of carbon monoxide; it also describes the apparatus devised by Graham and by Sinnatt for the determination of minute percentages in a large volume of gas. Presumably the bulletin is intended for those not already skilled in such work, for the methods of using the apparatus for the whole of the analyses are described in very great detail. A diagram of the apparatus, instead of the actual photograph shown, would have made the description easier to follow.

The fourth bulletin, on the preparation of thin sections of coal for the microscope, is an excellent résumé by the Messrs. Lomax of their patient work on this subject. The processes are described in great detail, and the bulletin will be very helpful to anyone wishing to prepare

sections, though the authors do not gloss over the difficulties of, or minimise the long practice needed to acquire skill in, these preparations.

The fifth bulletin is concerned with the melting point of coal ash. Reference is made to the work of other observers in this field, and detailed description is given of the authors' apparatus for determining melting points on a small quantity of ash. Many results are given, and the conclusion is arrived at that no definite connexion between composition and melting point can be traced, and that direct determination must be resorted to for knowledge of the melting point of any given sample.

The sixth bulletin is a general account of boiler feed waters, corrosion, and formation of scale; and of softening processes and plants. The causes of scale formation, and the chemical reactions on which softening processes are based, are quite well described, and the bulletin forms a useful practical introduction to the subject. The phraseology, though, might well be subjected to revision in many places. To speak of a water "containing" degrees of hardness seems to me objectionable; and though the authors do not like the definition of temporary hardness as that which disappears on boiling, and would substitute "that due to carbonates," yet they define permanent hardness as the "residual" hardness. "More universal" can hardly be justified; and the authors say that the "capacity of a plant cannot be increased," when they mean that the plant cannot be worked beyond its capacity. Again we are told that if necessity demands it, a certain plant should be *chosen*: obviously, if there is necessity there can be no choice. Many similar lapses occur, not only in this bulletin, but throughout—for instance, the book is described on the title page as a compendium: it is not a compendium, but a collection—and the trouble is, that this looseness of phraseology tends to make the reader suspect (and, indeed, tends to produce) looseness of thought. A little more care over expression would have been very well spent.

These bulletins justify their publication. Some contain original matter; others are useful compends, and probably come into the hands, largely, of those to whom their contents are useful, but who would not know where else to look for the information. Misprints are few—the name Drechsel is misspelt, and on page 33 of the sixth bulletin 0.02 should, I think, be 0.2. There is a very ambiguous sentence, ending page 17 and beginning page 18 of the third bulletin, which calls for revision in any reprint. The repetition of the title of the bulletin at the bottom of each page, close to the text, worried me a good deal; but this may be a personal idiosyncrasy.

J. T. DUNN

THE CHEMISTRY OF WOOD. By L. F. HAWLEY and L. E. WISE. American Chemical Society Monograph Series. Pp. 334. New York. The Chemical Catalog Co., Inc., 1926. Price \$6.00.

This work is one of the series of monographs undertaken by the American Chemical Society (1919) on a programme comprising some 60 sectional subjects. The authors have justified selection for their particular task in producing a volume which is something more than a bibliography.

Representing distinguished centres of research, they have given us at first hand a critical record of the investigations of the Forest Products Laboratory (Madison) and other American schools which group around this very live institution, collated in due perspective with those of the German and Scandinavian workers in this field. In entering upon their task they state in an opening paragraph: "We have worked unhampered by trails or precedents" in a "pioneering adventure." This declaration of independence, in its exuberant freshness, early stimulates the anticipation of a student disciplined in old-world traditions, further raised by the authors' statement, on the following page, that their two chapters on lignin are presented "with a certain degree of temerity but without apology"—this after a description of their critical method of exhausting the literature of a subject "befogged in speculation and bandied to and fro in an endless series of polemics and debates."

Expectations, however, thus raised are damped by the statement, "We are dealing with the chemistry of wood, a product that has already been elaborated by the plant. Our subject, then, is static not dynamic." May we suggest, as a disappointed reader, that this delimitation takes us from the "Chemistry of Wood" to the "Chemistry of Timber." Here we have a shortened *exposé* of the dilemma, in terms of its material horns with or upon which the authors struggle in their introduction. It appears in yet another form, "We have consistently attempted to differentiate between *speculation* and *investigation*," which we convert into the usually accepted form of the antithesis, "theory and actuality." The authors fail to see that in ruling out hypothesis they, in this case, rule out reality. Since Wood is the Tree, and the tree is not a mere assemblage of carbon compounds, but a structural complex of organised products, it is clear that resolution of the complex by laboratory methods involves the ever-present problem of the relationship of the products of resolution to the original, as to one another; this must be considered, and can only be discussed in terms of what the authors describe as "speculation," i.e., theory. In effect they repeatedly in the text depart from the limitation of their formal disclaimer to discuss speculative essays on the constitution of cellulose and lignin.

But, for the patient attention of the present reader, and the more useful information of the prospective student, we shorten our criticism into a highly appreciative commendation of the main text, with a reference to "Die Chemie des Lignins," by Walter Fuchs, recently reviewed in this JOURNAL, which successfully grapples with the science of the subject *sans phrase*, and supplies a clear exposition of those aspects which the present work confuses.

The book will be widely adopted as an indispensable work of reference, since it represents a critical selection of the records of all the important investigations of wood substance (ligno-cellulose) and associated secondary products in genetic relationship. The main divisions of the subject-matter are the following: "Chemical Components of Wood"; "Proximate and Summative Analysis of Wood"; "Decomposition of Wood"; and "Wood as Industrial Material."

It is to be suggested to the authors that in the next edition of the work the introduction should set forth, in text-book terms, what is commonly accepted as our exact knowledge of cellulose, lignone and inferentially ligno-cellulose. The relatively brief space required for this *exposé* would add cogency to their contention that in this field it is especially necessary to discriminate between "speculation and investigation," or rather between agenda and acta.

C. F. CROSS

THE CHEMISTRY OF CELLULOSE AND WOOD. By A. W. SCHORGER, Ph.D. Pp. xiv+596. London: McGraw-Hill Publishing Co., Ltd., 1926. Price 30s.

This work is the fruit or rather harvest of a ripe experience, and, to judge from the records, of devoted personal work in this field. In the first sentence of the preface it claims to "cover completely the scientific and empirical data available on the chemistry of wood." This claim and the reputation of the author will commend his achievement for appreciative reception by the large and increasing body of chemists engaged in the scientific-technical development of "cellulose." From a critical reading of the text the claim can be confirmed and the commendation emphasised.

Your reviewer's working experience of nearly 50 years shapes a number of critical points upon which to judge the fulness and accuracy of the text, and the text more than satisfies such critical examination.

In sequence of chapters the first four deal with wood formation, structure, proximate composition, with a special account of lignin and lignification, and colour reactions by which identified; the next six chapters develop the subject of "Cellulose," dealing with hemi-celluloses, the typical celluloses of cotton and wood, the modifications included under "Gelatinisation" and by interaction with oxidants and acids. Chapter 10 deals with the conversion of celluloses to sugars, and Chapter 11 with various interactions of wood substances with reagents.

After these follow pulping processes (12), destructive distillation (13), bacterial and fungoid attack (14), animal digestion (15). The concluding chapter describes in detail some 40 laboratory methods and processes of determining proximate components of mixtures and ultimate constituent groups of individuals comprised in the field connoted by the title of the work.

It is our next duty to make certain critical reflections, the first of which is that writers of books on these subjects should be aware that their subject matter tends to the "disperse," in evident correlation with a primary characteristic of the object matters. Cellulose as subject, or objectively as a form of matter, confers apparent solidity upon a large, even multiple proportion of water. Now our brother chemists of the definitely systematised sections of the science are disciplined in a literature marked by a highly concentrated, even crystallised, form of expression.

These are the characteristics of "Beilstein." Our familiarity with this text, however, induces forgetfulness of the "genial" labours involved in the elaboration of such a work. If authors in the cellulose field were mindful of this model they would not merely correct and check the present diffuse expansion of our sectional

literature, but would clear the vision of research workers, many of whom implicitly confess that they "cannot see the wood for the trees." Thus the present author evades the task of laying a ground plan conforming with the logic of the science, trusting to an empirical classification of subject matter to ensure coherent exposition. As an illustration, Chapter 9, "Action of Acids on Cellulose," ranges from the "hydrocellulose" degradations to the synthetic ester reactions; these are polar opposites and a section which appears to unite the underlying conceptions confuses rather than elucidates. There is a chapter (No. 7) under the heading "Gelatinised Cellulose," dealing exclusively with cellulose-water interactions and effects. The application to these of the terms "hydrate" and "hydration" is ruled out after discussion, in favour of a word merely descriptive of an external manifestation of intermediate effect, i.e., of dispersion. Now there is no ascertainable break, e.g., in the hydration effects from that of "hygroscopic moisture" through the mercerisation phase, to that represented by the gelatinised xanthate and viscose; the conversion of wood pulp to "Pergamyn" is continuous, and a function of the conditions of beating. In dealing with these the author makes repeated use of the rejected term "hydration," with the apology of the inverted commas, which produces the effect of ceremonial dress qualified by a coloured necktie.

But "Gelatinisation" is equally characteristic of what we may describe, in following the argument, as cellulose dehydrates, the esters of the nitrate type, the properties of which are dominated by the unresolved complex. On the author's plan these derivatives are inappropriately treated, as stated, in a mixed company—aristocrats with poor relations—and they are left out of what should be a comprehensive treatment of dispersoid phenomena.

Similarly in the chapter on oxycellulose the empirical "viewpoint" is preferred with the result of a record of investigations in time sequence—excellent history, but confusing the modern student in his search for the underlying and essential factors.

A further and last reflection is based upon a statement of critical general import in the preface: "The vast number of organic compounds has been largely produced from simple chemicals by synthesis. The research was prosecuted on the basis of chance and probability, and was not hampered by knowledge of an existing sample which had to be duplicated or torn apart." Through the obscurity of these misused terms and aided by the context, we discern, though dimly, the author's intention to contrast the basis and discipline of systematic chemistry with those of the section comprising cellulose and lignin, but with the apparent result of inverting the accepted view. In the first place, the latter are "organic" compounds, as so distinguished from the "vast number of carbon compounds" of the systematic science. And in respect of the contrast of research method, it is the order of progress in the systematic science to "tear apart" or rather methodically to dissect an existing sample, to duplicate it, but beyond this in thus verifying its constitution to confirm and extend theory, the dominating pursuit, particularly ruling out the factors of chance and probability.

Contrariwise any student interested in the philosophy of the subject will discern a notable element of chance in the historical evolution of the chemistry of cellulose and wood; also the influence of probability, periodically yielding to necessity as the mother of invention, but under rigorous birth control and with very discriminating selection of father.

These reflections are not intended to prejudice the reception of a book reflecting the industry and competency of the author—but rather to point the way to another which shall better fulfil the exacting demands of students to whom Beilstein is a Bible. C. F. CROSS

THE PAPER MILL CHEMIST. By HENRY P. STEVENS, M.A.
Third revised Edition. Pp. ix + 317. London:
Ernest Benn, Ltd., 1926. Price 10s. 6d.

This useful book is very well known, and the present writer believes that it has been and still is much appreciated by chemists and others concerned with the chemistry and technology of the pulp, paper-making and stationery trades. It first appeared in 1908, and a second revised and enlarged edition followed in 1919. We have now the third revised edition under review.

Apart from an enlargement in the size of the pages, the general lay-out of the volume is exactly the same as that of its predecessor of 1919, even to the total number of pages. The size of the original volume was decidedly convenient for slipping into the pocket when one required it for reference whilst engaged in the factory, and, consequently, one is disposed to be just a trifle critical of the wisdom of the change which has been made, especially as there would seem to be no practical advantage gained by the alteration, the disposition of the letterpress and the illustrations being quite the same.

A fairly careful comparison of the two editions has been made, and one is not a little surprised to find that, with one exception on page 172, where, in a brief footnote, Sanders' alternative method of titrating bisulphite liquor is given, new material is non-existent. Considering the activities of the various technical associations attached to the industry in this country, Canada, U.S.A., Germany, etc., it is somewhat disappointing that some new data of sufficient importance and value to be incorporated in a book such as this have not been gleaned from the published work of the past seven years. A good deal of space has rightly been given to the analysis of sulphite liquors, but a similar treatment of sulphate liquor is wanting. Some brief consideration might have been given to the smelting furnace for converting the salt cake to sulphide of soda, to the more modern method of washing wood pulp in the diffuser, and so forth. One, of course, recognises that the publication is not intended to be a complete handbook in the true sense of the word, and that the author is, no doubt, strictly confined to certain limits as to the size of his volume; but, after all, these are matters of no little interest to British readers, and it is not to be forgotten that the book is also for sale on the American Continent. For this latter reason one considers that the American gallon and the short ton should be mentioned in the chapter on weights and measures, as well as the conversion figures for

"grammes per litre to lbs. per cubic foot," and *vice versa*, factors which are continually required in practical mill work.

A few minor errors might just be mentioned in conclusion. The formula Na_2CO_3 on page 68, line 26, is obviously a printer's error. On page 24, Table IX, the printing of the names of the chemicals has been badly done, and the footnotes on pages 297 and 299 should be brought up to date. J. T. STRACHAN

CHEMISCHE TECHNOLOGIE DER ORGANISCHEN VERBINDUNGEN. Edited by Dr. R. O. HERZOG. Second new and enlarged edition. Pp. xii + 997. Heidelberg: Carl Winter, 1927. Price, paper 66 m., bound 70 m.

The object of this book, as stated in the preface, is to give a coherent and readable account of the methods and materials pertaining to the chemical technology of organic compounds, but it is rather doubtful whether this object has been attained. Some sections are clear and pleasantly readable, but others, from their very nature, are bound to be somewhat of the dictionary type. The task of making a work of nearly a thousand large pages readable and attractive to the general student is bound to be almost a superhuman one. On the other hand, it is obvious that a full and encyclopædic account of such a wide field would extend far beyond the limits of one volume—even a large one such as this. For this reason, it is not surprising to find that many sections are far too short and inadequate to be of much help to the technical chemist, and in almost every case the information is considerably less detailed than that in the corresponding sections of Ullmann's *Enzyklopädie*.

Subject to these reservations, the book can be recommended as being sound and accurate as far as the reviewer has been able to judge. It is well printed and copiously illustrated, and contains many large-size folding drawings and plans of plant and factory lay-out. The first section of the book is divided into the following subsections:—tar and bitumen; oils, fats, and waxes; resins and rubber; carbohydrates; fermentation industries; proteins (tanning, glue and gelatin, milk and its products). The second includes subsections on:—coal tar dyes (including ink); essential oils and perfumes; pharmaceutical products; explosives; photographic preparations (including photographic paper etc.); special preparations, including organic acids, solvents, acetylene and its products, and formaldehyde. The third section is devoted to the chemical technology of textiles, and is, perhaps, the most detailed in the book. It includes dyeing, bleaching, mercerisation, loading, printing, chemical cleaning, etc.

In a work of this size, by so many different authors, there is bound to be a good deal of difference of treatment, some sections being far better than others. Although very free from actual errors, the severe compression of certain sections often gives a false perspective which may prove nearly as misleading as actual error. One of the weakest sections of the book is that dealing with pharmaceutical products, which occupies only 29 pages, and is so compressed as to be of very little value. Insulin, for example, is dismissed in five and a half lines, and the

bald statement that the pancreas used for its preparation must be fresh is almost misleading in its lack of emphasis. The whole important subject of organic arsenic and antimony compounds is compressed into twenty-seven and a half lines, and no mention at all is made of the important work of British scientists on derivatives of ergot, adrenaline, and other important substances. The section dealing with essential oils and synthetic perfumes is also very meagre. The section devoted to carbohydrates includes chapters on celluloid and artificial silk, but the 13 pages allotted to the latter are somewhat inadequate, in view of its importance at the present time. Some cross-reference should be made to this chapter in the section on textiles. Amongst the better parts of the book, mention may be made of those on linoleum and on the products derived from acetylene. The latter, though very brief, is clearly written, and has an excellent diagrammatic scheme of the industry. It is surprising that the important subjects of low-temperature carbonisation and hydrogenation of coal are ignored. The book concludes with a section on the subject of effluents and their purification. The importance of this troublesome question is generally not sufficiently recognised in technical literature, and the inclusion of this section is therefore very welcome.

PERCY MAY

DAS KALKBRENNEN MIT BESONDERER BERÜCKSICHTIGUNG DES SCHACHTOFENS MIT MISCHFEUERUNG UND DIE GEWINNUNG VON KOHLENSÄUREHALTIGEN GASEN. By BERTHOLD BLOCK. Second enlarged edition. Pp. xii + 512. Leipzig: Otto Spamer. 1924. Price: paper, 25 g.m.; bound, 27-50 g.m.

The whole subject of lime burning is treated comprehensively in this book, both from the theoretical and practical standpoints. An enumeration of all the points discussed would occupy too much space, but the scope of the book can be gathered from the following summary.

The opening sections contain a few statistics and an outline of the most important applications of lime, which, so far as quantity is concerned, are in building, metallurgy, agriculture and the chemical industries. The chemical and physical processes involved in lime burning are clearly stated. Throughout the book the author keeps prominently in view the division of the process into three periods, viz. "pre-heating," "burning" and "cooling," and the practical detail incorporated may be exemplified by the fact that several graphs are given showing the relation between the size of the lumps of raw limestone on the one hand and the duration of burning and the maximum temperature attained on the other. In order fully to appreciate the subject of fuel consumption, this is calculated first for an "ideal lime-kiln" from thermochemical data and the distribution of the total heat over the preheating, burning and cooling periods is traced. In the following 100 pages the use of various classes of solid, liquid and gaseous fuels is discussed, and even the question of burning lime by electricity is touched upon. Here again the practical aspect is not lost sight of, for data are given showing the size of the lumps of coke that can be used in shaft kilns to secure economical and efficient burning. Nearly 40 pages are devoted to the description and testing of the refractory linings for kilns, and mention of the aluminous

product, "dynamidon," is evidence that the section is well up to date, and the practical character of the information is illustrated by the explanation of the right and wrong way of laying blocks of quartz-schist.

Although the principles embodied in rotary-, ring-, and tunnel-kilns have been applied to lime-burning, the old form of shaft-kiln appears to hold the predominant place still for economy both in fuel and labour. The well-known method of charging these with alternate layers of raw material and fuel is referred to by the author as "mischfeuerung," though others prefer different terms, such as "schichtfeuer." Details of the construction of kilns are given, and also an interesting account of experiments the author has made on "layer formation" by means of a model kiln, using small pieces of marble, some of which were coloured red. In discussing the application of the waste gases, it is pointed out that when these are used in sulphur recovery they must be free from oxygen, as in the Chance process, which, by the way, is written "Chanze," one of the few misspellings in the book. Several sections are occupied with the engineering side of the subject, such as natural and artificial draught, carbolic acid pumps, and methods of filling and emptying kilns.

A section is devoted to the composition and properties of the raw materials and products, and contains a number of tables of analyses of specimens from various localities and the effect of impurities, such as silica, etc. It is pointed out that many limestones contain bitumen and other organic substances which, though combustible, do not diminish the fuel consumption during burning, because they are volatilised during the pre-heating period, and in fact absorb a portion of the energy of the fuel in the process of volatilisation. A section of general interest is one in which various appliances are described for the control of the burning process and testing of the products, etc. One point may be noted, that for observing the flow of gases, the device first mentioned, depending on the insertion of a throttle disc in the gas main, would be less reliable than the Pitot tube mentioned later.

The book is well printed, and the text is illustrated with 270 diagrams and plates which on the whole are clear, but some are on rather too small a scale and some of the graphs are difficult to interpret, as they are plotted vertically, instead of horizontally, on the page. Certainly the book can be recommended to those who are directly connected with lime-burning, and others who are interested in the application of science to industry will find much that is not only of value, but also suggestive to them. A book of this type would form very useful reading for students of chemical technology, as it gives illustrations of the way in which technical problems can be attacked and solved.

The author is an enthusiast on the subject of lime-burning, and the wide range of application of the products in commerce and industry. Two quotations from the book seem to the writer to sum up the author's mental attitude—"Kalk ist die Grundlage jeder Kultur" and "Beobachtung ist alles." Though one might demur in accepting the former dictum, no objection can be raised to the latter.

WALTER C. HANCOCK

DIE CHEMIE DES STEINKOHLENTEERS. By GUSTAV SCHULTZ. Vol. I. *Die Rohmaterialien*, edited by ERWIN FERBER. Pp. viii+568. Fourth edition, completely revised. Brunswick: F. Vieweg u. Sohn A.G., 1926. Price, bound 42.50 r.m.: paper 39.50 r.m.

The last edition of Schultz's work on the "Chemistry of Coal Tar" appeared 27 years ago, so that considerable revision has been necessary in the preparation of the present edition. Judging by the first volume, which is under consideration, and which deals with the raw materials, the revision has been carried out in a thorough manner. The subject is treated particularly in its relation to the artificial organic dyestuffs, which themselves are dealt with in the second volume of the complete work, which has yet to appear. This volume is divided into three principal parts, dealing with the raw materials, intermediates, and notes on technical apparatus respectively. The section on raw materials opens with a short historical sketch of the development of the coal-tar industry, followed by a description of the properties of coal tar and the different distillation processes employed in its preparation. Numerous photographs and diagrams illustrate this part of the work.

The second part, dealing with the intermediates, occupies the greater part of the volume. Usually a book of this nature is at first a disappointment to the reader, inasmuch as his first action is to test it as regards its treatment of his own particular fields, which are usually limited in scope, and in which he is, of necessity, something of a specialist. In the case of the reviewer the work responded to this test as well as might be expected, whilst a careful examination of less familiar ground gave the impression that the whole section will prove of interest and use to all those needing a handy book of reference in this very wide field.

The third part gives a somewhat brief account of certain pieces of technical apparatus. Such a section is rarely of use to those in industry, but it might have been made of greater interest to students who have not the opportunity of a first-hand knowledge of plant. Thus, the apparatus described consists entirely of vessels used for various purposes, which, after all, are merely enlarged editions of similar laboratory plant. A student might well be expected to translate these familiar articles into terms of iron and steel, but who would expect him to conceive in his own imagination a filter-press or a modern centrifuge? J. E. G. HARRIS

PORTLAND CEMENT: ITS COMPOSITION, RAW MATERIALS, MANUFACTURE, TESTING AND ANALYSIS. By RICHARD K. MEADE. Third edition. Pp. xii+707. Easton, Pa.: The Chemical Publishing Co.; London: Williams & Norgate, 1926. Price: \$10.

The earlier editions of this book gained a reputation as a treatise that would appeal to and teach those actually concerned with the production of Portland cement, and the present issue should enhance that reputation. It is written in that spirit of free and open dissemination of information which is characteristic of industrial life in the United States, because so far as cement manufacture in that country, at any rate, is concerned the experience of one factory is usually available for other factories, and

even foreigners are not excluded from the community. We have here the astounding spectacle of a consulting cement expert publishing what one imagines must be a part of his stock-in-trade, if such a term is permissible in this connexion. It is rarely that discussions of some of the subjects here dealt with, such as the repairs costs of different classes of mills, the man-hours requirements of cement production, and the loss of heat by radiation from cement coolers, are to be found in print, and the information that is given has the value of being founded on experience. The raw materials, process of manufacture, and methods of testing of Portland cement are dealt with exhaustively in a scientific fashion, but always with a practical knowledge of the subject.

The thermal efficiency of rotary kilns is of vital interest to cement manufacturers because of its important bearing on cost of production, and this subject is discussed on the basis of heat balance sheets in a chapter on the scientific considerations of the burning process. There are many matters on which cement manufacturers hold various opinions, and the author's presentation of evidence and views on such are interesting and valuable. The effect of clinker-weathering and percentage of lime in the clinker upon the power required for grinding, the power required for running rotary kilns of various sizes, the cost of lubrication in cement works, the cost of building cement works, the absorption and distribution of power in cement manufacture, the design of coal-extraction screws, the capacities of rotary kilns—are all subjects of prime importance in the industry upon which information is always welcomed.

One of the more modern developments of cement manufacture is the application of the waste-heat boiler to recover the heat in the gases leaving the rotary kiln, and the actual results from a number of installations are given, with such useful details as the design of the air-sealing ring needed with the plants.

The cement works chemist is well catered for by detailed descriptions of methods of analysis (including rapid methods for works routine) based on personal experience, coupled with details of automatic sampling devices, the area required for laboratories, laboratory grinding, etc.

Being of American origin, the conditions dealt with are those existing in the U.S.A., and, although this does not materially detract from the utility of the book, lack of intimate knowledge of the British cement industry has led to statements which call for comment. The standard of British cement quality quoted is the obsolete British Standard Specification published in 1910, which has since been revised three times, and this doubtless accounts for the unfounded claim made by the author that American cement is superior to that manufactured in any part of the world. The existing British Standard Specification demands a tensile strength of 325 lb. per square inch at 7 days, and when this is compared with the American standard of 200 lb. per square inch there is no room for doubt as to the respective standards of quality in the two countries. The author's statement that cement ground to pass 90% through a 200-mesh sieve is impracticable could only have been written in ignorance of the fact that thousands of tons of British Portland (rapid hardening) cement are ground to pass 98% through the 200-mesh sieve.

THE MANUFACTURE OF ENAMEL PAINTS. By DOUGLAS WAIT. Pp. viii + 152. London: Scott, Greenwood & Son, 1927. Price 10s. 6d.

The title of this little volume is somewhat misleading. Actually, the book contains a very elementary account of the physical and chemical properties of paint and varnish materials with some special reference to the manufacture of enamel paints. The book may be of great value to students in evening classes who already have some knowledge of the practical side of paint and varnish manufacture, but it is not likely to be of much use to the general technical chemist who wishes to acquire some information on this branch of industry. Technical terms, well understood in the trade, are frequently introduced and taken for granted without any definition or indication of their meaning being given.

Part I comprises two chapters dealing with the elementary chemical and physical properties of pigments and two chapters devoted to white pigments. These are the best in the book, and give a brief but clear and, on the whole, accurate account of the opaque as well as the semi-opaque and transparent white pigments. Part II is concerned with paint and varnish mediums, and includes chapters dealing with thinners, oil bases, driers, etc. The information in this section is somewhat too scanty, and is not always very accurate in giving a good idea of modern methods. Part III is nominally devoted to enamel paints, but only the last two out of four chapters actually deal with the enamel paints themselves. Curiously enough, these chapters are the least satisfactory in the whole book, and are far too brief and scrappy to be of any value.

In spite of the adverse criticisms which it has been necessary to make, the book has many good features, and it might be found very useful as the basis of elementary instruction in the chemistry of paints and varnishes. It is well printed and illustrated, and is written in a clear and lucid style, though the number of split infinitives is somewhat formidable. The price is too high for a small elementary book of this type, and it is to be hoped that a second edition may appear at a price to place it more easily within the reach of elementary students, and others likely to find it useful.

PERCY MAY

LUBRICATION IN COLLIERY PRACTICE. By N. SIMPKIN, M.Sc., Assoc.M.I.Min.E., and A. DAWE, B.Sc. Pp. xiv + 167. London: The Colliery Guardian Co. Ltd., 1926. Price 10s.

Messrs. Simpkin and Dawe have set out to place in the hands of colliery managers, engineers and others engaged in actually running or supervising colliery plant, a small reference book into which one could dip at all and sundry times when desiring to know what grade of oil to purchase for lubrication purposes, and they have certainly achieved their aim.

Not only colliery engineers, but any engineer who is responsible for the proper running of machinery—nay, even the fitter-mechanic who is in charge of a particular machine will benefit (and the machinery also) by having this little book by them.

Really and truly the book consists of Chapter No. VII, but the other chapters are very interesting, and written in very concise form; the absence of padding is particularly pleasing, and the language and terms used are such as not to befog even the veriest mechanic.

Not only are the chapters describing the testing and interpretation of tests written interestingly, but the authors have departed from the usual method of describing the apparatus by borrowing the description from catalogues, and have gone out of their way in plentifully annotating the precautions required in carrying out the tests, which generally prove them to be masters of their job.

Having to deal presumably with the oils on the market or available for uses in collieries, the authors have perhaps made a little too much of compounded oils, and it may be as well perhaps to point out that to use compound oils in steam cylinders in presence of high-temperature and high-pressure superheated steam is like the bicycle lamp on the bicycle, "just sufficient to satisfy the policeman," since under the conditions prevailing, in such a steam cylinder the animal or vegetable oil used for compounding splits up into its chemical components and does not add to the effectiveness of the lubrication; but, on the contrary, results in sticky, semi-charred, gummy substance depositing on the slide valves and rods.

There is no engine oil, of whatever description, used or required to be used by the engineer which cannot be obtained as a pure mineral oil.

N. A. ANFILOGOFF

CASEIN: ITS PREPARATION, CHEMISTRY AND TECHNICAL UTILISATION. By E. L. TAGUE, Ph.D. Pp. v + 218. London: Constable & Co., Ltd., 1926. Price 17s.

The purpose of this book, as stated in the preface, is to explain the chemistry and the industrial uses of casein in the light of present-day practise. The first half is taken up with a study of the chemical and physical properties of casein; much space is occupied in detailing methods of preparation of pure casein and many of its compounds. But the author does well to point out the necessity for a large amount of intensive research work before the constitution and properties of the substances whose methods of preparation are described, are properly understood. The second half is taken up with a consideration of the methods of the technical preparation and of the uses of casein, and includes about thirty pages devoted to patents and prescriptions. The book supplies a much-needed want, and it is a useful addition to the literature of a substance whose remarkable properties endow it with great technical and commercial possibilities. If for no other reason the extensive bibliography should recommend the book to a place in all technical libraries.

R. A. BERRY

PHOTOGRAPHIC CHEMICALS AND CHEMISTRY. By J. SOUTHWORTH and T. L. J. BENTLEY. Pp. vi + 121. London: Sir Isaac Pitman & Sons, Ltd., and Henry Greenwood & Co., Ltd., 1927. Price 3s. 6d.

This book is not intended for the critical reader, and it would be unfair to review it in too critical a spirit. The authors have "hitched their wagon to a star."

when they state in the preface that "the volume is designed to give the reader a fully up-to-date and reasonably accurate account of the known facts and the theories that mark the modern science of photographic processes." If they have not quite achieved all they set out to do, they have produced a very readable little book which should prove useful to many photographers. It may be doubted whether the first part, an introduction to chemistry, is justified in its present form, and whether a single chapter of definitions would not be adequate, leaving more space for essentially photographic material. This would permit of a welcome expansion of the latter part of the work, which deals with negative processes, development, printing-out papers, etc. There is a good list of photographic chemicals, with their properties and uses, and a list of solubilities, concluding with a somewhat inadequate index. There are a number of slips in the text and a few misstatements, which do not, however, detract from the usefulness of the book, which is quite the best of its kind that has been published at so low a price. A word of praise is due to the publishers for the very excellent printing and the freedom from typographical errors. H. W. GREENWOOD

HIGH VACUA. By Dr. G. W. C. KAYE. Pp. xii+175. London: Longmans, Green & Co., Ltd., 1927. Price 10s. 6d. net.

High vacuum technique has, largely under the influence of the electric lamp and discharge tube industry, made unprecedented strides during the past twenty years. The development of the mercury vapour pump by Gaede, Langmuir and others has enormously facilitated the rapid production of low pressures; and side by side with this and other improvements in pump design has grown up a system of vacuum routine, much of which was unknown a decade or so ago.

This routine is dealt with in a very readable and practical manner in the volume under review. Much of the work is necessarily devoted to descriptions and diagrams of pumps, the statements not only of the limit of vacuum obtainable, but also of the relative speed of pumping being particularly welcome, although the actual dimensions of the pumps are seldom given. The efficiency of modern diffusion and condensation pumps would seem to be yet another confirmation of the real existence of molecules and of the kinetic theory, since the principles which govern efficiency of exhaustion in this way are based directly on the kinetics of molecules having abnormally long free paths.

Of general vacuum routine, fused metal-to-glass joints are particularly clearly treated. Many metals, in addition to platinum, are wetted by molten glass; and, even in those cases in which the coefficients of expansion differ considerably from that of glass, permanent joints may be made by suitable construction. This is of special importance in the case of copper, since it allows electrical leads to be fused directly into the glass. Analogous to these are joints between metal and silica, and between silica and glass. Many other practical points, such as the importance of wide connexions in high vacuum apparatus, the action of so-called "getters" for eliminating the last traces of

gas, the construction of mercury traps, the elimination of adsorbed gases, and the quantitative measurement of extremely low pressures are also dealt with.

Above all, Dr. Kaye is to be congratulated on having produced a book in which so much of the atmosphere of actual working conditions is reflected. It is a volume which should be of great practical help in the many branches of chemistry and physics in which high vacua are used. F. B. M.

THE LEAD STORAGE BATTERY. By H. G. BROWN, A.M.I.E.E. Second edition. Pp. 186. London: The Locomotive Publishing Co., 1926. Price 5s.

This work, which is divided into ten chapters with appendix, deals generally with the lead accumulator, and, although obviously written for those in charge of storage battery installations of moderate size, will be found useful by those whose interest in electrical storage does not extend beyond the cells required for wireless equipment or the motor car. The electrical accumulator industry has been transformed and enlarged beyond all expectation by the introduction of wireless and the rapid development of the autocar in this country, and there is a real call for some such publication as the above.

The treatment, which is essentially practical in character, will prove of great value to those for whom it is written. With a sense of fitness which characterises the whole work, the author summarises his advice to battery users in a series of "Don't's," all of which are pertinent, the last being well worth reproduction, viz., "Don't remain in doubt—consult the manufacturer if anything unusual occurs, and shift the responsibility on to him."

The book is copiously illustrated, but, as is often the case in many such works, a large number of the illustrations are so lacking in detail as to be of very little value. The author describes a useful series of chemical colorimetric tests for impurities in battery acid, and provides a novelty in the form of printed colour standards against which comparison should be made. For those in charge of storage batteries, the work can be thoroughly recommended, whilst to those concerned with small units it will prove a useful and interesting source of information, and it is to be hoped that in future editions the author will devote even more space to the treatment of the needs of this very large class of user.

C. A. KLEIN

CANADIAN INDUSTRIAL NOTES

It is announced that the British syndicate interested in the development of the north and east side of the Lake St. John district, Quebec, include Pease Partners & Co., of Darlington.

The Cooper Leaf Tobacco Company will erect a tobacco plant at Wallaceburg, Ont. The company will confine its immediate attention to the drying and curing of tobacco for the British market, but eventually it will manufacture tobacco products.

The Pabst Brewing Co., Saskatoon, Ltd., is erecting a brewery at Saskatoon, Sask., which will cost in the vicinity of \$300,000. The famous Pabst Brewing concern of Milwaukee, U.S.A., is interested in the new plant.

BOOKS REVIEWED, NOVEMBER, 1926, to MAY, 1927

The date on which the review appeared is given in brackets
at the end of each entry

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The Natural History of Ice and Snow. By Dr. A. E. H. Tutton, F.R.S. (21s.) Handbook of Photomicrography. By H. Lloyd Hind and W. Brough Randles. (New edition; about 12s. 6d.)

Scott, Greenwood and Son

The Manufacture of Enamel Paints. By D. Wait. (10s. 6d.) Starch-making and the Manufacture of Dextrin, Starch Sugar, Syrup and Sugar Colouring. By F. Rehvald. (12s. 6d.) Glue and Glue Testing. By Dr. S. Rideal. (Third edition, revised and enlarged, 12s. 6d.) Bone Products and Manures. By T. Lambert. (Third edition, revised and enlarged; 10s. 6d.)

Sherratt and Hughes

The Chemists' Year Book, 1927. Edited by Dr. F. W. Atack. (21s.)

MERCURY FROM COAL TAR

By W. KIRBY, B.Sc.

The company with which the writer has the honour to be associated operates continuous stills, which work on the principle of heating a stream of tar to a temperature such that the tar is sharply divided into two fractions, pitch and oils. The oils pass over as mixed vapours into a series of three condensers maintained at decreasing temperatures, where anthracene oil, creosote oil, and light oils are deposited in the order named.

When these stills are dismantled for overhauling, it is a customary experience to discover in "pockets" in the coil of the light-oil condenser quantities of free mercury. In order to arrive at an estimation, a trap was fitted to the lowest part of this condenser. After the lapse of six months the mercury collected in this manner amounted to one part of mercury from 7 million parts of tar. Weekly estimations were then undertaken, the quantities of mercury recovered being now much larger, averaging one part of mercury from 1.5 million parts of tar. It is highly probable that these estimations err considerably on the low side, as it would be expected that the vapourised mercury in the hot oil vapours leaving the pitch separator would preferentially condense in the anthracene and creosote condensers. It is a curious fact, however, that mercury is never found in these condensers. This may be due to the mercury being colloiddally dispersed in the heavy oils, a phenomenon which would be favoured by its condensation in minute quantities in the presence of enormously larger volumes of oil.

The mercury is deposited in a bright untarnished condition, but if it is not removed for long periods it is then usually discovered associated with variable quantities of mercuric oxide.

The possibility that mercury from this source might have an isotopic constitution differing from that of ordinary mercury induced the writer to send a few pounds of the metal to Prof. Aston, who kindly agreed to undertake its examination. His results, published in *Nature* of April 2, show that no difference in constitution could be detected.

The photographic effects of the mercury were examined in this laboratory, and were found to be normal.

The source of the mercury is possibly cinnabar as an impurity in iron pyrites or dispersed as such in the coal substance, or it may be present in the coal associated with bituminous matter such as idrialite.

The writer is indebted to Dr. C. C. Carpenter for permission to publish this note.

Tar Works,

South Metropolitan Gas Company.

CANADIAN INDUSTRIAL NOTES

The financial statement of the Asbestos Corporation, Ltd., for eleven months ending December 31, 1926, gave operating profits of \$1,237,008, compared with \$781,979 shown by the old company for the entire 1925 period. After the usual interest, depreciation, preferred dividends, etc. were deducted, a balance of \$205,228 was applicable to common stock. The general financial position of the new company is greatly improved over that of the old one.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICE

ANNUAL GENERAL MEETING, JULY 4 to 8, 1927

In accordance with the provisions of By-law 68, notice is hereby given that the Annual General Meeting of the Society of Chemical Industry will be held in the Debating Hall, The Union, University of Edinburgh, on Tuesday, July 5, 1927, at 10 a.m.

A programme of the Meetings appeared on page 392 of *CHEMISTRY AND INDUSTRY*, for April 29, 1927.

In accordance with the provisions of By-law 23, notice is hereby given that the following members of Council retire from their respective offices at the forthcoming Annual General Meeting:

Mr. Francis H. Carr, C.B.E., *President*; Dr. E. Frankland Armstrong, F.R.S., Professor J. W. Hinchley, Professor J. C. Philip, F.R.S., and Sir Richard Threlfall, K.B.E., F.R.S., *Vice-Presidents*: Mr. W. A. S. Calder, Mr. W. H. Coleman, Dr. William Cullen, and Mr. J. Arthur Reavell, *Ordinary Members*.

Mr. Francis H. Carr, C.B.E., has been nominated for re-election to the office of President under By-law 19, Mr. E. V. Evans, Mr. C. S. Garland, Dr. H. Levinstein, and The Right Hon. Sir Alfred Mond, Bart., M.P., have been nominated Vice-Presidents under By-law 20.

Dr. E. W. Smith has been elected Hon. Treasurer, and Dr. E. Frankland Armstrong has been elected Hon. Foreign Secretary.

Members are requested to nominate on or before May 13 next, fit and proper persons to fill the four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the General Secretary of the Society.

By-law 22. An ordinary Member of Council shall be nominated by five or more members upon Form B in the Schedule, a copy of which form shall be furnished by the General Secretary upon the written or verbal request of any member; but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form.

A nomination shall be declared invalid by the Council if:—

(a) The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

(b) The nomination is not made on the authorised printed form, or substantially not in the manner directed thereon.

(c) The nomination form is signed by less than five members not disqualified or not ineligible to nominate as provided by the By-laws.

(d) The nomination form is not received before or upon the day appointed therefor.

(e) The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the General Secretary, and shall not be submitted for election.

J. P. LONGSTAFF,
General Secretary

CHEMICAL ENGINEERING GROUP

An additional meeting of the Chemical Engineering Group was held in the Cinema of the American Film Company at Wardour Street on Monday evening, April 25, under the chairmanship of Mr. F. H. Rogers, when Professor J. W. Hinchley gave a paper on the Holley permanent mould machines.

At the beginning of the lecture Professor Hinchley dealt with the great utility of such a machine in repetition work, and touched upon the difficulties that are to be encountered when permanent moulds have to be used for iron castings. The moulds in this machine are formed of two light hollow cast-iron moulds, which can be opened and closed by means of a toggle joint mechanism. The thickness and outer surfaces of these moulds are designed to ensure a proper rate of removal of heat after the metal has been poured, whilst the inner surface is coated with a refractory material. This material must be sufficiently hard to resist the cutting action of the molten metal, and of sufficient thickness to transmit the heat at the proper safe rate, and of such a nature that no gases are formed when in contact with the molten metal. The machine in its latest form consists of a horizontal circular table, which is rotated at the rate of one revolution every two minutes. On this table or merry-go-round are fixed twelve of these moulds. After a casting has been discharged from a mould the mould is cleaned by a blast of air at a pressure of about 200 lb. per sq. in., and is then coated with a layer of carbon about $\frac{1}{32}$ in. thick from an acetylene flame. Should a core be necessary, it is then put in position by hand, and the mould closed. Further rotation of the table brings the mould opposite the pourer, when it is filled with molten metal. After filling, the table rotates through a distance which allows sufficient time to elapse for the molten metal to set, and when this point is reached the mould is automatically opened and the casting ejected by suitably placed ejection pins. Further rotation of the table brings the mould round to the air blast where the cycle of operations is repeated. On such a machine casting carburettor parts, motor-car pistons, etc., a man can pour four hundred castings per hour.

Professor Hinchley also discussed the composition of the iron used in such repetition work, as well as the strengths of the castings produced. He also drew attention to the fact that an extremely uniform casting was obtained, and therefore the allowance for machining could be considerably reduced from that prevalent in repetition work. A number of castings were on view to illustrate the various points discussed.

After the lecture a film was shown of the works of the Holley Carburettor Company, in which both the large single-mould machines and those of the rotary type were shown under working conditions. The film was followed by an interesting and pertinent discussion, in which a large number of gentlemen took part.

BIRMINGHAM AND MIDLAND SECTION

At the meeting held at the University of Birmingham on April 5, Mr. Collis presiding, Mr. A. A. King, works manager, Messrs. Albright & Wilson, Oldbury, read a paper on "Ultra-violet light."

One of the most urgent needs of chemists and others was, he said, practical filters by means of which one might isolate any selected region in the ultra-violet spectrum. None is at present available, and we are driven to compare differences in reaction obtained with filters which still allow visible as well as more or less ultra-violet rays to pass through them. Perhaps the most useful filter for fluorescence work is Chance Bros.' ultra-violet glass, which cuts out all but the extreme red of the visible spectrum, and transmits rays from 4000Å to 3250Å.

It is physiologically impossible to experience complete darkness in a room into which invisible ultra-violet rays are emitted. Even though every other material within range is non-fluorescent, the lens of the eye is fluorescent in these rays, and the retina becomes aware of a blue, misty illumination. This principle was made use of during the war for invisible light signalling.

A much more important application of this effect is that, by their fluorescence, certain imitation gems can be distinguished from the natural stones. The method is not confined to such materials, and it promises important development. The presence of minute impurity in some substances can be detected by its fluorescence, and afterwards identified by chemical methods.

Even laboratory "distilled" water may profitably be examined in the rays. Certain impurities, otherwise unsuspected, show up, and the author demonstrated the need for a succession of redistillations, culminating in double distillation in platinum vessels, to obtain a practically non-fluorescent sample of distilled water. Ultra-violet light could be used for testing the presence of arsenic. Some twelve months ago he had recourse to the most refined of the known methods of detecting and estimating minute quantities of arsenic in food substances. Finally he selected the Gutzeit method, which gives a mercury-arsenic yellow stain, as most suitable for further examination. An attempt to intensify the stain in monochromatic light served its purpose, but it occurred to him to expose the stains to ultra-violet radiation. It was discovered that by the method one may estimate quantitatively arsenious oxide of an order of minuteness beyond what has been hitherto possible with any other method with which he was acquainted. Absorption of the rays by the mercury arsenic stain makes this intensely black, so much so that stains which are quite indistinguishable in ordinary light stand out a startling black upon a fluorescent background. They had been able to estimate with certainty as little as 0.00000005 gram as As_2O_3 , and to detect even smaller masses.

Arising from this work the author showed that, with good samples of crystallised mercuric chloride fluorescing in the rays, some parts are a bright pink, while others are very faintly blue. This mercuric chloride twice recrystallised in the laboratory showed no sign of the pink fluorescence, which was found to be due to the presence of mercurous chloride. The light showed the distinction between vegetable and mineral oils; amber (genuine and artificial); uranium acetate and nitrate; and some organic and inorganic pigments. Such experiments opened up a new field of titration work. It was suggested by work done by Mellet and Bischoff in

detecting obliterated and forged signatures on cheques etc. by exposing them to ultra-violet radiation. His example was the titration of phosphates which he had found useful for muddy liquors. To an ordinary sodium phosphate in neutral solution was added a drop of saturated solution of quinine sulphate. As long as the solution is alkaline there is but a trifling fluorescence, but the approach to acidity is heralded by an intensely blue fluorescence. This is due to the temporary and eventually permanent formation of the acid sulphate of quinine. He suggested that the method may lend itself to the investigation of the mixing of reactive and other solutions.

CALENDAR OF FORTHCOMING EVENTS

- May 6. SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group*. Annual General Meeting. Imperial College of Science and Technology, Kensington, S.W.7. Formal business meeting at 6 p.m. An informal dinner will be held at 6.30 p.m., and at 8 p.m. a paper entitled "Chemical fire extinguishers" will be read by Dr. W. R. Ormandy.
- May 6. SOCIETY OF CHEMICAL INDUSTRY, *Manchester Section*, 16, St. Mary's Parsonage, Manchester, at 7 p.m. Joint meeting with the Fellows of the Chemical Society resident in Manchester and district. "Mechanism of some simple reactions from the standpoint of the electronic theory of valency," by Prof. R. Robinson.
- May 7. BIOCHEMICAL SOCIETY, The University, Oxford Road, Manchester, at 3 p.m. (1) "Variations in the serum calcium of rabbits," by Kathleen Cullane and S. W. F. Underhill. (2) "Attempted isolation of a type precipitinogen from *B. aertrycke* Mutton," by F. C. Happold. (3) "Experiments on the origin of succinic acid in muscle and liver," by P. W. Clutterbuck. (4) "Action of tyrosinase on phenols," by C. E. M. Pugh and H. S. Raper. (5) "Chemical changes in muscle," by E. Boyland and A. D. Ritchie (introduced by H. S. Raper). (6) "The carbohydrate-phosphate component of animal nucleic acid," by J. Pyde and J. M. Peterson. (7) "Some observations on methylated glycerophosphates," by J. Pyde and E. T. Waters. (8) "Fermentation of propionic acid by *Aspergillus niger*," by T. K. Walker and P. D. Coppock (introduced by H. S. Raper). (9) "Hemocyanin. Part IV. The dependence of the shape of the oxygen dissociation curve on the state of ionisation of the protein," by Ellen Stedman and E. Stedman.
- May 11. INSTITUTE OF METALS, Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1, at 8 p.m. Seventeenth Annual May Lecture on "The growth of crystals in supersaturated liquids," by Sir H. A. Miers.
- May 11. ROYAL SOCIETY, Burlington House, Piccadilly, W.1, at 8.30 p.m. *Conversazione*.
- May 12. OIL AND COLOUR CHEMISTS' ASSOCIATION. Annual General Meeting. Rooms of the National Federation of Paint Manufacturers, 8, St. Martin's Place, Trafalgar Square, London, W.C.2, at 8 p.m. "Some physical factors influencing properties of paint pigments," by A. de Waele.
- May 18. CHEMICAL SOCIETY, Theatre of the Royal Institution, 21, Albemarle Street, W., at 5.30 p.m. The Faraday Lecture entitled, "Problems and methods in enzyme research," by Prof. Richard Willstätter.

THE INSTITUTE OF FUEL

A joint meeting of the Vice-Presidents and Members of the Councils of the Institution of Fuel Technology and the Institution of Fuel Economy Engineers was held under the chairmanship of Sir Alfred Mond at 37, Lowndes Square, S.W.1, at 3 p.m. on April 29. As President of both Institutions, in November last Sir Alfred Mond, having found a general desire both amongst those most closely associated with the problems of fuel economy and amongst those throughout the country who have a general interest in the question, that the two existing Institutions should be merged into one, suggested terms of fusion.

The following terms of fusion were subsequently accepted by the Councils of both Institutions:—

(1) That the name of the merged Institutions be "The Institute of Fuel."

(2) That the Councils of both Institutions as constituted at present be merged and form the Council of the "The Institute of Fuel," and that in the autumn following the inauguration of the Institute of Fuel a new Council shall be elected by ballot of the members of the Institute.

(3) That the present Honorary Secretaries of each present Institution be joint Honorary Secretaries of "The Institute of Fuel."

At the meeting the final steps for the fusion of the existing Institutions and the inauguration of the "Institute of Fuel" were taken. Sir Alfred Mond expressed his great gratification that the fusion had been successfully accomplished, and thanked the Vice-President, Chairman, and Members of the Council of both Institutions for their co-operation in bringing about the present happy result. The essential importance of the problems connected with fuel economy and fuel technology to the future of British industry was becoming increasingly recognised. The Government was vitally interested in the subject, and had appointed a National Fuel and Power Committee, of which he had the honour to be chairman, to investigate and consult upon the various problems in their many aspects. That Committee was progressing satisfactorily with its work, and it was of the utmost importance that there should be a unified Institution, important in numbers and personnel, to investigate, advise and instruct the Committee and the community on these highly technical matters. From the readiness to co-operate which had already been shown, he felt that the "Institute of Fuel" was being inaugurated under the most favourable auspices. There have been many who had been waiting to join a unified Institute and now doubtless they will all come forward to add strength and numbers to an institution which is to play a great part in the future of British industrial expansion.

Sir Alfred Mond moved the formal resolutions to give effect to the fusion, which were seconded by Sir Hugh Hirst, who said that on account of the national importance of the subject and of the fact that it was essential there should be one body to deal authoritatively with the problems of fuel technology, he was very glad that the fusion had been effected.

Sir William Larke proposed, and Sir Philip Dawson seconded, the appointments of Mr. H. L. Pirie and Mr.

Edgar C. Evans as joint Honorary Secretaries of the Institute of Fuel. This was carried unanimously.

The following were present at the meeting:—Sir Alfred Mond (President), Sir Hugo Hirst, Sir David Milne-Watson, Colonel Sir William Smith, Prof. H. B. Dixon, Prof. R. V. Wheeler, Sir William Larke (Chairman, Institution of Fuel Technology), Mr. P. C. Pope (Chairman, Institution of Fuel Economy Engineers), Messrs. G. R. Thursfield, F. A. Freeth, T. Barratt, A. W. A. Chivers, R. Lessing, John D. Troup, Sir Philip Dawson, Messrs. H. Tomlinson-Lee, John Bruce, J. Gander, T. Trimmell, W. M. Selvey, Edgar C. Evans, S. McEwen, W. A. Woodeson, E. W. L. Nicol, H. L. Prie, L. C. Harvey, N. W. Travers, and T. Hardie.

CERAMIC SOCIETY

The annual meeting was held at the North Staffordshire Technical College, Stoke, on April 11, Mr. F. Turner presiding. Mr. Frank West, President of the Refractory Materials Section, was present. The Council, in their 28th annual report, stated that there was a membership of 707 and 77 collective members. During the closing sessions eight meetings were held at Stoke, and the Refractory Materials Section had a successful two days' meeting at Leeds in September. The arrangements had been completed for the visit of members to Czechoslovakia. Between 70 and 80 members were intending to go. They would be the guests of the Czechoslovakian Ceramic Society. The President announced that the President for the ensuing year would be elected by the Refractory Materials Section. The following other officers were elected: Vice-Presidents, Mr. George Price, Mr. B. J. Moore, and Mr. Walter Emery; Members of Council, Messrs. A. J. Campbell, C. D. Grimwade, G. Price, T. G. Simpson, G. Campbell, J. A. Audley, A. Heath, G. Allman, J. H. Colclough, T. A. Simpson, T. Simpson, D. F. W. Bishop; Hon. Sec., Dr. J. M. Mellor.

CORRESPONDENCE

THE LIFE OF FABRICS

SIR:—The Department of Scientific and Industrial Research has just issued a pamphlet on "Co-operative Industrial Research" which has received a very good Press. This is most welcome to those people who know what struggles some of the associations are having to maintain existence when some of the trades with which they are connected are in such bad financial condition. It seems a pity that such a ludicrous estimate should be included as that which is given on the question of laundry research. I refer to the item, "Depreciation of fabrics calculated on five years' life." I don't think I am wrong in assuming that collars and sheets form staple articles in a laundry's operations. Is anybody—scientific or otherwise—expected to believe that collars and sheets last five years when sent to laundries. The Laundry Research Association has no need to be bolstered up by such a ludicrous estimate. If the Laundry Research Association would educate laundries to cease using perborates and hypochlorites, the length of life of collars etc. would be increased, though not to a period of five years.

* Yours faithfully,
C. M. WHITTAKER

PERSONAL AND OTHER ITEMS

The King has been pleased to nominate Dr. H. H. Dale, F.R.S., to be, for five years, a member of the General Council of Medical Education and Registration in the United Kingdom, in succession to Sir Nestor Tirard, M.D.

The Rt. Hon. Sir Alfred Moritz Mond, M.P., has been appointed a Director of the Westminster Bank.

Mr. E. M. Myers has been appointed manager of the coke-ovens and by-product plants of Bolekow, Vaughan & Co. in the Bishop Auckland district.

The University of St. Andrews will confer the honorary degree of LL.D. on Sir Alfred Mond, P.C., M.P., and on Sir Richard Gregory, the Editor of *Nature*, at the graduation ceremonial on June 28.

Prof. C. A. Edwards, D.Sc., professor of metallurgy at the University College of Swansea, has been appointed Principal of the College.

The Council of Manchester University has accepted the resignation of Professor F. L. Pyman, D.Sc., Ph.D., F.R.S., who has been appointed head of the research department of Messrs. Boots, Ltd., Nottingham. Prof. Pyman has held the Chair of Technological Chemistry in the Faculty of Technology since 1918.

Dr. G. J. Robertson, M.A., B.Sc., has been appointed to the senior lectureship in chemistry at St. Andrews, vacant through the resignation of Dr. G. McOwan.

At a recent meeting of the Académie des Sciences, it was announced that Baron Edmond de Rothschild had made a gift of 38,000,000 f. (about £306,000) for the formation of an institute for chemical and physical research as applied to biology.

April 30, 1927, marked the completion of the first century of University College, London, which has always been a centre of research as well as of teaching. A chemical laboratory was opened in the college as early as 1828, and the staff has included distinguished investigators such as Thomas Graham (of colloid fame), A. W. Williamson, and Sir William Ramsay.

We deeply regret to learn of the death of Professor Starling, the eminent physiologist, to whom we owe the discovery of hormones, and much fundamental work on the physiology of the blood system.

The late Mr. A. W. Scott, for 55 years professor of science at St. David's College, Lampeter, left £33,521. Amongst other bequests he left £7000 to the University of Cambridge, and £1000 to the Royal Society for the advancement of physical science, £250 to the British Association, the Physical Society and the Institute of Physics; and an interest in the residue to the Universities of Oxford and Cambridge.

The late Mr. W. H. Stuart, J.P., chairman of the British Flint Glass Manufacturers' Association, left £44,463.

Research Association of British Paint, Colour and Varnish Manufacturers

The Director of Research to this Association, Dr. L. A. Jordan, has issued some notes on the activities of the Association, from which we learn that the subscriptions already guaranteed exceed the minimum required to secure the full participation of the Department of

Scientific and Industrial Research for the five years. A programme of research has been drawn up, and steps are being taken to inquire into the problem of growing certain oil seeds, particularly tung and perilla, within the Empire. Co-operation with the British Electrical and Allied Industries Research Association on problems of insulating varnishes is contemplated, whilst the Boot Trade Research Association has pointed out that the cracking of patent leather is essentially a paint problem. Further co-operation has begun in connexion with paint and varnish standard specifications, colour standards, and the measurement of colour fading, and exposure tests. The Laboratory at Teddington is practically ready for occupation, and good progress has been made in the formation of a card index and the compilation of records of work in particular subjects.

British Association

The ninety-seventh annual meeting of the British Association will be held at Leeds on Wednesday, August 31, to September 7, 1927. The president is Prof. Sir Arthur Keith, M.D., LL.D., F.R.S., and the sectional presidents include Prof. E. T. Whittaker, F.R.S. (Mathematical and Physical Sciences), Dr. N. V. Sidgwick (Chemistry), and Mr. C. G. T. Morison (Agriculture).

High-Pressure Gas Research

The Department of Chemical Technology of the Imperial College announces that a special course of eight lectures on "High-pressure gas research" will be given on Fridays at 4 p.m., commencing May 6, by Prof. W. A. Bone, D.Sc., F.R.S., and Drs. D. M. Newitt and D. T. A. Townend. The fee for the course is one guinea.

Lectures in Metallurgy

The Worshipful Company of Armourers and Brasiers announces that a course of three lectures on "Special steels and their application in engineering," will be given at the Sir John Cass Technical Institute, 31, Jewry Street, Aldgate, E.C., by Dr. W. H. Hatfield, on May 17 and 31, and June 14, at 6.30 p.m.

The Armourers and Brasiers' Company also announces that a course of three lectures on "Oxidation, corrosion and passivity of metals," will be given at the Royal School of Mines, Prince Consort Road, South Kensington, S.W., by Mr. U. R. Evans, on May 18 and 25, and June 1, 1927, at 5.30 p.m. Admission to both courses is free without ticket.

The Company has also founded senior and junior industrial bursaries, particulars of which may be obtained on application to the company's offices at Armourers' Hall, 81, Coleman Street, London, E.C.2.

Research Scholarships in Technology

The Governing Body of the Manchester College of Technology announces that a limited number of Research Scholarships in Technology (each of a value not exceeding £100) will be awarded in July. Applications must be received before July 6. Subjects in applied chemistry and other technological subjects can be chosen for the research, which will be carried out in the College (Faculty of Technology of the University of Manchester).

Ramsay Memorial Fellowships

The Ramsay Memorial Trustees at the end of June will consider applications for a Ramsay Memorial Fellowship for Chemical Research. The value of the Fellowship will be £250 a year, to which may be added a grant for expenses not exceeding £50 a year. Applications must be not later than June 6. Full particulars as to the conditions of the award are obtainable from the secretary, Ramsay Memorial Fellowships Trust, University College, Gower Street, London.

The German Dye Trust

The *Times* reports that at a meeting on April 28 of the board of the I.-G. Farbenindustrie, it was stated that the gross profit for 1926 was 168,074,000 Reichsmarks, and the net profit, after writing off 75,236,860 Reichsmarks, was 68,718,255 Reichsmarks. A dividend of 10% is proposed. The board expressed its approval of the results shown during the year 1926. The improvement in industrial conditions had been evidenced in a marked degree in the business of the I.-G. In spite of increased competition, it had been possible to increase production and exports. The market in Germany for pharmaceutical products had left something to be desired, but exports had developed favourably. It was noticeable, however, that several countries had adopted a protectionist policy for the encouragement of pharmaceutical industries at home. Owing to the fusion with the Cologne-Rottweil A.G., the activities of the I.-G. in the artificial silk domain had increased. In return for corresponding concessions, the I.-G. will factories immediately. It was prophesied that the I.-G. would shortly be taking a prominent part in German benzene production, and a large annexe to the present Merseburg works had been erected for the purpose of carrying out coal hydrogenation on an industrial basis.

Glanzstoff Silk in America

The Vereinigte Glanzstoff Works, of Elberfeld, has established the American Glanzstoff Corporation at Wilmington, in America, with a capital of \$7,000,000 7% preference shares and 300,000 shares without nominal value. The new firm will have all the Glanzstoff patents at its disposal, and will produce especially fine artificial silk thread. The average daily production at the commencement will be about 7 tons.

COMPANY NEWS

BRITISH DRUG HOUSES, LTD.

The report for 1926 shows a trading profit of £16,863, compared with £55,300 for 1925. With £6719 brought forward, there is available £12,491. The preference dividend absorbed £9680, leaving £2811, which it is proposed to carry forward. Many adverse factors combined to depress the profits. Being primarily a producing concern, the company suffered heavily from the general strike and the prolonged coal dispute. Also their trade declined with South America, owing to unfavourable conditions in that country. An encouraging increase in the turnover, both in the home and export trade, is recorded during the first three months of 1927.

RUBBER GROWERS' ASSOCIATION

Presiding at the ordinary general meeting on April 28, Mr. E. B. Skinner (chairman) said they deplored the deaths of seven members, including the Hon. C. H. Strutt, who had been a member of the council since 1913. The membership of the association continued to expand. The issued capital represented by the association had now reached £106,000,000. With regard to the accounts, the amount carried forward last year was larger than usual, mainly due to the closing down of the research station in Malaya at the end of October, consequent on the taking over of the Association's scientific staff by the Rubber Research Institute of Malaya, which is now operating in matters of rubber research for the whole of Malaya. The Honorary Gold Medal of the association had been awarded to Sir Edward Rosling and Mr. Eric Miller respectively for services rendered in connexion with the organisation and development of scientific research work for the plantation rubber industry. The work of the propaganda committee had continued in the direction of extending the existing uses of rubber and of investigating new uses. The two principal points of interest during the past year have been the establishment of the American rubber pool and the policy which many producers adopted of holding surplus stocks themselves instead of selling during a time when there was more rubber being produced than was required for the time being. These two factors helped to prevent wild fluctuations in price during 1926. It was believed that the average price for the current year would be 1s. 9d. The chairman felt they could look forward with confidence to the future, as all countries were realising the enormous value of rubber for so many purposes. He had great hopes that rubber would soon be used on a large scale for other purposes than tyres and tubes, which, at present, absorb approximately 80% of the world's output of rubber. With regard to the criticism contained in letters to the Press against the Stevenson scheme, the Association had consistently supported the scheme, and quite recently leaders of the producing section of the industry had publicly expressed their entire sympathy with a continuance of the scheme and pointed out its beneficial effects on the industry generally. The rubber industry lost a great friend and staunch supporter by the death of Lord Stevenson, and members of the Association, in appreciation of his valuable help, had subscribed £2870 to a scholarship fund to be named after him.

AMERICAN CYANAMID CO.

Dividends have been declared of $1\frac{1}{2}\%$ on the preferred stock, and 1% plus $\frac{1}{2}\%$ extra on the common stock.

THARSIS SULPHUR AND COPPER CO., LTD.

A dividend has been recommended of $7\frac{1}{2}\%$, equal to 3s. per share, less tax. After writing off £14,581, the sum of £99,522 has been carried forward. No dividend was declared for 1925.

EASTMAN KODAK COMPANY

The net profit for 1926 amounted to \$19,860,634, after providing for depreciation, Federal taxes, etc., compared with \$18,467,113 for 1925.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
Bisulphite of Lime—£7 10s. per ton, packages extra.
Bleaching Powder—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
Borax, Commercial—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid—£5—£5 5s. per ton, carr. paid.
Copper Sulphate—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate—£38 per ton d/d.
Nickel Ammon. Sulphate—£38 per ton d/d.
Potash, Caustic—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Sal ammoniac—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
Salt Cake—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%—£21 per ton. Sod. Bicarbonate (refined)—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
Sod. Phosphate—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt)—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide—Golden.—6½d.—1s. 5½d. per lb., according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
Arsenic, Sulphide, Yellow—1s. 9d. per lb.
Barytes—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide—2s. 6d.—2s. 9d. per lb.
Carbon Bisulphide—£20—£25 per ton, according to quantity.
Carbon Black—5½d. per lb., ex wharf.
Carbon Tetrachloride—£45—£50 per ton, according to quantity, drums extra.
Chromium Oxide, Green—1s. 1d. per lb.
Diphenylguanidine—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbanilide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep.—6s.—6s. 3d. per lb.

Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.

Charcoal.—£6 15s.—£10 per ton, according to grade and locality.

Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.

Red Liquor.—9d.—1s. 16° Tw. per gal.

Wood Creosote.—1s. 9d. per gal., unrefined.

Wood Naphtha.—Miscible, 4s.—4s. 3d. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.

Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.

Brown Sugar of Lead.—£40 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 8½d.—9d. per lb. Crude 60's, 2s. 6d.—2s. 8d. per gal.

Acid Cresylic, 90/100.—2s. 8d.—2s. 9d. per gal. Steady. 97/99.—2s. 1½d.—2s. 6d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.

Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.

Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 8d.—2s. 3d. per gal., ex works in tank wagons.

Toluole.—90%, 1s. 9d. to 2s. 0½d. per gal. Pure, 1s. 10d.—2s. per gal.

Xylol.—2s.—2s. 6d. per gal. Pure, 3s. per gal.

Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.

Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/160, 1s. 6d.—1s. 11d. per gal. Solvent 95/160, 1s. 6d.—1s. 7d. per gal. Solvent 90/190.—1s. 1½d.—1s. 4d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.

Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.

Pitch, medium soft.—7s.—80s. per ton, f.o.b. according to district. Nominal.

Pyridine.—90/140.—8s. 6d.—13s. per gal. Nominal. 90/180.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.

Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.

Acid H.—3s. 3d. per lb. 100% basis d/d.

Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.

Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.

Aniline Salts.—7d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.

Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 20/31° C.—4d. per lb.

m-Cresol 98/100%.—2s. 8½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—2s. 3d. per lb.

Dimethylaniline.—2s. per lb. d/d. Drums extra.

Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.

Dinitrochlorobenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

α-Naphthol.—2s. per lb. d/d.

β-Naphthol.—11d.—1s. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb. d/d.

β-Naphthylamine.—3s. per lb. d/d.

p-Nitraniline.—1s. 9d. per lb. d/d.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb. d/d.

R. Salt.—2s. 2d. per lb. 100% basis d/d.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—8d. per lb., naked at works.

p-Toluidine.—2s. 2d. per lb. ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Firm and brk.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.

Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 5½d.—1s. 6½d. per lb. Less 5%. Firm.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogalllic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. 1s. 4d.—1s. 5d. per lb. Technical 11½d.—1s. per lb. Both in good demand.

Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.

Acid, Tartaric.—1s. 2½d. per lb. Less 5%. Firm market.

Amidol.—9s. per lb. d/d.

Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.

Atropine Sulphate.—11s. per oz. for English make.

Barbitone.—6s. 6d. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth

Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—

8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—

8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb.

Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Sub

chloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—

7s. 9d.—8s. per lb. Extra and reduced prices for

smaller and larger quantities respectively; Liquor

Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.

—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—3s. 2d.—2s. 4d. per lb. Potassium.—1s. 9½d.—2s. per lb. Sodium.—2s. 0½d.—2s. 2d. per lb. All spot.

Calcium Lactate.—1s. 3½d.—1s. 4½d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 6d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ether meth.—1s. 1d.—1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £33 per ton net.

Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 3d. per lb. net. Synthetic, 11s.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb.; Detached cryst., 14s. 6d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.

Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonol.—11s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4½d. per lb.

Phenacetin.—3s. per lb.

Phenazene.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 97s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 5d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Rosorcin.—4s. per lb. spot.

Saccharin.—55s. per lb. Very limited enquiry.

Solol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 2d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonol.—7s. 6d. per lb.

Tartar Emetio B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.

Thymol, Puriss.—11s.—12s. 6d. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (ex Anethole).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. 6d. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—9s. 6d. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol (ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. per lb.—(ex Shui Oil) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—27s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—13s. per lb.

Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 1d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—9s. 6d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 17s. 6d. per lb. Japanese, 8s. 3d. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than June 25th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on May 12th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

1.—Applications

Bridgford, Marle, and Gibbons Bros. Muffle furnaces. 10,087. Apr. 21.

Cooper, Henshaw, and Holmes & Co. Treatment of gaseous mixtures. 10,512. Apr. 19.

Davis. Compounds etc. for removal of fur etc. from boilers etc. 10,857. Apr. 22.

Kohout. Furnaces. 10,625. Apr. 20.

Lister et Cie., and Lister. Grinding mills. 10,822. Apr. 22.

Lodge-Cottrell, Ltd., and Lodge. 10,941. See XI.

Pickard. Splitting emulsions. 10,808. Apr. 22.

Semet-Solvay Co. Heat transfer structures. 10,486. Apr. 19. (U.S., 13.5.26.)

Singer. Apparatus for distilling liquids. 10,497. Apr. 19. (Ger., 19.8.26.)

Techno-Chemical Laboratories, Ltd., Gram, and Soderlund. Drying. 10,942. Apr. 23.

Trocknungs- Verschwelungs- und Vergasungs-Ges., and Honigmann. Means for continuous drying of fine granular masses. 10,831. Apr. 22.

Umpleby. Furnaces etc. 10,432. Apr. 19.

Urban Corporation. Separation of gases from mixtures. 10,920 -1. Apr. 23. (Fr., 27.4.26 and 1.5.26.)

I.—Complete Specifications

*8915 (1926). Wood. Pulverising. (269,319.)

15,372 (1926). Minter. Kilns. (269,361.)

17,851 (1926). British Thomson-Houston Co., Ltd. Furnaces. (255,479.)

21,929 (1926). Pedersen. Furnaces. (269,397.)

22,286 (1926). Carborundum Co., Ltd. Driers. (269,956.)

32,793 (1926). Pasquiers. Drying. (263,838.)

*15,434 (1926). Darco Sales Corporation. Reactivating purifying-agents. (269,469.)

*29,999 (1926). Dwight and Lloyd Metallurgical Co. Treating materials. (269,480.)

*5865 (1927). Meyerhofer. Conversion of solids, solutions, and gases. (269,491.)

*9017 (1927). Semet-Solvay Co. Distillation systems. (269,517.)

*10,343 (1927). Polanyi and Bogdandy. Producing finely-distributed mixtures of mutually insoluble bodies. (269,586.)

II.—Applications

Abbott. Compound for testing oil. 10,556. Apr. 20.

I.-G. Farbenind. Manufacture of products from coal etc. 10,480. Apr. 19. (Ger., 16.4.26.) Production of fuel gas. 10,481. Apr. 19. (Ger., 19.4.26.)

Johnson (I.-G. Farbenind.). Production of hydrocarbons of low boiling point. 10,735. Apr. 21.

Pickard. 10,808. See I.

Siemens & Halske A.-G. Means for testing gases of combustion. 10,849. Apr. 22. (Ger., 26.5.26.)

Soc. des Prod. Chim. de Clamecy. Distillation of wood. 10,865. Apr. 22. (Fr., 22.4.26.)

Spindler. Apparatus for production of artificial petroleum. 10,472. Apr. 19.

Tormin. Apparatus for carbonising coal etc. 10,475. Apr. 19. (Ger., 30.4.26.) Manufacture of coke. 10,476. Apr. 19. (Ger., 8.9.26.)

II.—Complete Specifications

30,606 (1925). Meyer. Fuels for internal-combustion engines etc. (269,222.)

446 (1926). Nielsen and Laing. Manufacture of water-gas. (269,234.)

902 (1926). Cox and McDermott. See III.

2636 (1926). Umpleby. Gas-generating apparatus. (269,269.)

*29,603 (1926). Soc. de Recherches et D'Exploit. Pétrolières. Activating carbon or carbonaceous substances and production of combustible gases. (269,477.)

*29,762 (1926). Lundin. Production of carbolic acid gas. (269,478.)

*6818 (1927). Seelig. Cracking of oils. (269,499.)

*9196 (1927). I.-G. Farbenind. Production of liquid hydrocarbons. (269,521.)

*10,040 (1927). I.-G. Farbenind. Manufacture of unsaturated gaseous hydrocarbons and hydrogen. (269,517.)

*10,480 (1927). I.-G. Farbenind. See III.

*10,481 (1927). I.-G. Farbenind. Manufacture of fuel gas. (269,594.)

III.—Complete Specifications

902 (1926). Cox and McDermott. Purification of benzol, petrol, and the like. (269,242.)

*10,480 (1927). I.-G. Farbenind. Manufacture of products from coal tars, mineral oils, etc. (269,593.)

IV. Applications

Brightman, Chorley, and British Dyestuffs Corp., Ltd. Azo dyestuffs. 10,858-9. Apr. 22.

Carmichael (I.-G. Farbenind.). Increasing fastness to light of dyestuffs. 10,861. Apr. 22.

I.-G. Farbenind. Manufacture of dyestuffs. 10,819. Apr. 22. (Ger., 22.4.26.)

Scottish Dyes, Ltd., Smith, and Thomas. Production of dyestuff intermediates. 10,501. Apr. 19.

IV. -Complete Specifications

*9197 (1927). I.-G. Farbenind. Manufacture of dyestuffs containing chromium. (269,522.)

*10,318 (1927). I.-G. Farbenind. Manufacture of diazo-sulphamic acids of the cyclic series. (269,582.)

*10,319 (1927). I.-G. Farbenind. Manufacture of compounds of aromatic para-diamines with sulphur dioxide. (269,583.)

V. -Applications

Barbon and Delaville. Treating residual liquors from treatment of cellulose material. 10,704. Apr. 21. (Fr., 21.4.26.)

Courtanlds, Ltd., Hazeley, and Hegan. Manufacture of artificial filaments etc. 10,736. Apr. 21.

Imray (I.-G. Farbenind.). Manufacture of cellulose esters. 10,499. Apr. 19.

Muller. Apparatus for continuously drying cellulosic materials. 10,951. Apr. 23.

Nobel's Explosives Co., Ltd., and Rintoul. Cellulose products. 10,500. Apr. 19.

Potts (Atack). Manufacture of paper. 10,396. Apr. 19.

Wells. Separation of vegetable fibrous material. 10,576. Apr. 20.

Yorkshire Dyeware & Chemical Co., Ltd., and Craven. Treatment of wool. 10,947. Apr. 23.

V.—Complete Specifications

14,192 (1926). Fish. Preparing paper pulp. (255,030.)

18,340 (1926). Soc. Fabr. Soie Rhodiaseta. Manufacture of artificial silk. (269,377.)

20,744 (1926). Fabricord, Inc. Obtaining fibres from flax, hemp, etc. (269,389.)

22,761 (1926). Heberlein & Co. Improving vegetable fibres. (258,598.)

*9684—5 (1927). British Celanese, Ltd. Manufacture of cellulose derivatives. (269,529-30.)

*10,028 (1927). Verein f. Chem. Ind. Treatment of precipitated acetyl cellulose. (269,543.)

VI. Applications

Brandwood. Fluid treatment of yarns etc. 10,386. Apr. 19.

Carmichael (I.-G. Farbenind.). 10,861. See IV.

Chem. Fabr. Mileh, and Landner. Dyeing fibres. 10,818. Apr. 22. (Ger., 23.1.25.)

I.-G. Farbenind. Dyeing and printing cellulose esters etc. 10,952. Apr. 23. (Ger., 23.4.26.)

Taylor. Bleaching-machines. 10,910. Apr. 23.

VII. -Applications

Gaillard. 10,827. See XVI.

Haddan (Stackable). 10,655. See XVI.

James (Merek & Co.). Colloidal iodine. 10,586. Apr. 20.

Stevens and Vantin. Manufacture of tin iodine compounds. 10,866. Apr. 22.

Urbain Corporation. Recovery of phosphorus etc. 10,699. Apr. 20. (Fr., 21.4.26.)

VII.—Complete Specifications

3594 (1926). Azogeno Soc. Anon., and Toniolo. Concentrating ammonium nitrate solutions. (247,229.)

4472 (1926). Aluminum Co. of America. Treatment of metallic oxides. (248,360.)

9939 (1926). I.-G. Farbenind. Manufacture of basic chromium salts. (251,267.)

26,917 (1926). Oesterreichische Chem. Werke. Production of persulphuric acid and its soluble salts by electrolysis. (265,141.)

*8741 (1927). Gerlach. *See* XI.

*10,039 (1927). I.-G. Farbenind. Recovery of sulphur from solutions of ammonium polysulphides. (269,546.)

VIII.—Complete Specifications

15,850 (1926). Scheidhauer & Gessing A.-G. Manufacture of clay-bonded products. (262,383.)

29,474 (1926). Quartz & Silice Soc. Anon. Blowing and moulding articles in silica glass. (263,766.)

IX.—Applications

Curtin. Preserving wood. 10,507. Apr. 19.

Montgomerie. Bituminous emulsions. 10,916. Apr. 23.

IX.—Complete Specifications

*9126 (1927). Soc. Le Xylum. Manufacture of magnesia cements. (269,518.)

*10,047 (1927). Portland-Cementwerk Balingen Ges. Manufacturing acid-proof hydraulic binding-agents. (269,549.)

X.—Applications

Carne. Soldering aluminium. 10,111. Apr. 19.

Marks (Kemel Laboratories Co.). Production of beryllium. 10,630. Apr. 20.

X.—Complete Specifications

1208 (1926). Lewin. Refining brass and bronze secondary metals and their residues. (269,253.)

4472 (1926). Aluminum Co. of America. *See* VII.

6328 (1926). Siemens & Halske A.-G. Electrolytic refining of copper. (264,116.)

7167 (1926). Dieker (Metals Protection Corp.). Protecting iron and steel against corrosion. (269,305.)

9203 (1926). Marks (Amer. Smelting & Refining Co.). Recovery of zinc from dross. (269,321.)

9536 (1926). Rushen (New Jersey Zinc Co.). Treatment of zinciferous materials. (269,324.)

12,073 (1926). Johnson (I.-G. Farbenind.). Manufacture of pure iron. (269,345.)

15,735 (1926). Lauber. Electric furnaces for the manufacture of aluminium. (256,193.)

25,723 (1926). British Thomson-Houston Co. Electroplating. (259,983.)

*22,465 (1926). Vulcan Detinning Co. Electrodeposition of tin. (269,474.)

*10,301 (1927). Goldschmidt A.-G. *See* XI.

XI.—Application

Lodge-Cottrell, Ltd., and Lodge. Electrical precipitation of small particles from gases. 10,941. Apr. 23.

XI.—Complete Specifications

6328 (1926). Siemens & Halske A.-G. *See* X.

11,391 (1926). Wade (Philips' Gloeilampenfabr.). Manufacture of oxide cathodes for discharge tubes. (269,341.)

15,735 (1926). Lauber. *See* X.

18,504 (1926). Automatic Telephone Manuf. Co., Ltd., and Farrant. Electrolytic cells. (269,378.)

18,865 (1926). Hart Accumulator Co., Ltd., and Hardy. Secondary electric batteries. (269,380.)

25,528 (1926). Seig. Accumulators. (269,344.)

25,723 (1926). British Thomson-Houston Co. *See* XI.

26,917 (1926). Oesterreichische Chem. Werke. *See* VII.

1418 (1927). Aletter and Strasser. Accumulators. (264,539.)

*22,465 (1926). Vulcan Detinning Co. *See* X.

*8464 (1927). Standard Telephones & Cables, Ltd. Magnetic core materials. (269,510.)

*8465 (1927). Standard Telephones & Cables, Ltd. Magnetic materials. (269,511.)

*8741 (1927). Gerlach. Cells with quicksilver cathodes for the decomposition of alkali chlorides. (269,513.)

*10,301 (1927). Goldschmidt A.-G. Production of aluminium conducting-material. (269,580.)

XII.—Complete Specifications

20,229 (1926). Erslev. Preparing fats of a plastic and pliable consistency. (269,384.)

*7790 (1927). Industrial Spray-Drying Corp. Manufacture of a finely-divided dry soap product. (269,506.)

*8960 (1927). Industrial Spray-Drying Corp. Manufacture of soap powder. (269,516.)

XIII.—Application

Johnson (I.-G. Farbenind.). Production of coloured brushwork lacquers. 10,482. Apr. 19.

XIV.—Applications

Dunlop Rubber Co., Ltd., and Twiss. Manufacture of rubber etc. 10,421. Apr. 19.

Scheithaur. Regenerating rubber. 10,659. Apr. 20. (Ger., 8.5.26.)

XV.—Application

Technicolor Motion Picture Corp. 10,523. *See* XXI.

XVI.—Applications

Gaillard. Treating superphosphates. 10,827. Apr. 22. (Spain, 22.4.26.)

Haddan (Stackable). Production of ammoniated superphosphate. 10,655. Apr. 20.

Ialhenroth. Producing soluble phosphates. 10,577 and 10,615. Apr. 20. Producing mixed manures. 10,596. Apr. 20. (Sweden, 20.1.27.)

Selbi Soc. Manufacture of fertiliser. 10,820. Apr. 22. (Fr., 16.10.26.)

XVI.—Complete Specification

513 (1926). Johnson (I.-G. Farbenind.). Manufacture of mixed fertilisers containing nitrates. (269,235.)

XVII.—Application

Kienzle. 10,519. *See* XIX.

XVII. Complete Specification

177 (1926). Steffen. Obtaining tricalcium saccharate. (261,693.)

XIX.—Applications

Avanzi. Preparation and preservation of fish etc. products. 10,842. Apr. 22. (Italy, 22.4.26.)

Kienzle. Manufacture of flavouring etc. substances from sugar cane. 10,519. Apr. 19.

XIX.—Complete Specification

*10,292 (1927). Woo. Manufacture of edible substances. (269,576.)

XX.—Applications

Abraham. Production of material containing thymol and polymerised formaldehyde. 10,528. Apr. 19.

Chem. Fabr. vorm. Sandoz. Preparation of gall acids. 10,852. Apr. 22. (Ger., 24.4.26.)

Commercial Solvents Corp. Catalysts for synthetic methanol production. 10,648 -8. Apr. 20. (U.S., 21.6.26, 26.5.26, and 25.10.26.)

James (Merck & Co.). 10,586. *See* VII.

Legerlotz. Oxy-phenyl-alkyl-ketones. 10,871. Apr. 22.

Raschig. Production of chlorthymol. 10,743. Apr. 21. (Ger., 29.4.26.)

XX.—Complete Specifications

904 (1926). Marks (Du Pont de Nemours & Co.). Compositions containing organic mercury compounds. (269,243.)

7052 (1926). Johnson (L.-G. Farbenind.). Manufacture of aromatic derivatives of formamide. (269,302.)

*6722 (1927). Chem. Fabr. vorm. Schering. Manufacture of new alkaloid salts of camphoric acid. (269,498.)

*10,085 (1927). Rubber Service Laboratories Co. Manufacture of acetaldehyde. (269,556.)

XXI.—Applications

Klaver. Manufacture of photographic negatives and prints. 10,740. Apr. 21. (Holland, 21,426.)

Technicolor Motion Picture Corp. Preparation of coloured reproductions by imbibition. 10,522. Apr. 19. (U.S., 30,426.) Hardening gelatine films etc. 10,523. Apr. 19. (U.S., 30,426.)

XXI. Complete Specification

18,870 (1926). Dufay, and Comp. D'Explor. des Proc. de Photographie en Couleurs Dufay. Colour photography or cinematography. (262,386.)

XXIII. Application

Higgins, and United Water Softeners, Ltd. Production of sterilising-agents etc. 10,845. Apr. 22.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence) 35, Old Queen Street, London, S.W., has received the following inquiries for British goods: British firms may obtain further information by applying to the Department and stating the specific reference number: *Australia*: Cutlery (390); Wire-woven asbestos packing, polishes, japan and varnish finishes (405); Steels (A.X. 4608); Drugs, chemicals, pharmaceutical preparations (437) *Austria*: Belting, rubber goods (411). *Belgium*: Shellac (412). *British India*: Copper conductors (B.X. 3469); Steel tyres, best Yorkshire iron (South Indian Railway Company, Ltd., 91, Petty France, London, S.W.1). *Canada*: Chinaware, earthenware, glassware, (C.X. 2279). *Dutch East Indies (Java)*: Pig lead (A.X. 4606) *Egypt*: Metal polish, blacking, paint, oils, greases, acids, leather, copper hardware, ironmongery, belting, mild steel, galvanised plates (C.X. 2268). *France*: Iron and other metallurgical products (393); Oilseeds (414). *Mexico*: Chinaware (428). *Peru*: Piping, filtering plant (A.X. 4186) *South Africa*: Motor spirit (B.X. 3454); Paraffin oil (B.X. 3453). *Uruguay*: Paper and cardboard (B.X. 3135).

Vertical Retorts

The Aberystwyth Gas Company has placed an order with the Woodall Duckham Vertical Retort & Oven Construction Company (1920), Ltd., for a Woodall-Duckham continuous vertical retort plant, comprising 8 unit retorts having a total carbonising capacity of 40 tons per day. The installation is complete with coal breaker and elevator, producer coke hoist, and waste heat boiler of the vertical type.

Coricol Finishes

The British Dyestuffs Corporation, Ltd., has recently issued a pattern card illustrating shades on leather which may be obtained by the use of Coricol Finishes. Following upon the sale of Necol Leather Finishes (formerly marketed by Nobel Chemical Finishes, Ltd.), Coricol Finishes have been introduced to meet the demand for grain finishes which do not obscure the

grain, but assist in the production of even shades of colour on irregular stock. Coricol Finishes are capable of giving a coloured finish which is absolutely fast to damp and rubbing and at the same time of extreme fastness to light. These qualities are secured by incorporating suitably coloured organic pigments with nitro-cellulose varnishes. They can be applied to all classes of grain leather, but are primarily intended for spraying on coloured leathers. Drying is accomplished quickly. After skins treated with Coricol Finishes have been aired for a while, they may be grained, ironed or lightly glazed. The present Coricol Finishes include Scarlet R, Yellow G, Black R, White, and Brown A, and two mode shares of Coricol Fawn S and O. With these products it is possible to match practically all the shades at present in demand for the shoe trades. Other additions will be made at a later date. The pattern card describes the application of the finishes.

News from Advertisements

The Technical College, Cardiff, advertises for a full-time lecturer in chemistry (p. viii).

Analytical chemist required for sugar factory in Peru (p. viii).

Lady assistant chemist required for analytical laboratory of food factory near London (p. viii).

A manager as well as assistant manager are required for an alkali works in India (p. viii).

A chemist is wanted for a laboratory in the Midlands (p. viii).

A mineral analyst, with foreign and colonial experience of buying ores, desires responsible appointment (p. viii).

A chief chemist is wanted for an important wool-firm (p. viii).

PUBLICATIONS RECEIVED

THE DYEING OF TEXTILE FIBRES. By R. S. Horsfall, M.Sc. and L. G. Lawrie, A.I.C. Pp. x + 414. London: Ernest Benn, Ltd., 1927. Price 28s.

LUBRICATION AND LUBRICANTS. A Treatise on the Theory and Practice of Lubrication, and on the Nature, Properties, and Testing of Lubricants. By L. Archbutt, F.C.S., and R. Mountford Deeley, M.Inst.C.E., M.I.Mech.E., F.G.S. Fifth edition, revised throughout, greatly enlarged, reset. Pp. xxxii + 650. London: Charles Griffin & Co., Ltd., 1927. Price 36s.

OIL AND RETORTABLE MATERIALS. A Handbook on the Utilisation of Coal, Torbanite, Cannel and Oil Shale. By G. W. Halse, B.Sc. Pp. vi + 176. London: Charles Griffin & Co., Ltd., 1927. Price 7s. 6d.

PROCEEDINGS OF THE CHEMICAL ENGINEERING GROUP OF THE SOCIETY OF CHEMICAL INDUSTRY. Vols. VIb and VII 1924—1925. Pp. 199. London: Chemical Engineering Group, 1927. Price 10s. 6d.

SOME INDUSTRIAL DEVELOPMENTS AND THE CHEMICAL ENGINEER. Presidential Address by Sir F. L. Nathan K.B.E., delivered at the 5th Annual Corporate Meeting of the Institution of Chemical Engineers, held at the Hotel Victoria, London, on March 11, 1927. Pp. 7. London: Institution of Chemical Engineers, Abbey House, Westminster, S.W.1.

CHEMIE, TECHNOLOGIE UND ANALYSE DER NAPHTHEN SAUREN. By Dr. M. Naphtali. Band VIII. Monographien aus dem Gebiete der Fett-Chemie, edited by Dr. K. H. Bauer. Pp. 144. Stuttgart: Wissenschaftliche Verlagsgesellschaft m.b.H., 1927. Price 14 r.m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Manufacturers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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No. 19

EDITORIAL

Industrial Conditions in America

WE are glad to publish this week a short article by the Rt. Hon. Tom Shaw commenting on the report of the delegation recently appointed to study industrial conditions in the United States and Canada. Mr. Shaw is a Member of Parliament who is well acquainted with the industrial conditions in this country, in America, in several European countries and some Asiatic countries. He has travelled widely and made a special study of labour conditions; he was Minister of Labour in the last Government, and he speaks with an authority on industrial matters which gives his remarks considerable importance. We are therefore sure that our readers will be attracted to his article and glad to read it. Mr. Shaw compares, as we all do, the United States with the United Kingdom, it is useful to do this if we remember the many factors which require consideration, but it would be even more instructive to compare the United States, a partially developed continent, with another partially developed continent, the Disunited States of Europe. We in Europe have done much to cause unnecessary disunion, and it is very difficult to see how much of this disunion could have been prevented. It is part of our task as scientific men to do something to promote community of interest between ourselves and our various neighbours, and this is one reason why we think the meetings of the International Union are of such value. The chemical industry has many ramifications and many bonds linking the industry of this country with the industries of other countries. The soda industry, the dyestuffs industry, and several other branches of the chemical industry provide opportunities for pooling of knowledge, such as Mr. Shaw advocates, and for community of interest between the manufacturers of Britain, France, Germany, and America. Imperial Chemical Industries, Ltd., and its allies on the Continent may in time form an organisation powerful as a peace factor, but, nevertheless, powerless when angry passions sway the cabinets and peoples of Europe. The concluding words of Mr. Shaw's article are an earnest appeal for peace in industry. In this

country we have had a long period of strife and the financial loss occasioned by strife, culminating in the events of last year, the effects of which we shall long feel. As the balance sheets at the end of last year are being published, they make melancholy reading. The sacrifice of energy and money was very nearly futile, and it will require all the advocacy of such men as Mr. Shaw to prevent a recurrence of this disastrous experiment. People who are compelled by circumstances to meet frequently have only to assume that those they meet are rogues to ensure foolish and disreputable treatment. Mutual distrust between employers and workers is the cause of much of our trouble, and it is not very material at the moment to consider whether the distrust is justified or not. It is our business to make sure that the distrust in the chemical industry, at any rate, is not justified and does not exist. We have a good record in the chemical industry, and we ought to keep it; we shall keep it if we, on both sides, exercise ordinary good sense and fair play. Mr. Shaw has alluded to unemployment, to increased production, and to the elimination of waste. It is quite probable that many of our readers may hold political opinions which differ from those of Mr. Shaw; few will dissent from his view that the two sides in industry should have greater confidence in each other. We have given distrust, strife, stoppage of work and waste of time and energy a fair trial; suppose we try the effects of increasing trust, a little patience, fair play, and a recognition of the fact that most employers and most workers have their good points. We can easily begin this in the chemical industry, for we are already half-way there.

The Chemical Engineering Group

The Proceedings of the Chemical Engineering Group, Vols. VIb and VII, 1924, 1925 have just been published. They include many interesting papers; in 1924 there were two papers on crystallisation by Mr. Hugh Griffiths and Mr. T. V. Barker, which we thought were unusually interesting, and two papers by Mr. F. M. Potter and Mr. H. C. Marris on chemical works costs, which should

be useful to many chemists; in 1925 are several papers on fuel questions, including some of the smokeless-fuel papers read at Leeds in July, 1925. The list of all the papers in 1925 is a long one, and we can here mention a few only: one by Mr. David Brownlie on "Steam generation under critical conditions"; "The internal-combustion boiler," by Mr. Oscar Brunler; "The treatment of solvents used in dry cleaning," by Prof. J. W. Hinchley; "The combustion of sulphur-containing materials," by Mr. P. Parrish; "Smokeless fuel," by Dr. C. H. Lander and Dr. Margaret Fishenden; "Solid smokeless fuels," by Mr. E. C. Evans; and "A study of tar," by Mr. F. S. Sinnatt and Dr. J. G. King. Many of these and the other papers are of considerable importance; they make a handsome volume of 200 pages. Some of the papers have already appeared in this JOURNAL, but others are now published for the first time. We were glad to see in Mr. T. V. Barker's paper a couple of correct drawings of copper-sulphate crystals; many incorrect drawings of these crystals were published sixty and less years ago which still find their way into modern text-books, and it is singular that so common a substance should have received such treatment. In the old days, when many compounds were prepared in tubs in the back yard, applied chemistry was often merely large-scale chemistry, and involved but little knowledge of engineering. The time will come when chemical engineering will not only be essential to applied chemistry, but will, so far as the manufacture of chemicals is concerned, be very nearly identical with it. We do not ourselves see how anyone who is concerned in the manufacture of chemicals on the large scale can dispense with this volume of proceedings, and we think the Society and the Group have every reason to be proud of it. Our satisfaction with the Group and its activities is tempered by the news that Mr. Talbot is retiring from the post of Honorary Secretary. Mr. Talbot will still take a keen interest in the Group, but can no longer spare the time to attend to so much detail as his office has involved. Mr. Talbot is a Leeds man, and that, obviously, implies a good deal of energy and determination; he has, however, shown these qualities to a greater extent than could be expected even from a native of that great city. He has devoted much time to the Group, has helped it enormously, and enlivened it by the vigour of his actions and speech. His methods have been breezy rather than unctuous; he has wasted neither his own time nor the time of other people, and he will be very much missed. He has seen the Group become an important organisation, and taken a leading part in making it important. When we consider the record of solid achievements of the Group, it is surprising to remember that its foundation was so recent as in 1918, when about seventy gentlemen met in Cheapside to discuss its formation. At that meeting Mr. Talbot was appointed to act as recorder of the proceedings, and ever since he has acted as the Group's Honorary Secretary. He can look back with pride on the part he has played in the rapid development of the Group, and everyone will agree with the wisdom of retaining his services by including him in the Committee. We are glad that he has done so much, and are sorry that he cannot continue to do it.

INDUSTRIAL CONDITIONS IN THE UNITED STATES AND CANADA

By THE RT. HON. TOM SHAW, P.C., C.B.E., M.P.

The Report of the delegation which was appointed to study industrial conditions in the United States and Canada is indeed both interesting and intriguing. There is one omission which is very important. Not a word of the Report refers to the fact that prohibition is, theoretically at any rate, in operation in the States, and there is no attempt to show what effect it has had on industry, or how the purchasing power which formerly went into the channels of the "trade" now finds an outlet. Perhaps the delegation considered discretion the better part of valour so far as such a hotly-contested question is concerned. When, however, attention has been called to this omission, a frank expression of admiration for the conciseness and suggestiveness of the Report may be permitted.

I do not think we can copy either America or any other nation too slavishly, but certainly one or two facts pointed out by the delegation will repay consideration.

We ought never to forget certain advantages possessed by the United States. The delegation, on pages 10 and 11, show how vast the territory of the States is. Three million square miles, a spread of nearly 20 degrees of latitude and 60 degrees of longitude, with all kinds of climates, soils, minerals, and other natural resources; these, indeed, form a formidable list. Add to them the fact that between State and State there are no irritating and time and effort-wasting tariff barriers and hindrances to trade, and the possibilities of prosperity in the States seem to be boundless. In my opinion, even what is generally considered a drawback may be another source of strength. I refer to the mixed races of immigrants America has received. There may be a disadvantage in making the country a huge tower of Babel, but people who have the pluck and initiative to emigrate are in general the strongest and most self-reliant of their race, and a nation receiving the strongest and most adventurous of other races cannot fail to derive at least some benefit.

The Report shows that the States still remain largely agricultural, the last census showing one-third of the population working the land. This huge home market is of tremendous importance when the industrial position is considered. Its existence can never be left out of account by a serious student of industrial and economic conditions.

On page 12, the Report comes seriously to grips with a tremendously important question. The delegation say, in effect, that the employers in many industries which were badly hit after the 1921 depression found that wages reductions as a policy were bad, and turned rather to increasing efficiency and production, a reduction of costs, and the maintenance of wages—"purchasing power" is the expression used by the delegation. *This led to a real increase of purchasing power, which has had a great effect.*

There is almost a touch of romance in the sensational development in electrical, building and constructional, transport and automobile work. These developments are shown to have led to incalculable advances in all

directions. I am left with the feeling that Americans see things in a bigger way than we do, and their mental horizon is wider.

Frankly, I cannot say I am favourably impressed by another American development discussed by the delegation. They speak of the buying on the instalment system, which has "become a marked feature of American life amongst all classes." Particularly do I remember from my own experience how some English working-class families have suffered through hanging millstones of debt round their necks by constantly buying on credit, and sinking deeper and deeper under the load. Credit buying and "instalment purchasing" I, personally, *do not* desire to see developed amongst our workers at home.

The picture painted by the delegation is certainly not altogether a garden of roses. In Appendix 9, attention is called to unemployment, and an estimate is made according to which the States had $3\frac{1}{2}$ millions of unemployed in the bad times of 1921. Speaking of even these times of high prosperity—as they have been described—the Report goes on to say:—"The Board (i.e., the National Industrial Conference Board) estimate that there is at any time about 1,750,000 unemployed, out of a total of 12,000,000 workers engaged in manufacturing industries." In a word, some $14\frac{1}{2}$ per cent. of workers idle, even in prosperous times, in a country where efficiency of management and volume of production are being envied, and sometimes copied, by other nations! In fact, the lowest estimate of unemployment appears to be $12\frac{1}{2}$ per cent., and "fluctuations . . . in the volume of unemployment appear to be greater than in Great Britain." What a picture!

There is, however, no doubt that when full wages are earned, the man who is a skilled worker gets much higher wages than here at home, and has also a greater chance of regular work than the huge mass of unskilled and semi-skilled workers which immigration has provided in such huge proportions in the States.

What particularly can the States teach us here at home? The Report, if carefully studied, will supply, if not a completely satisfactory answer, at least many important suggestions. First of all, may I refer to one which I personally consider very important.

On page 41 there is a paragraph dealing with the exchange of ideas, experiences, and information, even between competing firms. There is a very free and effective supply of information to Trade Associations and Chambers of Commerce which helps manufacturers better to estimate possibilities. The old British idea of every firm being a little world of its own, doing its work in its own way, and being proud of being absolutely self-contained, and having "no connection of any kind with any other firm," was all right when the world was struggling to get British goods. Now, *when the struggle is to sell British goods*, the old stupid, secret, individualist method of working, which desires to "have no connection with the other fellow," is sheer madness. Exchange of information and co-operation would revolutionise some British industries. Take agriculture for instance. I have never been in a town in an agricultural area yet where Danish produce of all kinds was not on sale. Why? Denmark has no perceptible advantage. Neither in soil,

transport, nor human material is she our superior. But in intelligence she is. Her farmers do not insist on working on century-old lines, every man buying, selling, and making up for himself. On the contrary, they co-operate, buy in bulk, make up on scientific lines, sell through their own agencies, pool knowledge, adopt scientific methods—and beat us hollow. If we will persist in every man "standing independently," working on expensive and out-of-date lines in his own small way, buying and selling as if the world had stood still since the days of the stage coach, paying huge sums for the transport of his produce because he cannot send a "full load," and similar "peculiarities," we shall lose our position in the world.

If there is one thing which stands out prominently in the Report, it is that the tendency of Americans voluntarily may even gladly, to scrap old methods and machinery for something better, is largely responsible for the admittedly enormous advance made. Small uneconomic concerns have to go. Old-fashioned, slow, and uneconomic methods are giving way to new, large-scale, and "standardised" industry. It may be regrettable that the old "personal touch" and individual design have to go. We have, however, talked an "infinite deal of nothing" about personal touch and individual design. There is clear undisputed evidence that in many American concerns run on the new lines the workers are nearer the management, and more active in suggesting improvements, than ever the workers have been in our "personal touch" firms. As to "individual design" and its twin brother, "excellence of manufacture," may I say I prefer American ways? So long as there are very rich people there will always be a limited market for individuality of design and super-excellence of craft work. Certainly, if I were personally rich, I would buy articles in which design and hand-work are at their best.

America has discovered—the word is not too strong—the huge purchasing strength of the people who could afford things when they became cheaper. The Ford car was perhaps the greatest pioneer in the race for the money of the poorer classes. Have we not a tendency at home to stick to individual design and super-craftsmanship, which only the very few can afford, forgetting that many purchasers at small prices may be better than a few at high prices? One must admit after reading the Report that the American manufacturer in many ways is superior to his British rival. He makes machinery do nearly all the hard, dangerous, and dirty work. He does not look upon a working man as worth only so many shillings a week, and cut his rates when he exceeds the sum. He seems perfectly satisfied to consider the amount a worker earns as not being the principal thing. If I may put it in my own way, what he pays is quite secondary to what he gets for what he pays.

He is generally, if I have read the Report rightly, not so "stick in the mud," not so individualist, not so hidebound, and rather more scientific than the bulk of our employers. As to the workmen, the Report says, "The fact that the American employer welcomes the British artisan above any other for his skill and reliability speaks for itself." A fine tribute to the often-maligned British worker. The reading of the Report does

not prove to me that America is a land of perfect industrial peace and harmony, or that it is Heaven for the workers. Strikes and lock-outs there are conducted often with a concentrated bitterness we do not know.

I am quite satisfied that in these islands we have workmen as good as, or better than, anywhere in the world, including America. But if we are to be prosperous we must be prepared to learn from America methods of scientific management, how to eliminate waste, and how to get efficiency in production.

Will the British worker be an obstacle to the introduction of newer methods and improved machinery?

That, in my opinion, depends on whether he has confidence that he will get a square deal. Let a body of employers say to their workers that, however much they earn, rates will not be cut if the utmost intelligence is used to increase production, and see what the result will be.

Whatever takes place a careful reading of the Report can only do good. It is idle to deny that British workers are suspicious—I personally think, with good reason. But just as employers must wake up if we are to go ahead, my own friends the workers must cease to assume that increased production means necessarily "taking it out of their bones." On the contrary, where hours are lowest, wages highest, and conditions best, is the greatest volume of production to be found. Eternal bickerings and strife lead to low earnings, loss of profits, and privation for the workers. Reason, fair play, and justified trust alone can be a foundation on which scientific improvements may be built. If the discussion of the Report helps the two sides in industry to get greater confidence in each other it will have done good. Without that confidence real development on scientific lines is impossible.

DRIERS AS APPLIED TO PAINT AND VARNISH*

By CLAUDE E. WATSON

To most people the term "drier" is quite familiar and is known as something that is added to paint and varnish to cause either to dry more rapidly. Driers have been used many years for this purpose, but it is only within the last few years that they have been investigated with a view to better understanding why and how they work in conjunction with paint and varnish. The lack of knowledge concerning these points has been the cause of many failures in otherwise protective coatings, due to their improper use. However, through careful investigation, the paint and varnish industry has learned that they must be handled with the same great care as powerful drugs are by the medical profession. When used in very small quantities they accomplish their work in a very efficient manner, but when used in excessive quantities they will generally cause destruction, and very efficiently too. Technically, these materials are not driers, but are accelerators of oxidation, and paint or varnish does not dry in the true sense of the word, but hardens up by a process of oxidation. However, throughout my paper, I will use the terms with which we are all familiar.

During the last six years we have done considerable experimental work with driers, and during this time have accumulated some very valuable information, both on theory and practical application. Our work has entailed many disappointments and much contradictory evidence due to variations over which we had no control, but by averaging results over long periods, we eventually arrived at results which are practical. The subject is one which both puzzles and fascinates, and while we have mastered many difficulties, we have much to learn yet. As time is short, I have endeavoured to make my paper a brief outline on both theory and practice. Some of the theories are given in the hope that they will be freely discussed with the object of pointing out weaknesses, because it is only through sincere criticism that facts are discovered and proved.

To understand the function of driers, it is first necessary to understand why a liquid film of paint or varnish changes to a semi-solid, dry film. Since linseed oil is used to the greatest extent in paint, and is the one oil that has been studied most, we will follow its drying mechanism as investigated by Friend, Weger, Morrell and others. The oil hardens by oxidation, which takes place at the unsaturated linkages of linolenic and linolic glycerides; the glyceride of linolenic acid takes on oxygen at its three double bonds and further oxidises to yield carbon dioxide, acetic acid, etc. The glyceride of linolic acid simply takes on oxygen at its two double bonds and does not yield volatile products. It is due to the oxidation of these two glycerides that the film hardens, because the other saturated glycerides present in linseed oil do not oxidise under normal conditions. These, along with the glycerol radical, help to keep the film soft. (It is the presence of excessive amounts of these saturated glycerides in soya bean, fish oils, poppy seed oil, etc., which cause them to be slow drying.) During the initial period of oxidation the oil absorbs molecules of oxygen rather than atoms forming peroxides, and there is very little change until the tenth hour. During this period the peroxides are formed; then the oil begins to change colour, owing, no doubt, to the action of these peroxides. These oils represent a raw linseed oil which has been subjected to 21 hrs.' blowing with air, which is quite similar to the drying process. The peroxides now accelerate the further oxidation of the oil quite rapidly, as is indicated by the increase in viscosity shown by the samples; they are therefore termed catalysers and the process is known as auto-oxidation, which is the process of combustion in air that takes place at a slow rate under normal conditions.

From the above it is not very difficult to understand just how the oxidation of the oil takes place. The next step is to understand how the film is formed. As the blowing process proceeds the viscosity increases, and after the tenth hour an emulsoid colloid is slowly formed in which the oxidised and partially oxidised portions of the oil are the disperse phase, while the unoxidised portions are the medium. As the process of oxidation goes on the oil becomes more viscous, because the phase is becoming greater and greater while the medium is becoming less and less. Since the phase is insoluble in the medium, internal surfaces are gradually developed which must rub against the liquid surrounding them or

* Read before the Ottawa Section on March 17, 1927, with the permission of the Ottawa Paint Works

against each other, causing the once limpid oil to become very viscous, until eventually the medium is so small that the phase can no longer be surrounded, and consequently the oxidised portions come in contact with each other, causing the film to set, so that it will not wet an object which touches it lightly. Following this period, continued oxidation gradually causes the film to set very hard, because with the medium practically eliminated, it requires quite a force to cause the particles to move about each other.

Linseed, china wood, perilla, soya bean, and fish oil will all act in the manner mentioned above by themselves; the last-named two dry very slowly, but when added in paint and varnish they are all too slow for practical purposes. Therefore it is to assist in these reactions that driers are used. Driers are compounds of metals which are soluble in oil with or without the aid of heat, and when added to paint or varnish cause an acceleration of the rate of oxidation. According to Van Wirt and Rhodes, the percentage of volatile products and the total oxygen absorption is the same with or without driers; therefore they simply accelerate the process. They may just assist in the formation of the peroxides or they may hasten the whole reaction throughout; in the former case they would be termed false catalysers, whilst in the latter they would be termed true catalysers. Catalysis designates those chemical reactions which by themselves proceed slowly, but are materially hastened when some foreign substance is added. I am of the opinion that the driers hasten the whole reaction, and therefore claim that they are catalytic in their action. To go thoroughly into this matter would require a paper by itself; therefore I will only deal briefly with theories which aim to prove this statement.

Since driers are in colloidal solution, they are in a very finely divided condition. Now, Wenzel's law states that the greater the absolute surface, the greater will be a chemical change; therefore reactions must occur quite rapidly at the surface of the driers, because, being in a finely divided condition, their absolute surface must be great. When an oil film containing drier is exposed to the air, oxygen is adsorbed by the drier, and as a result of this adsorption it is activated. This adsorption involved the temporary combination of the oxygen with the drier, not as a true chemical compound, but as an indefinite combination which is always varying as the oxygen is being used up in the reaction. For instance, when oxygen is adsorbed by cobalt, manganese or lead, oxides are not formed, because if this were so there would be no acceleration; we assume this, since it is very hard to dissolve the oxides of these metals in hot oil so that they will accelerate drying. As stated before, the result of this adsorption is simply that the oxygen is activated. After this it is taken up rapidly at the double bonds of the unsaturated glycerides, forming peroxides; then, by means of the combined action of these peroxides and the activated oxygen carried by the drier, the final process of oxidation is accelerated. The action cannot be called either physical or chemical, because it is accomplished by both physical and chemical means. We do know that heat alone will accelerate drying, as also will the ultra-violet light rays present in sunlight, there being no drier present.

From tests, we know that there is a decided difference in results obtained when using lead, manganese or cobalt driers. Lead is a weak drier, while manganese and cobalt are strong driers. It requires practically 50 parts of lead to accomplish the same work as 7 parts of manganese or 3 parts of cobalt, but in no case is the work accomplished in the same manner. From this, it is quite apparent that there is a decided difference in the adsorption and activating capacities of these three metals.

I have stated that the work of drying, using the different metals, is not accomplished in the same manner. When these metals are added to oil in proper proportions and then these oils are poured on glass slides, the oil with the lead drier gradually changes from a thin limpid oil to one which is very viscous; it then gradually becomes tacky, and then, by the end of the drying, it has set dry to the touch, but for a considerable time retains a slight tackiness. The other two oils, with manganese and cobalt as drier, do not show this gradual change, but remain in about the same limpid condition until near the end of the drying period, then the change through the viscous condition to the dry film with no sign of tackiness is a decidedly rapid one compared with the lead oil.

I believe the above actions are best explained by referring to the orientation theory regarding surface structure in organic liquids. The molecules in this class of liquid arrange themselves at the surface so that the least active portions are turned towards the vapour phase, whilst the most active portions are turned toward the liquid phase. When lead, manganese or cobalt are added to the oils in equal strengths, it is observed that the lead oil has a lower surface tension, and the manganese or cobalt oils have a slightly higher surface tension than the original oil. Therefore, it would be quite reasonable to believe that whilst the driers are distributed throughout the whole film, yet the manganese or cobalt oils contain no metal in the surface film, whereas the lead oil has metal present in the surface film. This being the case, when the films are exposed to air, because the manganese or cobalt are covered by a layer of inactive molecules, it takes considerable time for the oxygen to penetrate to the metal, but when it does reach the metal, the oxidation is rapid, on account of the high adsorption and activating capacities of these metals, with the result that the film is not dried throughout, but more towards the surface. With lead, because it is present in the surface film, it starts the process of adsorbing and activating oxygen at once, but on account of its low capacity, the process is gradual, with the result that the film is oxidised throughout, but in this process some of the lead salt is forced to the surface, and therefore leaves the dry oil with a tacky feel.

Since driers are oil-soluble compounds of metals which are capable of forming more than one oxide, providing that the salts of the higher oxides are less stable than the salts of the lower oxides, one can readily see that there are many metals capable of being used as driers, but because some lack efficiency and others are too expensive, only the compounds of lead, manganese and cobalt are used to any great extent; therefore, my discussion deals solely with these materials.

Driers fall within three general classes. There are the raw materials which are dissolved in oil directly; there are raw materials which are made by chemical processes; and, third, there are liquid driers, japan driers, etc., which are made from both of the raw materials. The first class includes litharge, red lead, and lead acetate, from which lead driers are made; manganese dioxide, acetate, carbonate, borate, sulphate, precipitated hydrate and recovered manganese, from which manganese driers are made; and cobalt oxide, sulphate and acetate, from which cobalt driers are made. The second class includes lead resinate and linoleate, manganese resinate and linoleate and cobalt linoleate and resinate, either fused or precipitated. In making the precipitated driers, an aqueous solution of the metallic salt is derived from either lead acetate, manganese sulphate or cobalt sulphate as the case may be. The oil or resin is made into a soap by boiling with caustic soda. The soap solution is now added gradually to the water solution while the mixture is agitated, the whole procedure being controlled as to temperature, concentration of the different solutions, etc. The fused driers are made by dissolving compounds of the first class directly in oil or resin by means of heat. They are much darker in colour than the precipitated driers, and contain a much lower percentage of metal, which makes them less popular. The third class includes japan driers, liquid driers, oil driers, grinding japans, etc., some of these names designating the purpose for which the drier is made. Some are simply solutions of metals in oil, others are these solutions thinned with turpentine or mineral spirits, whilst others are solutions in oils and resin or resin alone, thinned with turpentine or mineral spirits. I will not go into the manufacture of these materials: that information is available in literature dealing with paint and varnish. I will deal solely with their use and the results obtained.

For many years the raw materials of the first class were the only driers available to the paint and varnish industry, and in their use many opinions have been expressed as to the advantage of one compound over another, but of late years the advent of manufactured raw materials has given us driers which, in most cases, have more advantages than any of the old driers.

(To be continued)

CZECHOSLOVAK SUGAR PRODUCTION AND EXPORT

The British Commercial Secretary reports that, according to the Bulletin of the State Statistics Office, the Czechoslovak sugar production during the season 1925-26 was as follows:—Total number of sugar factories, 166 (of which 102 were raw sugar factories, 53 were mixed factories, and 11 were refineries); the total number of workers was 69,393; the area under beet cultivation was 307,405 hectares; sugar beet worked up, 8,824,175 t.; sugar production (in raw sugar equivalent), 1,507,344 t.; and export of sugar was 1,079,910 t. The amount of sugar beet grown in the 1926-27 season so far is estimated at 6,232,987 t., the total area under cultivation being 258,176 hectares.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING, JULY 4 to 8, 1927 ACCOMMODATION

Members who intend being present at the Annual Meeting, and who have not yet booked their rooms, are strongly urged to do so without delay, as hotel accommodation in Edinburgh during July is being rapidly reserved.

No bedrooms are now available in the North British Station Hotel—the Headquarters of the Society.

Single room accommodation for both men and women is still available in the University Hostels. Immediate application for such should be made to the Hon. Secretary of the Section—Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

A list of other hotels was published in *CHEMISTRY AND INDUSTRY* for February 4, 1927, p. 105.

RAILWAY FACILITIES

The Railway Companies of Great Britain (except the Metropolitan, the Metropolitan District, and London Electric Railway Companies) have agreed to issue tickets at the ordinary single fare and one-third for the double journey to persons travelling to Edinburgh to attend the meeting. Tickets will be available from Saturday, July 2, to Saturday, July 9.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

BRITISH CHEMICAL ABSTRACTS INDEX, 1926

The Index to the Abstracts for 1926, covering both Pure and Applied Chemistry, is now ready, and copies are being distributed by the printers to members of the Society and subscribers to the *JOURNAL*.

CHEMICAL ENGINEERING GROUP

The annual business meeting was held on May 6 at the Imperial College, Mr. F. H. Rogers presiding.

In his report on the work of the previous year the Hon. Secretary, Mr. H. Talbot, was able to report another successful year of work and of increasing membership. The membership at the end of 1926 was 447, compared with 430 the year before. During the year the General Committee had held 10 meetings—all well attended and meetings of the Data Sheet and other sub-committees had also been held.

A number of important papers had been read at the meetings in 1926, many of which were joint meetings, either with various sections of the Society, or with other bodies, such as the Institution of Chemical Engineers etc. The paper read before a joint meeting of the Group and the Institution of Chemical Engineers on the "Beet sugar industry," on April 14, 1926, proved to be extremely interesting, and was followed on April 16, 1926, by the visit of a large party to the Kelham factory, near Newark. The best thanks of the Committee and members of the Group were due to Mr. Alfred Wood, Secretary of the British Sugar Beet Society, and to Mr. Kwantes and his colleagues, who made the meeting and the visit so thoroughly interesting and enjoyable.

During 1926 the outstanding event in the Group's work was the Congress of Chemists held in London under the auspices of the Society of Chemical Industry, and with the co-operation of the General Committees or Councils of a number of other bodies. The members of the General Committee of the Group assisted in the organisation of the Congress, and the Chairman of the Group, Mr. C. S. Garland, who was also Chairman of the London Section, presided over the deliberations of the principal Executive Committee responsible for the details of the Congress. The Group Committee wished to place on record their high appreciation of the most excellent results accruing from the arduous duties devolving upon Mr. Garland and the members of the Executive Committee and the special committees associated with him. It was safe to say that no more successful gathering of British chemists had been held in the history of chemical organisation in this country.

Special attention was also called to the conferences on "Fuel" subjects, completing the series inaugurated in July, 1925, with the meeting in Leeds. Largely as a result of this series of meetings, a new branch of the Society—the Fuel Section—was formed early in 1926, and the Hon. Secretary of the Group acted as one of the Joint Hon. Secretaries of the new Section. This "Fuel Section" of the Society, which now charges itself with the development of meetings of this kind, was advancing with rapid strides, and bade fair to become one of the most important branches of the Society's activities.

The Group had maintained and extended its relations and its joint meetings with other Societies and learned bodies, and it was no exaggeration to say that a larger spirit of co-operation was becoming apparent among scientific and technical workers than ever before existed. This was initially of advantage to those concerned, and ultimately must react beneficially upon the nation's industrial progress.

The balance sheet for 1926 again showed a small credit balance, and it was a source of satisfaction to the Committee to find that whilst no curtailment of their activities had been necessary, the support received on the way of members' subscriptions and from the parent Society was adequate to enable them to complete the year's programme. The Committee was grateful to the Council of the Society for the assistance extended to the Group's work.

The Committee wished to record their thanks to the Assistant Secretary, Mr. Mackie, and the office staff associated with him for their help in carrying on the work of the Group during the year.

The Data Sheet Sub-Committee had held several meetings during the year, and five data sheets were almost ready for issue. It was regretted that it was not possible to complete any of these for printing during the year 1926.

The volume of "Proceedings" for the second half of 1924 and 1925 was prepared for publication during 1926, but issue had to be deferred, owing to various difficulties regarding illustrations, until early in 1927.

In conclusion, the Committee wished to express their sincere thanks to the members of the Group for the increasing interest being expressed in the work. It was hoped that a further access of membership and an even

more successful year of effort would be experienced during 1927.

The following officers of the Group were elected:—Chairman, Prof. E. C. Williams, M.Sc., M.I.Chem.E.; Hon. Secretary, H. J. Pooley, M.I.Chem.E.; Hon. Treasurer, F. A. Greene, M.I.Chem.E. Major V. F. Gloag and Messrs. P. Parrish, D. Rider, H. Talbot, and A. J. V. Underwood were elected to fill the vacant places on the Committee due to the retirement of Messrs. S. G. M. Ure, E. W. Smith, T. W. Stainer Hutchins, and F. M. Potter.

Warm regret was expressed at the retirement of Mr. H. Talbot from the General Secretaryship of the Group, which he has held since its inception. Special resolutions were carried to express the gratitude of the Group for the invaluable work which Mr. Talbot has done so long for the Group.

After an informal dinner, Dr. W. R. Ormandy read a paper entitled "Chemical fire extinguishers." Dr. Ormandy traced something of the history of fire-fighting in London, and showed how the present-day fire brigade organisation came into being. He then discussed the main groups of fire extinguishers, dealing with soda and acid extinguishers, the carbon tetrachloride group, powder extinguishers, and the more modern utilisation of a foam blanket. The paper will appear shortly in CHEMISTRY AND INDUSTRY.

LONDON SECTION

The Annual Meeting was held in the Chemical Society's Rooms on May 2, Mr. C. S. Garland (Chairman of the Section) in the chair.

The report of the committee for the session 1926—27 stated that 9 meetings had been arranged during the session, and the Section had been fortunate in securing a number of prominent chemists to give accounts of recent developments in various departments of chemical industry. The list of papers was given. The average attendance at the meetings had been 74. The chairman said he believed this was a record, and one of which the committee was proud.

Since the last Annual Meeting of the Section the first Congress of Chemists held in this country had taken place in London, in July of last year, in conjunction with the Annual Meeting of the Society of Chemical Industry, the Society having accepted the joint invitation of the London Section and the Chemical Engineering Group to hold the meeting in London. The Executive Committee was composed of representatives of the London Section and the Chemical Engineering Group, with whom were associated representatives of other chemical organisations. It was generally recognised that this congress was an unqualified success.

The report stated that Mr. C. S. Garland was due to retire from the chairmanship, and the committee had elected Mr. W. J. A. Butterfield to fill the office of chairman for the ensuing session. Dr. G. W. Monier-Williams had expressed his wish to retire from the secretaryship owing to pressure of other work. The committee had to express to Dr. Monier-Williams their grateful thanks for and appreciation of his splendid work as Hon. Secretary of the Section for the past seven years. They felt that the present activity of the Section was largely due to the able way in which he had con-

ducted its affairs, and his ready inspiration in obtaining suitable subjects and authors for the many interesting papers that had been presented during his period of office. The Committee had elected Dr. R. T. Colgate in his place.

The members of the Committee to retire under Rule 7 were Mr. W. H. Coleman, Mr. J. A. Reavell, and Mr. W. G. Wagner. The Committee had also accepted, with regret, the resignation of Dr. W. Cullen. The following nominations had been received:—Dr. T. H. Durrans, Dr. G. W. Monier-Williams, Mr. S. G. M. Ure, and Mr. A. J. V. Underwood. Mr. F. H. Carr retired from the Committee in October, owing to his election as President of the Society, and the Committee had elected Prof. G. T. Morgan to fill the vacancy. Prof. Morgan was now nominated for re-election.

The Chairman formally declared the following elected:—Chairman, Mr. W. J. A. Butterfield; Hon. Secretary, Dr. R. T. Colgate; Committee Members, Dr. T. H. Durrans, Dr. G. W. Monier-Williams, Mr. S. G. M. Ure, and Mr. A. J. V. Underwood. The re-election of Prof. G. T. Morgan to the Committee was also confirmed.

The Chairman proposed that the Section should express its sincere thanks to Dr. Monier-Williams, in view of his retirement from the office of Hon. Secretary, for the manner in which he had conducted the affairs of the Section for the past seven years. The secretaryship, he said, was no easy task, and few realised the amount of hard work which was necessary on the part of Dr. Monier-Williams in order to ensure that things ran so smoothly, and in order to secure the papers which members had enjoyed. The success of the Section was due very largely to the work of Dr. Monier-Williams, and he asked the members to express as heartily as they could their very sincere thanks for all Dr. Monier-Williams had done during the past seven years. The vote of thanks was accorded with acclamation.

Dr. Monier-Williams, responding, expressed appreciation of the Chairman's remarks, and of the manner in which the vote of thanks had been accorded. After thanking the Chairman and Committees with whom he had served, he said the Section was to be congratulated upon having secured the services of Dr. Colgate, and he was perfectly certain that in Dr. Colgate's hands the Section had a bright future.

Mr. W. J. A. Butterfield proposed a vote of thanks to Mr. Garland for his very able conduct of the affairs of the Section during the past two years. No one could have performed the duties of Chairman better than he had done; the organisation of the Annual Meeting of the Society, in the hands of the London Section, was supervised by him in the most capable manner, and the arrangements were carried out in a manner which redounded to the credit of the Section and of the Society.

Dr. B. Dyer seconded the vote of thanks, which was accorded with enthusiasm.

Mr. Garland, responding, said his two years of office as Chairman had been a period of unalloyed pleasure, not only because the work itself had been so pleasant, but also because he had had the loyal help and co-operation of a number of men who had been good enough to cover up his deficiencies, and perhaps make the most of his few virtues. His interest in the Section in the future

would not be less than it had been in the past, and he hoped he might have the privilege of serving the Section in future in some humbler capacity.

At an ordinary meeting which followed the Annual General Meeting, a paper on "Recent investigations on contact insecticides" was presented by Mr. F. Tattersfield and Mr. C. T. Gunningham.

The authors, after defining the term "contact insecticides," gave a description of the work carried out at Rothamsted on this subject, with brief references to the researches of other investigators. A quantitative evaluation of the toxicity by contact of various substances, at a series of concentrations, was obtained with a special apparatus. The authors described the results obtained for a number of different tropical plants used as fish poisons. Derris, White and Black Haiari were shown to have insecticidal values of a high order. "Tubatoxin," the chief constituent of all three of these plants, has been proved to have a very high toxicity to certain adult insects. Various species of *Tephrosia* were also shown to be toxic, although not quite of the same order of toxicity as the above. The extracts of all these plants were stated to render foliage repellent to certain caterpillars. The authors also gave a full account of the toxicity of many series of synthetic organic derivatives to *A. rumicis*, the common black aphid on broad beans, and various insect eggs.

After references to the recent work of Richardson and Smith on the dipyrityls and to Siegler and Popenoe on the fatty acids, the group of fatty acids was dealt with at some length. It has been found that for this group toxicity increases on ascending the series up to the acid containing eleven carbon atoms, after which there is a decline. Toxicity disappears at tetradecylic acid (myristic). An analysis was made of the bearing of certain physical properties on the toxicity of fatty acids. None of these, however, were found to account fully for the values obtained.

The authors concluded that, so far, no simple generalisation has been discovered, capable of explaining the variations in insecticidal action, and it was considered that the next advance would come from work of a more detailed physiological character. Field trials which have been carried out with some of the substances discussed indicated that some of these were yielding important confirmation of the laboratory experiments.

OTTAWA SECTION —

At the regular meeting of April 21, presided over by Mr. A. E. MacRae, the first paper was entitled "The electro-plating and electro-refining of nickel," by Mr. W. C. Gardiner. This was the winning essay for the prize offered by the Ottawa Section to students in chemistry and chemical engineering of Queen's University, Kingston, Ontario.

Electro deposition of nickel is the basis of two important Ontario industries, viz., nickel refining and nickel plating. Although the principles of these two are similar, the ends in view are different, as is also the technique. A pure thick deposit is sought in refining, whilst in plating a thin (0.001 in.) protective coat of good appearance is aimed at. The quality of the deposit is largely determined by its physical structure.

and a knowledge of the factors influencing the latter is a necessary aid in arriving at desirable deposits; however, all these factors are not yet known. Among the known ones, the speaker discussed those which follow and which are the main factors.

1. *Current density*: this may only be increased to a certain point, after which poor deposits result.

2. *Concentration and agitation*: either of these leads to an increase of the metal content of the solution at the cathode and so allows the use of higher current densities.

3. *Temperature*: will allow higher concentration of solutions, increase the conductivity and decrease the occlusion of hydrogen.

4. *Conductivity*: increased conductivity reduces power costs and also tends to reduce the tendency to form "tree" deposits.

5. *Metal ion concentration*: controls the fineness of grain.

6. *Hydrogen ion concentration*: optimum values have been determined and running checks can be carried out colorimetrically.

7. *Addition agents*: colloids and reducing substances which influence structure of deposits, but do not affect 1-6 and 6 above.

8. *Structure of base metal*: may lead to defective deposits.

9. *Metal distribution and throwing power*: in irregularly shaped cathodes all parts are not equally distant from the anode so that the nearer portions receive higher current densities, the metal distribution not being uniform.

Consideration was given to the choice of bath constituents and the functions of these in plating, the composition of the anodes, operating conditions and also plating on zinc, aluminum and die castings.

Two electrolytic processes are being used for refining nickel, viz., the Hybinette and one used by the International Nickel Co. The main points of each were given. In both a nickel of high purity is obtained electrolytically, but in one the refining is electrolytic throughout with a high recovery of precious metals, whilst in the other metallurgical (furnace) methods are used to a greater extent and the recovery of the precious metals must be a further separate operation.

Mr. G. E. Grattan next presented a paper on "Seed analysis." The production of foodstuffs is as yet Canada's basic industry; control of weeds and seeds is therefore essential to agriculture. Control in Canada dates back to 1902, and last year some 60,000 samples were examined. This has led to decentralisation of the work. Samples are tested for purity and germination value by either the Irish or the Continental routine.

According to whether the seed is for home or export use. In the main the work is done by girls employed seasonally; these employees must be familiar with many hundreds of seeds. A representative weight of the well-mixed seed is picked over, the weed seeds removed, identified and counted. Thus, the purity is determined. For germination tests an average sample is placed between blotting paper or on cloth, soil or sand in an electrically controlled germination chamber, the moisture, heat and air supply being regulated and the number of viable seeds counted after various periods. Attention is also given to the value of growth.

Some seeds seem to have a "dormancy" period, and must be ripened in an oven before attempting to germinate them. Others show a retarded germination due to their being impervious to moisture until the outer covering is broken in some manner; these are scratched before putting in the germinator. Field experiments are used to determine whether there is ability to stand the Canadian winter and, also, if the plant is true to type. As some of these tests need 28 days to complete, research is under way to determine viability by the catalase content of the seed, and results so far are promising.

A hearty vote of thanks was accorded both speakers, and Mr. Gardiner conveyed the thanks of the Queen's Student body to the Ottawa Section.

CALENDAR OF FORTHCOMING EVENTS

- May 13. ASSOCIATION OF ECONOMIC BIOLOGISTS, Imperial College, Prince Consort Road, South Kensington, at 2.30 p.m. (1) "Principal plants yielding alkaloids," by Lieut.-Colonel A. T. Gage. (2) "Biochemistry of the alkaloids," by Dr. T. A. Henry. (3) "Medical aspects of the alkaloids," by Dr. J. Trevan.
- May 18. CHEMICAL SOCIETY, Theatre of the Royal Institution, 21, Albemarle Street, W., at 5.30 p.m. The Faraday Lecture entitled, "Problems and methods in enzyme research," by Prof. Richard Willstätter.
- May 18. INSTITUTE OF CHEMISTRY, Belfast and District Section. Annual General Meeting. Royal Belfast Academical Institution.
- May 18. ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY, Northampton Polytechnic Institute, St. John Street, Clerkenwell, E.C.1, at 7.45 p.m. "Protective effects of metal deposits on iron," by S. Wernick.
- May 18 & 19. SOCIETY OF GLASS TECHNOLOGY. On May 18, Special General Meeting in University College, Gower Street, London, W.C.1, at 2.30 p.m. Also Ordinary General Meeting at 2.40 p.m. (1) "The decomposition of glass by water at high temperatures and pressures," by Dr. G. W. Morey and Dr. N. L. Bowen. (2) "Brittleness of glass," by Prof. G. Gephloff. (3) "The new British 15-arm automatic suction bottle machine," by F. Redfern. (4) "Standard durability tests for bottles." The ninth Annual Dinner will be held in the Hotel Cecil, Strand, W.C.2, on May 18, at 7 for 7.15 p.m. On May 19, at 2.30 p.m., a general discussion will be held on "Furnace efficiency." In particular the discussion will be continued on the paper presented by Prof. W. E. S. Turner to the April meeting, on "A brief review of furnace developments." On the morning of May 19, a visit has been arranged to the Lamp Works of the General Electric Co., Ltd., Brook Green, Hammersmith, W.6.
- May 19. SOCIETY OF CHEMICAL INDUSTRY, Nottingham Section. Visit to the soap works of Messrs. Gerard Bros. at New Basford, at 2.45 p.m. Time permitting, a tour of the works will be followed by a short meeting, at which Mr. T. H. Gray will deal with some general considerations concerning the manufacture etc. of soaps.
- May 19. CHEMICAL SOCIETY, Burlington House, Piccadilly, W.1, at 8 p.m. Ordinary Scientific Meeting. "New developments in the study of acid catalysis: the catalytic catenary," by H. M. Dawson.

CHEMICAL SOCIETY

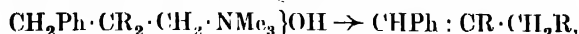
Thirty-nine new Fellows were elected by ballot at a meeting on May 5. The President, Prof. H. Brereton Baker, C.B.E., F.R.S., reminded Fellows that on May 18, at 5.30 p.m., at the Royal Institution, Albemarle Street, W.1, Prof. Dr. Richard Willstätter will deliver the Faraday Lecture, entitled "Problems and methods in enzyme research", admission will be by ticket only. At the ordinary scientific meeting on May 19, Prof. H. M. Dawson will give an account of his investigations on "New developments in the study of acid catalysis. The catalytic catenary." Applications for Research Grants must reach the Assistant Secretary not later than June 1.

Prof. C. K. Ingold discussed:

The nature of the alternating effect in carbon chains. Part XVIII. Mechanism of exhaustive methylation and its relation to anomalous hydrolysis. [With W. Hanhart.]

THE mechanism previously proposed (J., 1926, 1305) in connection with anomalous hydrolysis is shown to be applicable to exhaustive methylation and to the decomposition of quaternary ammonium compounds generally. In particular, (a) it accords with the formation of olefines in the absence of an α -hydrogen atom; (b) it embraces the generalisation ("Hofmann's rule") that ethylene is preferentially eliminated, and predicts the existence of exceptions and border-line cases; (c) it defines and explains the conditions governing the replacement of olefine elimination, the "primary reaction," by the elimination of methyl or another alcohol, the "secondary reaction"; (d) it embraces the different modes of decomposition of hydroxides and chlorides and leads to the deduction that other salts will furnish intermediate phenomena in an approximately regular series.

Prof. R. Robinson, in a written communication, observed that the formation of ethylene derivatives by all the usual methods was primarily due to the tendency of some atom (Br') or group (NR_3, OH_2 , etc.) to hold to its electrons. The general displacement caused by the group confers acid character on the substance, and for obvious reasons the proton is normally detached from the β -position. Occasionally, however, it leaves the α -position (e.g., the formation of stilbene derivatives) and in rearrangements of the borneol—camphene type it is detached by anions or anionoid neutral molecules from the γ -position. This is doubtless the explanation of the method of formation of *isosafrole* recently observed by Baker and Robinson, and a prediction based on this hypothesis is at present being tested. They anticipate the new molecular rearrangement:



etc. The effect of the phenyl group and of other substituents on the course of the formation of ethylenes is considered from the point of view of the theory of general electronic displacements.

Prof. Ingold replied that he agreed that the tendency of the substituent to hold electrons was in all cases an important factor, but this, in his opinion, did not involve that the mechanism was the same, e.g., in the elimination of hydrogen bromide by the action of alkalis, and in

exhaustive methylation. The stabilising action of group, even in cases where no α -hydrogen atom is present, is different in the two cases.

Prof. H. Bassett discussed:—

The inter-relationships of the sulphur acids. [With R. G. Durrant.]

THE hydrolysis of sulphur probably takes place in accordance with the reaction $\text{S}_2 + 2 \text{HOH} \rightleftharpoons \text{H}_2\text{S} + \text{S(OH)}_2$. The sulphylic acid cannot be isolated because it readily decomposes to yield hydrogen sulphide and sulphurous acid. This decomposition has been shown to occur both in acid and alkaline solutions by experiments with sodium formaldehydesulphoxylate and with sodium hyposulphite. Formation of sulphylic acid is considered to be the first step in the Wackenroder reaction.

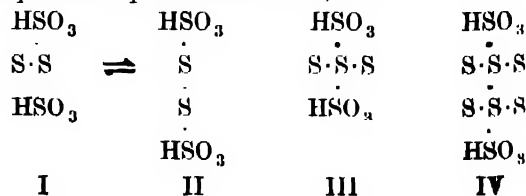
Thiosulphuric acid decomposes in three different ways:—(a) to yield sulphurous acid (or probably sulphonic acid) and sulphur according to the bimolecular reaction $2\text{H}_2\text{S}_2\text{O}_3 \rightleftharpoons 2\text{H}_2\text{SO}_3 + \text{S}_2$, (b) to yield hydrogen sulphide and trithionic acid, and (c) to yield an anhydro-acid $\text{H}_2\text{S}_4\text{O}_5$. Decomposition according to (b) is considered to be the fundamental reaction by which polythionates arise—both in acidified thiosulphate solutions, and in the Wackenroder reaction, whilst trithionic acid is considered to be the primary thionic acid. The higher thionic acids are formed from trithionic acid by addition of sulphur, the chief sulphurising agent being thiosulphuric acid.

All the decompositions of thiosulphuric acid proceed with diminution of acidity. Formation of the anhydro-acid $\text{H}_2\text{S}_4\text{O}_5$ corresponds with the removal of about half the acidity, and to its formation is due the somewhat paradoxical result that thiosulphate is apparently much more stable in very strongly acid solution than in moderately acid solution. The acid $\text{H}_2\text{S}_4\text{O}_5$ has a strong reducing action on methylene-blue, indigo, etc., being itself oxidised to tetrathionate. The cause of the colour of certain simple inorganic sulphur compounds is considered and attributed to the presence of a sulphur atom with a ten-electron sheath.

The President, in commending the authors' courage in attacking one of the most heartbreaking problems in inorganic chemistry, suggested that the telluric acids presented an even greater problem.

Dr. R. H. Pickard remarked that many of the reactions mentioned are of importance in the manufacture of chrome leather. He also asked why pentathionic acid and not a higher thionic acid, was the terminal decomposition product.

Prof. Bassett replied that there were reasons for thinking that tetrathionic acid could have either of the structures I or II, and that addition of sulphur to the first produced pentathionic acid, III.



this building-up process is to be ascribed to the tendency of the sulphur atom to become co-ordinated with four other atoms or groups. Further attachment of sulphur to a compound of the above structure seems unlikely. A similar building-up of higher polythionates might, however, occur from the second form of tetrathionic acid, and this would lead finally to octathionic acid, IV, with hexa- and hepta-thionic acids as intermediate steps. Some experiments in progress suggested that this may actually be possible.

Dr. W. J. Hickinbottom presented the following paper:—

The constitution of the disaccharides. Part XIV. Melibiose and its relationship to raffinose. [With W. Charlton and W. N. Haworth.]

ZEMPLÉN (Ber., 1927, 60, 923) has advanced new constitutional formulæ for melibiose and raffinose differing from those which had previously been assigned to these sugars by Haworth. On the basis of Zemplén's formula, methylated melibiose should give rise on hydrolysis to tetramethylgalactose and to 2:4:6-trimethylglucose. Completely methylated melibiose leads on hydrolysis to the isolation of crystalline tetramethylgalactose and to 2:3:4-trimethylglucose. The latter sugar was converted to the crystalline 2:3:4-trimethyl- β -methylglucoside, identical with that isolated on previous occasions from methylated gentiobiose, methylated amygdalin, and methylated raffinose. Haworth's structural formula for melibiose is therefore substantiated by these results. In both melibiose and raffinose the galactose residue is attached to the glucose residue through position (6) in the glucose chain. Other evidence is communicated which shows that melibiose is probably not a β -bi-ose, and the suggestion is made (based on optical data) that the disaccharide is of the α -type.

Dr. R. H. Pickard, remarking that the chemical evidence appeared convincing, deprecated the employment of analogies invoking optical activity. He was suspicious of "rules" based on considerations of optical activity when advanced in support of views on constitution.

BIOCHEMICAL SOCIETY

A meeting was held on May 7 in the Physiology Department of the University of Manchester, when the following papers were read:—

"Variations in the serum calcium of rabbits," by Kathleen Culhane and S. W. F. Underhill.—With the object of discovering whether the rise in serum calcium following insulin injections, as described by Davies, Dickens and Dodds, was caused by the insulin itself or by some impurity associated with it, and of finding whether this would provide an explanation of the frequent erratic response of the animals to insulin, the effect of samples of varying degrees of purity has been studied. In most experiments 6 rabbits were given insulin and 4 controls received no insulin. No rise in serum calcium was obtained within a short period of time with samples of which the potency varied from 0.05 mg. to 8.0 mg. to the unit. The complete curves for 24 hrs. with 4-hourly injections of small doses

of insulin (0.5 unit per kg.) were then followed, both when the rabbits were fed with oats and hay alone and when they received cabbage also. An increase in the serum calcium occurred in both insulin-treated animals and controls only on feeding with cabbage. Cabbage may cause a rise in serum calcium, the effect depending on its previous level, in which seasonal variations play a part. There is no relationship between insulin convulsions and serum calcium.

"Experiments on the formation of succinic acid in the body," by P. W. Clutterbuck.—A polarimetric method for following the conversion of succinic to malic acid in liver and muscle pulp was described. Using the minced organs, rabbit liver was 8 times as active, weight for weight, as rabbit muscle in bringing about both the conversion of succinic to fumaric and fumaric to malic acid. Using the method, with the minced organs, no production of succinic acid from the following possible precursors could be detected:—acetone, sodium acetate, acetoacetate, α -ketoglutarate, δ -ketohexonate and diacetylsuccinate. Cyanide, whilst inhibiting completely the change from succinic to fumaric acid, has no action on the conversion of fumaric to malic acid. The latter change is, therefore, a simple addition of the elements of water and not an oxidation-reduction process.

"The action of tyrosinase on phenols," by C. E. M. Pugh and H. S. Raper.—Happold and Raper have shown that tyrosinase only deaminates amino acids in the presence of certain phenols. They suggested that the phenol is oxidised to its *ortho*-quinone, and that this in turn attacks the amino acid. The present work deals with the isolation of the *orthobenzoquinone* and *orthotoluquinone*, in the form of their anilino derivatives during the progress of the action of tyrosinase on phenol and *p*-cresol respectively. It is also shown that catechol and homocatechol give rise to *orthoquinones*. Peroxydase and hydrogen peroxide produce *o*-quinones from catechol and homocatechol. The *orthoquinones* are probably not the final products of the action of tyrosinase on phenols. Measurement of the oxygen absorption suggests that more highly oxidised substances are subsequently produced.

"Chemical changes in muscle," by E. Boyland and A. D. Ritchie.—The chemical changes in plain, cardiac and invertebrate muscle require carefully modified analytical methods. Glycogen, lower carbohydrates, lactic acid, inorganic phosphate and soluble organic phosphates, by means of a suitable scheme, can be estimated on one sample of 5 g. The alcohol-insoluble residue is used for glycogen estimation, using one quarter of the amount of caustic potash usually advised in Pflüger's method, and thus reducing the volume of liquid in which the glycogen is precipitated. The alcohol extract, when free from proteins and lipoids, is treated with copper sulphate and lime to precipitate hexoses. The filtrate can be used for lactic acid estimation except in the case of mollusc muscle containing taurine; the taurine must be removed by boiling with mercuric oxide. Lactic acid is estimated by steam distilling in presence of potassium permanganate in an apparatus fitted with ground joints. The avoidance of the presence of air in the oxidation reduces the over-

oxidation of acetaldehyde to acetic acid. Lobster muscle contains variable amounts of glycogen (0.05% to 0.20%), and this is converted quantitatively into *D*-lactic acid on standing in alkaline phosphate. The large adductor muscle of the pecten contains a large quantity of glycogen (2%) which is not converted into lactic acid under these circumstances.

"Fermentation of propionic acid by *Aspergillus Niger*," by P. D. Coppock and T. K. Walker.—When *Aspergillus Niger* is cultivated upon calcium propionate as sole source of carbon, the first detectable product of fermentation is lactic acid. Later pyruvic acid makes its appearance. In no instance has the production of the latter acid been noted prior to that of lactic acid, and no malonic acid is produced. This suggests that the pyruvic acid arises from the oxidation of the lactic acid, and this supposition has been confirmed by growing the mould upon calcium lactate solutions, when pyruvic acid was obtained. When the mould is grown upon calcium pyruvate, the following substances are produced: ethyl alcohol, glyoxylic acid, and oxalic acid. The probable course of the reaction is presumed to be: pyruvic acid \rightarrow acetaldehyde \rightarrow ethyl alcohol; acetic acid (dismutation), then acetic acid \rightarrow glycollic acid \rightarrow glyoxylic acid \rightarrow oxalic acid. This sequence is rendered likely by the observations that the fermentation of calcium acetate yields glycollic, glyoxylic and oxalic acids, and that glycollic acid on fermentation yields glyoxylic acid.

"The carbohydrate-phosphate component of animal nucleic acid," by J. Pryde and J. M. Peterson.—With the view of elucidating the nature of the carbohydrate component of animal nucleic acid, attempts are in progress to methylate sodium nucleate and the sugar-phosphate compound obtainable from it. For the purpose of isolating the latter the most promising results have been obtained by a method which involves the treatment of sodium nucleate with nitric acid in the cold, and is based on the results of Steudel. A syrupy product is obtained which contains organic phosphorus and reduces Fehling's solution. It is found to give marked pentose or glycuronic acid reactions with Bial's orcin reagent, and with Tollen's naphthoresorcinol reagent. The pigments obtained give definite absorption spectra similar to those of the corresponding pentose pigments, but not identical with those prepared from arabinose and rhamnose, or from glycuronic acid, with which they have been compared. The naphthoresorcinol pigment obtained both from the syrupy sugar-phosphate and from sodium nucleate directly, like those obtained from pentoses and unlike that obtained from glycuronic acid, is insoluble in ether. It is suggested that grounds exist for investigating in greater detail the possibility that the supposed hexose of animal nucleic acid may be a substituted pentose.

"Some observations on methylated glycerophosphates," by J. Pryde and E. T. Waters.—A preliminary study of methylated glycerophosphates is calculated to simplify the investigation of similar derivatives of the hexose phosphates of muscle. The dimethyl ester of dimethyl β -glycerophosphate is obtained by applying various methylation processes to sodium β -glycerophosphate. The phosphoric acid group is unaffected by

distillation in a high vacuum, and the pure ester is obtained as a very mobile syrup having n_D^{15} 1.4268. The barium and a crystalline brucine salt have been prepared. Mixed sodium and glycerophosphates have been synthesised by the action of trisodium phosphate on epichlorhydrin. The fractionation and methylation of these mixtures is being investigated with the view of obtaining a definite methylated monoglycero- α -monophosphoric acid. Sodium dimethyl β -glycerophosphate is not hydrolysed *in vitro* by kidney phosphatase, nor has any evidence of its hydrolysis *in vivo* been obtained when it is injected into the blood stream of anaesthetised dogs with ureteric cannulae. On the other hand, there is some evidence of a slow hydrolysis of the mixed methylated α -glycerophosphates by kidney phosphatase *in vitro*.

The following papers were also read: "The attempted isolation of a type precipitinogen from *B. aertrycke*," by F. C. Happold, and "Haemocyanin. Part IV. The dependence of the shape of the oxygen dissociation curve on the state of ionisation of the protein," by E. and E. Stedman.

SOCIETY OF PUBLIC ANALYSTS

An ordinary meeting was held at the Chemical Society's Rooms on May 4, Mr. E. Richards Bolton, President, being in the chair.

Certificates were read for the first time in favour of Messrs. C. E. Corfield, B.Sc., H. E. C. Powers, B.Sc., J. D. Rogers, and A. Samson, A.R.C.Sc.

Certificates were read for the second time in favour of Messrs. F. C. Bullock, B.Sc., T. H. Fairbrother, M.Sc., R. S. Rack, and S. G. Sherman.

The following were elected members of the Society:—A. G. J. Lipscomb, B.Sc., W. L. Matthews, S. J. Rogers, B.Sc., E. F. Waterhouse, H. W. Webb, A. S. Wood, M.Sc., Ph.D.

The following papers were read and discussed:—

"Investigations into the analytical chemistry of tantalum, niobium and their mineral associates. VII.—The precipitation of tungstic acid by tannin. VIII.—The separation of tungsten from tantalum and niobium" by Dr. W. R. Schoeller and C. Jahn.—Small quantities of tungstic acid are quantitatively recovered from tungsten solutions containing alkali chloride by precipitation with tannin and cinchonine hydrochloride. A method of determining small amounts of tungsten in the presence of large amounts of earth acids has been based on this principle. Small amounts of earth acids in tungstic trioxide are determined by fusing the mixture with sodium hydroxide and treating the fused mass with sodium chloride solution. Sodium tantalate and niobate remain undissolved.

"The separation of vanadium and tungsten," by S. G. Clarke, B.Sc.—Vanadium may be determined in the presence of large amounts of tungsten by precipitation with cupferron (ammonium salt of nitrosophenyl-hydroxylamine) after treatment of the solution with hydrofluoric acid, neutralisation with ammonia, addition of hydrochloric acid and dilution. The precipitate is separated, washed and ignited at a low temperature, the residual vanadium pentoxide dissolved in dilute

sulphuric acid, and the solution reduced with sulphur dioxide and titrated with permanganate.

“The determination of moisture by the volatile solvent method,” by J. M. Jones and T. McLachlan.—This method of determining moisture is satisfactory for emulsions, such as butter and margarine, and gives more consistent results than any other method for such products as jam, honey and malt extract, though it is not possible to say whether these results are accurate. For powders which do not cake, the water-oven and air-oven method is preferable to this method. The use of toluene as a solvent enables the results to be obtained in a shorter time than when benzene or petroleum spirit is used.

“A study of antimony trichloride as a possible quantitative reagent for vitamin A,” by F. Wokes, B.Sc., and Dr. S. G. Willmott.—The reaction between antimony trichloride and vitamin A is probably due to condensation, and can be retarded by dehydration of the solvent. The depth of the initial blue coloration obtained under standard conditions may be used to measure the vitamin A content of the oil. The intensity of colour is expressed in Lovibond blue units 30 seconds after mixing the solution of the oil and reagent.

New processes for the determination of certain elements in lead,” by Dr. B. S. Evans.—The sample is dissolved in nitric acid, lead separated as sulphate, and arsenic precipitated with sodium hypophosphite and separated by shaking with benzene and filtering. Antimony is determined in the filtrate, and the arsenic in the precipitate is determined by an iodimetric method. Bismuth is determined colorimetrically with potassium iodide after separation of the lead as sulphate and chloride, and sulphur is determined gravimetrically after dissolving the metal in *aqua regia*, evaporating the solution to dryness, and dissolving the residue in dilute hydrochloric acid.

CANADIAN INDUSTRIAL ACTIVITIES

The annual financial report of the Canadian General Electric Company, Ltd., for the year ending December 31, 1926, shows gross profits, after reserves and taxes have been deducted, but before providing for depreciation, amounting to \$1,870,618, which is \$253,525 above the 1925 figure, an increase of over 15%. The sum of \$700,000 has been written off for depreciation as compared with \$600,000 in 1925. Net profits are \$1,170,618, an increase of \$236,867, or over 25%, which is available for dividends and reserve. All outstanding interest-bearing charges have disappeared from the balance sheet.

The Dominion Rubber Co., Ltd., had sales amounting to \$19,708,040 in 1926, an increase of \$2,916,656, or 14 1/2%. The net income from operations, before interest and depreciation of plant were deducted, amounted to \$1,696,765. Interest on funded indebtedness and other interest charges left the net income at \$1,043,263. Depreciation of plant, \$490,155, and preferred dividends, \$210,000, left a net surplus for the year of \$343,108. The profits during the year were adversely affected by the decline in crude rubber prices during the early months of 1926, which forced drastic reduction in selling prices, especially of tyres made from high-priced rubber.

OBITUARY

DR. JAMES BURGESS READMAN

James Burgess Readman, D.Sc., F.R.S.E., died at Bradford-on-Avon on March 24. Dr. Readman was educated at Glasgow Academy, and his first engagement was with the firm of Townsend, of Glasgow, where he became familiar with the manufacture of various chemicals. He afterwards went to New Caledonia, to investigate the nickel deposits, and on his return to Scotland worked out a process for the extraction of nickel, and established a works to carry out the process. After a few years of successful operation, these works were taken over by a French company. For family reasons, Readman then went to live in Edinburgh, and there took a course of theoretical and practical chemistry with J. Falconer King, the City Analyst, and in the early eighties took the B.Sc. Degree at the University of Edinburgh. He then decided to establish a laboratory in Edinburgh, principally with a view to research and consulting practice. When at Townsends, he had been impressed with the wasteful and costly method of manufacturing phosphorus by the decomposition of calcium phosphate with sulphuric acid, and the subsequent reduction of the metaphosphoric acid with carbon in clay retorts, and had carried out experiments with the object of substituting silica for the sulphuric acid, and in one operation at a high temperature producing a fusible slag, and distilling off the phosphorus. Various types of furnace were tried and failed. During a visit with the British Association to Canada, he heard Cowles describe the electric furnace for the reduction of aluminium, and at once realised that this was the type of furnace to carry out the reaction. On his return to Scotland the experiments were continued, but great difficulty was experienced in obtaining a supply of current for the purpose, as at that time electric lighting was in its infancy. From laboratory to semi-manufacturing trials, one unit was erected, and the whole of the current from the Kelvinside Power Station, Glasgow, taken during the day time to prove on a working scale the feasibility of the process. Ultimately the patent rights were purchased by Albright & Wilson, Oldbury, and at the present time it is understood that all phosphorus is manufactured by the Readman process. Incidentally, it may be stated that he was the first to introduce the electric furnace into this country for manufacturing purposes.

Readman then turned his attention to another scheme which had occupied his mind for a time, viz., the manufacture of cyanide from atmospheric nitrogen. It was known that nitrogen, passed over barium carbonate in presence of carbon converted it into barium cyanide, but no practicable method of carrying out the reaction had been successful. By the application of a different type of electric furnace, it was demonstrated that the preparation of barium cyanide could be carried out continuously by a constant feed and discharge. The process was favourably reported on by Sir Wm. Ramsay and Sir Alex. Kennedy, after a series of trials on a large-scale plant, and works erected at Leven, Fife, but misfortune dogged the career of the company. About the time the works were ready the South African war broke out, and the demand for cyanide, the consumption

of which had been rapidly advancing, immediately dropped. Stocks accumulated in South Africa and in the factories, and the Scottish Cyanide Company was unable to market its product. Other difficulties arose, and ultimately the works had to be dismantled and the valuable electric plant sold. Many of his personal friends, as well as himself, lost money in the venture, and Readman never recovered from the effects of this failure. As a method of fixation of atmospheric nitrogen this method will, in the opinion of the writer, be again revived. Like many other inventors, Readman never received the pecuniary reward of his labours. Modest in demeanour, devoted to industrial science, he was a regular attender at the annual meetings of the Society of Chemical Industry of which he was an original member—and British Associations, and was intimate with the leading chemists of the time—Ramsay, Thorpe, Tilden, and others.

G. H. GEMMELL.

DR. G. WEYMAN

We deeply regret to announce the death, at the early age of 38, of Dr. Geoffrey Weyman, F.I.C., chief chemist to the Newcastle-upon-Tyne and Gateshead Gas Company. Dr. Weyman underwent a serious operation six weeks ago, but his condition subsequently became more grave, and he passed away on April 29.

Dr. Weyman was born at Guildford, Surrey, but came of an old Shropshire yeoman family. He was at school at Cheltenham, and later at the High School, Edinburgh, and when his father moved to Newcastle 22 years ago, he matriculated at Durham University twelve months before he could enter Armstrong College, filling up the intermediate time in his father's office.

Upon taking his degree, he became chemist to the Elswick Gas Works of the Newcastle & Gateshead Gas Co. It is interesting to note that he was the first trained chemist employed by the company, and gradually developed the scientific side of the business until he had quite a considerable staff under him. He was greatly encouraged in his work by Mr. Thos. Hardie, now engineer to the Gas Light & Coke Co.

He was held in high esteem for his scientific attainments, was a regular contributor to the Technical Press and the author of several technical books, including his well-known "Modern Gas-Works Chemistry." In the field of invention may be mentioned his patent "Rayflex" open fire coke-stoves, and his investigations on the properties of coke are now being appreciated. From time to time he contributed papers to the North of England Gas Managers Association, and took part in the discussions. He has been Chairman of the Auxiliary Section of the North of England Association, and was one of the founders of the Newcastle Chemical Industry Club, of which he was Hon. Librarian for several years.

Dr. Weyman had long been a member of committee of the local Section of the Society of Chemical Industry, and took a very active part in its meetings. In fact, his last public appearance was at the March meeting of this Section, when he took part in the discussion, although obviously in ill-health.

Married in June, 1914, on the outbreak of the War, he was called up as an O.T.C., in due time going to the front,

but after some months was sent home for munition work.

Of a reserved and quiet nature, he yet commanded the complete devotion and loyalty of those under him. Sincere sympathy in their bereavement will be felt with his widow and three children. The interment was on May 2, in Lamesley Cemetery.

CORRESPONDENCE

THE STATUS OF SCIENTIFIC WORKERS

SIR,—My attention has been drawn to the letter from Mr. Bertram Ward which appeared in your issue of April 29, referring to the appeal which has been circulated by the above society.

Apparently Mr. Ward is in full sympathy with the main object of the appeal, that is to build up a body comprehending scientific workers in every branch of science, pure and applied, and in every kind of professional scientific occupation, in order to educate the general public towards a greater appreciation of the function of science in the national life, and thus create a greater demand for the services of scientific workers. But if I interpret him correctly, he is against collective bargaining with employing authorities for the purpose of obtaining better salaries and conditions of service for the members of a profession. The individual scientific worker is to be left unrestricted to make his own terms with employers backed up by reasoned yet vigorously insistent propaganda of a general character. Such a method he suggests is irresistible.

It would be interesting to know what Mr. Ward would include in the term "propaganda." Let me give one example: A few months ago the Air Ministry advertised for a scientist of specific qualifications and experience for a post of some responsibility. The salary attached to the post was, in the opinion of my Executive, quite inadequate. Accordingly they asked the Institute of Chemistry to join them in a deputation to the Air Ministry. As a result of the representations made by this deputation, the initial salary attached to the post was appreciably increased. Would Mr. Ward call this collective bargaining or educative propaganda? Would he suggest that this method was beneath the dignity of the representatives of the two bodies? Instances of this kind could be multiplied. It is notorious that the British Medical Association has successfully boycotted certain local authorities which have offered inadequate salaries to qualified medical practitioners; that this Association definitely recommends its members not to apply for such posts. Does Mr. Ward include such action under the heading of propaganda? Other professional bodies also lay down definite minimum scales of charges or minimum salaries for their members, and enforce them by characterising those who accept less than the minimum laid down as guilty of unprofessional conduct. This could hardly be called collective bargaining, and it would be difficult to see how it could be called propaganda, but it has certainly proved effective in raising the members of these professions in the public esteem.

Mr. Ward should consider this fact. If the present inordinately low salaries continue to be offered to men of high qualifications and experience in the various scientific

occupations, the standard of entry of the profession will be lowered. Let me draw his attention to a passage from the Report of the Medical Research Committee for the year 1925 to 1926 (p. 12):—"the Council have pointed to the urgent need for an improvement in the rewards and conditions of work and for an advance in public recognition of its value, intellectual and material, without which the recruitment of the best brains to this high type of national service is not likely to be effectively secured." They continue by stating that there are many urgent problems now waiting for solution, for which solution is confidently to be expected by methods already within reach, but "is delayed by a shortage of the most competent men."

Yours faithfully,

A. G. CHURCH, *General Secretary*,
National Union of Scientific Workers

PERSONAL AND OTHER ITEMS

Mr. T. R. Ferens, joint chairman of Rickett & Sons, Ltd., a generous benefactor to Hull, celebrated his 80th birthday on May 4. It will be remembered that Mr. Ferens gave £250,000 for the establishment of a university college at Hull.

Mr. S. G. M. Ure, M.A., M.I.Chem.E., has been appointed Hon. Editor of the Proceedings of the Chemical Engineering Group.

We regret to learn of the death, at the age of 66, of Prof. Adolf Miethe, one of the foremost authorities on photographic chemistry. In 1924 Prof. Miethe announced that he had obtained gold from mercury, but the claim is not yet generally accepted.

The death is announced from New York of Mr. Hudson Maxim, a well-known expert on explosives.

The following deaths are announced from Germany:—Dr. A. Liebmam; Prof. K. Windisch, professor of chemistry and agricultural technology at Hohenheim; Dr. R. Meyer, who was the first to elucidate the constitution of fluorescein; Dr. A. Ganswindt, formerly editor of the *Deutschen Farbenzeitung*.

The late Mr. J. E. C. Lord, managing director of J. E. C. Lord (Manchester), Ltd., tar distillers and manufacturing chemists, left £127,441.

Standardisation of Tar Products Tests Committee

As a result of the Tar Conference held in Manchester during November last year, the Joint Committee of the Institution of Gas Engineers, the Coke Oven Managers' Association and the Fuel Section of the Society of Chemical Industry has appointed a Standardisation

Tar Products Tests Committee consisting of the following gentlemen:—Mr. W. G. Adam, of the Gas Light & Coke Co.; Mr. S. Billbrough, of the Yorkshire Tar Distillers, Ltd.; Mr. G. B. Brook, of the British Aluminium Co., Ltd.; Dr. T. Howard Butler, of Wm. Butler & Co. (Bristol), Ltd.; Dr. A. F. Campbell, of Hardman & Holden, Ltd.; Mr. W. T. Collis, of the M. I. Land Tar Distillers, Ltd.; Dr. H. G. Coleman; Mr. E. V. Evans, of the South Metropolitan Gas Co.; Mr. H. Fergusson, of Burt, Boulton & Haywood, Ltd.; Mr. C. P. Finn, of the Coke Oven Managers' Association; Mr. A. G. Francis, of the Government Laboratory; Mr. G. A. Hebden, of the South Yorkshire Chemical

Works, Ltd.; Mr. H. W. James, of the South Metropolitan Gas Co.; Mr. J. H. B. Jenkins, of the London & North Eastern Railway; Mr. J. MacLeod, of the Glasgow Corporation Chemical Works Department; Mr. J. P. Miller, of John Miller & Co. (Aberdeen), Ltd.; Mr. H. E. Nickels; Mr. T. F. E. Rhead, of the City of Birmingham Gas Department; Dr. J. A. Roelofsen, of Dorman, Long & Co., Ltd.; Mr. F. S. Sinnatt, of the Fuel Research Board; Dr. P. E. Spielmann; Mr. G. E. Thomas, of the Graigola Merthyr Co., Ltd.; and Mr. W. J. U. Woolcock, C.B.E., of the Association of British Chemical Manufacturers.

Mr. Woolcock was asked to take, and accepted, the Chairmanship of the Committee. Dr. E. W. Smith and Mr. R. M. Drake were appointed Honorary Secretary and Assistant Honorary Secretary respectively.

The above General Committee, at its first meeting on April 12, appointed panels to deal with the standardisation of methods of testing tar and tar products as classified below:—

A.—Crude Tar.

B.—Pitch, Refined Tar and Creosote.

C.—Benzole Group of Substances and Pyridine.

D.—Carbolic Compounds; Naphthalene; Anthracene, etc.

and further panels to deal with:—

X.—Apparatus, Constants, etc.; and

Y.—Editorial (to obtain uniformity in terms and units throughout standard tests).

These panels will report back to the General Committee on the work they undertake, and throughout their investigations will work in close collaboration with the British Engineering Standards Association, the American Society for Testing Materials, the Institution of Petroleum Technologists, and other competent bodies.

All communications should be addressed to the Honorary Secretary, at 166, Piccadilly, London, W.1.

Reported Negotiations between British and German Chemical Industries

According to the *Financial Times*, a statement from Berlin indicates that a comprehensive agreement between German and British chemical industries is impending. The consummation of such an agreement would give the combination control of 37% of the total world export of chemicals and two-thirds of the world's dye production. The British United Press has learned at the headquarters of the German Dyestuffs Trust that the negotiations are proceeding satisfactorily. It is stated authoritatively that the agreement which is envisaged would provide for the exchange of German dye patents and information on manufacturing procedure, in return for a share (estimated at 50%, a figure which is not confirmed) in the British and Colonial dyestuffs markets. It is thought that the arrangement between Britain and Germany will not be limited to dyestuffs, but will include an arrangement for the manufacture and sale of mixed fertilisers, artificial silk, oil extracted from coal, and photographic, pharmaceutical and other chemicals.

Sir Alfred Mond, chairman of Imperial Chemical Industries, Ltd., accompanied by Sir Harry McGowan, chairman and managing director of Nobel Industries,

Ltd., was the guest last week of Dr. Carl Duisberg, President of the German Federation of Industries, at his estate at Leverkusen, adjoining the dyestuffs works. The British visitors later inspected the chemical works at Oppau and Leuna, after which German dyestuff shares are said to have risen greatly in value.

It is taken as a significant fact that Brunner, Mond and Co., Vickers, and the United Steel Companies are interested with the Shell Company in operating German patents for the hydrogenation of coal. Furthermore, Nobel Industries, Ltd., a constituent of Imperial Chemical Industries, Ltd., owns 7,500,000 marks worth (about £370,000) of shares in the German Koeln Rottweil Explosives Company, which last year merged with the German Dyestuffs combine. Courtaulds, the artificial silk firm, is interested with the German Dye Trust in the production of artificial silk. Moreover, the German Dye Trust is reported to be connected with the Anglo-Persian Oil Company. Other special chemical agreements between Germany and Britain are said to involve creosote oil, borax and benzol.

Errata

In the issue of May 6, on p. 409, col. 1, line 27, after the words "vitamins and," insert "hormones"; on p. 409, col. 2, line 5, for "incision," read "excision."

REVIEW

ARTIFICIAL FERTILISERS, THEIR CHEMISTRY, MANUFACTURE AND APPLICATION. By P. PARRISH, A.I.C., M.I.Chem. E., and A. OGILVIE, A.M.I.Mech.E., with a foreword by Dr. H. C. Brown. Vol. I. Pp. 355. London: Ernest Benn, Ltd., 1927. Price 45s. net.

Any technical work with which Mr. Parrish's name is associated is sure to be read by all interested in the technology of the subject, and the foreword by Dr. H. C. Brown will secure for the present work the interest of all connected with the British fertiliser trade. One cannot, however, refrain from supporting Dr. Brown when he says that he cannot agree with all the views expressed or all the data furnished, but in a work of this kind, which covers so large a field in great detail, there is bound to be a certain amount of debatable matter. Moreover, if this were not so, the book would not fulfil the purpose for which it has been written: that of indicating the problems with which the industry is faced to-day, and stimulating the examination of new ideas and new methods.

Quite half of "Artificial Fertilisers" is devoted to the history, chemistry and manufacture of superphosphate: compound manures and basic slag being also dealt with. The authors inform us in their preface that a second volume is to be published, which will, no doubt, describe the manufacture of nitrogen and potash fertilisers, which are only dealt with in the present work in their connexion with compound manures.

Mr. Parrish and Mr. Ogilvie are to be congratulated on having compiled a complete and up-to-date book of reference for the superphosphate industry, and although some of the figures relating to output and efficiency of machinery are perhaps open to question, there is no doubt that the work will prove a very useful one.

It is suggested that manufacturers of superphosphate have, in the past, paid more attention to the mechanical

condition of their product than to its chemical properties, but those who understand the difficulty of obtaining the maximum of soluble phosphate which is compatible with fine condition for mechanical distribution will not be surprised at this.

The world's output of phosphate rock, with full statistics, and a description of the mining processes employed, the manufacture, storage and despatch of superphosphate, compound fertilisers and basic slag are all dealt with in very complete detail.

The chapters dealing with mechanical den excavators, grinding mills, mixing, screening and bagging machines are very thorough; describing the practices and machines in vogue in European and American works, and comparing their output and efficiency in the fullest manner.

The depressed condition of the British superphosphate trade is commented on and discussed, the suggestion being made that British Nauru phosphate should be supplied to British manufacturers of superphosphate, less interest and sinking fund charges, for a period sufficiently long to enable the industry to recover from the effect of competition arising from depreciated foreign exchanges. Whether the deduction of these charges would enable Nauru phosphate to be delivered in this country at a price sufficiently low to compete with the very low price of North African phosphate is doubtful, but, in any event, the suggestion is not a new one, having been considered by more than one postwar Government and rejected after careful consideration.

The last chapter is devoted to the consideration of the trend of future developments in the direction of finding other methods of rendering phosphate soluble in water, and, after surveying the various attempts which are being made to this end, the authors conclude by advising the superphosphate manufacturers to watch all new processes.

As stated above, this work is a very useful one, and should be read by all fertiliser manufacturers.

COMPANY NEWS

NOBEL INDUSTRIES, LTD.

A further dividend has been declared on the ordinary shares of 12% less tax, making 15% for the year, and also a dividend has been announced on the deferred shares of 10% less tax.

ASSOCIATED LEAD MANUFACTURERS, LTD.

The profit for 1926 amounted to £65,079, compared with £132,071 for 1925. Interest on secured notes absorbed £9484, and the preference dividend absorbed £46,238. The directors propose to write off the preliminary expenses £8974. No dividend is recommended on the ordinary capital of £1,448,409, the balance of £50,213 being carried forward, against £49,831 brought in.

BRITISH CYANIDES CO., LTD.

This company is now offering 672,838 ordinary shares of 2s. each to existing holders in the proportion of two new shares for each ordinary held on April 25. The directors report a marked improvement in the position of the company since Christmas. In March there was a profit of £92, against a loss of £418 in February and a loss of £845 in January. The improvement in the price of prussiate of soda has been maintained, and new markets are being found for thiocarbamide and other

chemicals, the sale of which leaves a satisfactory margin of profit. All profits derived from the new synthetic resin or any products made therefrom are shared equally by the company with the Beetle Products Company. The consumption of moulding powders continues to expand. The cotton process has been the subject of intensive research work by the Bleachers' Association in collaboration with the Bradford Dyers' Association and the company, with the result that the Bleachers' Association has erected plant for operations on a semi-commercial scale.

BRITISH OIL AND CAKE MILLS, LTD.

The twenty-ninth ordinary general meeting was held on April 12, Mr. J. W. Pearson, chairman, presiding. In order to establish the brand "New-Pin" soap, a very heavy expenditure on advertising had been made. The directors had now decided to abandon this scheme, and the advertising expenditure had been written off, so that the year 1927 had been started free from encumbrances. Many mills in this industry had to close down owing to the coal strike, whilst others, including most of those belonging to the company, carried on by using oil fuel in place of coal. This was more expensive, and it was estimated that the cost of seed crushing during the last six months of 1926 cost £150,000 more than for the first six months of the year. The importation of oilseeds during 1926 was 255,000 tons less than in 1925, while, as compared with the same period there was an increase in the importation of foreign-made cakes of 40,000 tons and of oils 38,000 tons. There were indications of improvement in general conditions for 1927. Whilst the trading results of 1926 were better than 1925, a further betterment of the position was anticipated at the end of the current year.

UNITED GLASS BOTTLE MANUFACTURERS, LTD.

The fourteenth ordinary general meeting, held on April 21, was presided over by Mr. G. E. Alexander, who had been elected chairman in succession to the late Sir Ernest F. Oldham. Sir Max J. Bonn, K.B.E., and Major W. F. Dixon-Nuttall, D.S.O., had joined the board, the former being elected deputy-chairman. During the year work was commenced on the extensive improvements in plant and equipment to which the directors had given long and careful consideration, and over £82,000 was expended on capital account, principally at the St. Helens factories. Owing to the general strike and the coal strike, the trading profit of the company and its subsidiaries did not come up to expectations. The reduction in operating capacity in the factories utilising coal amounted to between 40 and 50%, meaning a loss in output of over 50,000,000 bottles, whilst the operation of the remaining furnaces necessitated the purchase of over 30,000 tons of coal at ruinous prices in order to meet the most urgent demands of customers. The first fiscal period of the year shows results which compare more than favourably with the corresponding period of 1926. Competition from home and foreign manufacturers was still very keen, but the Board were confident that the policy of concentration and modernisation of existing plants, together with the consistent quality and service of the company, would enable them to maintain their position as the premier glass bottle manufacturers of this country.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4 ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of ammonia £37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate.—2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, oaks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb., according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithophone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
Sulphur Chloride.—4d.—7d. per lb., carboys extra.
Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
Vermilion, pale or deep.—6s.—6s. 3d. per lb.
Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
Red Liquor.—9d.—1s. 16° Tw. per gal.
Wood Creosote.—1s. 9d. per gal., unrefined.
Wood Naphtha.—Miscible, 4s.—4s. 3d. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
Brown Sugar of Lead.—£40 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 8½d.—9d. per lb. Crude 60's, 2s. 6d.—2s. 8d. per gal.
Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. Steady. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 8d.—2s. 3d. per gal., ex works in tank wagons.
Toluole.—90%, 1s. 9d. to 2s. 0½d. per gal. Pure, 1s. 10d.—2s. 3½d. per gal.
Xylol.—2s.—2s. 4d. per gal. Pure, 3s. per gal.
Creosote.—Cresylic 20/24%, 10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/100, 1s. 10d.—1s. 11d. per gal. Solvent 95/100, 1s. 6d.—1s. 7d. per gal. Solvent 90/190,—1s. 1½d.—1s. 4d. per gal.
Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
Naphthalene.—Crystals,—£11 10s.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
Pitch, medium soft.—70s.—80s. per ton, f.o.b. according to district. Nominal.
Pyridine.—90/140.—8s. 6d.—13s. per gal. Nominal. 90/180—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
Acid Gamma.—4s. 9d. per lb.
Acid Amidonaphthol disulpho (1.8.2.4).—10s. 0d. per lb.
Acid H.—3s. 3d. per lb. 100% basis d/d.
Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
Aniline Salts.—7d. per lb., naked at works.
Anthranilic Acid.—6s. per lb. 100%.
Benzaldehyde.—2s. 3d. per lb.
Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
Benzoic Acid.—1s. 8½d. per lb.
o-Cresol 29/31° C.—4d. per lb.
m-Cresol 98/100%.—2s. 8½d. per lb.
p-Cresol 32/34° C.—2s. 8½d. per lb.
Dichloraniline.—2s. 3d. per lb.
Dimethylaniline.—2s. per lb. d/d. Drums extra.
Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
Dinitrochlorbenzene.—£84 per ton d/d.
Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
Diphenylamine.—2s. 10d. per lb. d/d.
α-Naphthol.—2s. per lb. d/d.
β-Naphthol.—11d.—1s. per lb. d/d.
α-Naphthylamine.—1s. 3d. per lb. d/d.
β-Naphthylamine.—3s. per lb. d/d.
p-Nitraniline.—1s. 9d. per lb. d/d.
m-Nitraniline.—3s. per lb. d/d.
o-Nitraniline.—5s. 9d. per lb.
Nitrobenzene.—6d. per lb., naked at works.
Nitronaphthalene.—1s. 3d. per lb. d/d.
R. Salt.—2s. 2d. per lb. 100% basis d/d.
Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
o-Toluidine.—8d. per lb., naked at works.
p-Toluidine.—2s. 2d. per lb. ex works, naked.
m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Purc, 80%.—£39 per ton, ex wharf London, in glass containers.
Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb. Firm and Disk.
Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots—1s. per oz.
Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
Acid, Camphoric.—19s.—21s. per lb.
Acid, Citric.—1s. 5½d.—1s. 7d. per lb. Less 5%. Advancing.
Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
Acid, Salicylic.—B.P. 1s. 3½d.—1s. 4d. per lb. Technical 11½d.—1s. per lb. Both in good demand.
Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
Acid, Tartaric.—1s. 3d. per lb. Less 5%. Firm market.
Amidol.—9s. per lb. d/d.
Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
Amidopyrin.—8s. 6d. per lb.
Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
Atropine Sulphate.—11s. per oz. for English make.
Barbitone.—6s. 6d. per lb.
Benzonaphthol.—3s. 3d. per lb.
Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuth B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d.—2s. 5d. per lb. Potassium.—1s. 11d.—2s. per lb. Sodium.—2s. 2d.—2s. 3d. per lb. All spot.

Calcium Lactate.—1s. 3½d.—1s. 4½d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Cresote Carbonate.—6s. per lb.

Ether meth.—1s. 1d.—1s. 1½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Gaiacol Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb., for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron. Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £33 per ton net.

Magnesium Oxide.—Light Commercial £67 10s. per ton, less 2½%; Heavy Commercial £22 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 3d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb.; Detached cryst., 14s. 6d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonol.—11s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. per lb.

Phenazone.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 97s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 5d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb. Very limited enquiry.

Solol.—2s. 4d. per lb.

Sol. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sol. Citrate, B.P.C., 1911.—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sol. Ferrocyanide.—4d. per lb., carr. paid.

Sol. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sol. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonol.—7s. 6d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.

Thymol, Puriss.—11s.—12s. per lb., according to quantity. Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (*ex Anethole*).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. 6d. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—9s. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—27s. 6d. per lb. Safrinol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—13s. per lb.

Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 1d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—8s. 9d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 16s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than July 2nd. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on May 19th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Baker. Heat-exchangers. 11,123. Apr. 26.
British Dyestuffs Corp., Ltd., and Chapman. Preparation of foams for fire extinction. 11,020. Apr. 25.
Broadbent & Sons, Ltd., and Hallitt. Centrifugal driers. 11,552. Apr. 30.
Brunler. Evaporating apparatus. 11,000. Apr. 25.

Electrolux, Ltd. Production of cold. 11,440. Apr. 29. (Sweden, 1.5.26.)

Erzröstung Ges., and Balz. Mechanical kilns. 11,015. Apr. 25.

L.-G. Farbenind. Producing solid materials in state of fine dispersion. 11,050. Apr. 25. (Ger., 28.4.26.)

Kocour. Apparatus for determining strength of solutions. 11,600. Apr. 30. (U.S., 1.5.26.)

Marsden, and Meldrums, Ltd. Apparatus for effecting intimate contact of gases and liquids. 11,308. Apr. 28.

Reavell. Spray drying-apparatus. 11,270. Apr. 27.

Salerni. Treatment of gases etc. 11,192 and 11,197. Apr. 26.

Thiesen. Apparatus for treating gases with liquids. 11,607. Apr. 30. (Ger., 3.5.26.)

Whitnough. Apparatus for production of dispersions of solids in liquids. 11,414. Apr. 29.

I.—Complete Specifications

7562 (1926). Carrier Engineering Co., Ltd., and Groom. Drying and separation from gases of soluble and condensable vapours, and impurities. (269,714.)

18,327 (1926). L.-G. Farbenind. Manufacture of nickel catalyst. (255,884.)

22,355 (1926). General Rubber Co. Furnaces for supplying drying-gases. (267,464.)

24,553 (1926). Visco Engineering Co., Ltd., and Smith. Apparatus for treating air or gas with liquid. (269,790.)

26,267 (1926). Kropp. Settling-tanks. (260,279.)

31,478 (1926). Babcock & Wilcox, Ltd (Babcock & Wilcox Co.). Utilising the heat of materials discharged from furnaces and kilns. (269,813.)

*26,781 (1926). Caals. Filter cloths. (269,841.)

*8982 (1927). Andveo Corp. Fire-extinguishing composition. (269,879.)

*9349 (1927). Akt. Separator. Centrifugal separator installations. (269,883.)

*10,034 (1927). Boyner and Pehrson. Introduction of air or gaseous fluid into the charge in rotary furnaces. (269,892.)

II.—Applications

Dubbs. Cracking hydrocarbon oils. 11,461. Apr. 29.

Dvorkovitz. Manufacture of carburetted water-gas. 11,272. Apr. 27.

Holzappel. Protecting interior of oil cracking retorts etc. 11,005. Apr. 30.

L.-G. Farbenind. Conversion of hydrocarbons. 11,347—8. Apr. 28. (Ger., 1.5.26.) Conversion of coaly materials into liquid products. 11,569. Apr. 30. (Ger., 5.5.26.)

Lederer. Apparatus for producing gas. 11,378. Apr. 28. (Austria 28.4.26.)

Lee and Thompson. Gas tar filter extractor. 11,297. Apr. 28.

Low Temperature Carbonisation, Ltd., and Parker. Distillation retorts. 11,295. Apr. 27.

Meyer. Fuels for internal-combustion engines etc. 11,612. Apr. 30.

Pollock. Cracking hydrocarbon oil. 11,462. Apr. 29.

Salerni. 11,192 and 11,197. See I.

Toula. 11,065. See III.

White (Illinois Anthracite Corp.). Apparatus for producing smokeless etc. fuel. 11,175. Apr. 26.

II.—Complete Specifications

25,082 (1925). Jackson (Western Gas Construction Co.). Manufacture of water-gas. (269,221.)

1681 (1926). Weber. Production of coke briquettes. (269,655.)

2287 (1926). Bentley and Appleby. Gas producers. (269,689.)

2561 (1926). Patart. See XX.

7295 (1926). Wannebo. Manufacture of gas from oil or tar or cracking oil or tar. (269,711.)

*448 (1927). Aluminum Co. of America. Calcining of coke. (269,849.)

*10,865 (1927). Soc. des Prod. Chim. de Clamecy. Distillation of wood. (269,927.)

III.—Application

Toula. Treatment of oils, tars, etc. 11,065. Apr. 25.

III.—Complete Specification

7295 (1926). Wannebo. See II.

IV.—Applications

British Dyestuffs Corp., Ltd., Bunbury, and Shepherdson. Manufacture etc. of aroylating agents. 11,146. Apr. 26.

British Dyestuffs Corp., Ltd., Baddiley, and Chorley. Dyes. 11,372. Apr. 28.

Carpmael (L.-G. Farbenind.). Manufacture of azo dyestuffs. 11,179. Apr. 26.

Dehn (Newport Co.). Making N-dihydro-1,2,2,1-anthraquinone azine. 11,017. Apr. 25.

L.-G. Farbenind. Production of orange vat dyestuffs. 11,052. (Ger., 15.11.26.) Manufacture of mordant dyestuffs. 11,288. Apr. 27. (Ger., 27.4.26.)

Imray (L.-G. Farbenind.). 11,187. See XX.

IV.—Complete Specifications

8762 (1926). L.-G. Farbenind. See XX.

*10,819 (1927). L.-G. Farbenind. Manufacture of dye stuffs. (269,918.)

V.—Applications

Carpmael (L.-G. Farbenind.). Dressing artificial silk. 11,178. Apr. 26.

L.-G. Farbenind. Treatment of fibrous materials etc. 11,567. Apr. 30. (Ger., 21.1.25.)

Laucks. Cellulose fibre product. 11,589. Apr. 30 (U.S., 3.5.26.)

Muller. Manufacture of cellulosic materials 11,048. Apr. 25.

Nanji. Treatment of plant materials etc. 11,410. Apr. 29.

Pathé Cinema Anciens Etablissements Pathe Frères. Mixtures of organic substances which can be adsorbed by cellulose ethers etc. 11,494. Apr. 29. (Fr., 13.4.27.)

Wells. Cooking vegetable fibre. 10,998. Apr. 25. (U.S., 29.6.26.)

V.—Complete Specifications

25,468 (1925). Mount. Wood pulp production. (269,256.)

28,282 (1925). Clavel. Treatment of products or goods of or containing cellulose acetate. (269,605.)

29,487 (1926). Heberlein & Co. Chemically varying artificial silk. (261,792.)

*10,704 (1927). Barbou and Delvaile. Treating residual liquors from treatment of cellulose material. (269,909.)

VI.—Applications

Bunney. 11,089. See XIII.

L.-G. Farbenind. Manufacture of wetting-agents. 11,061. Apr. 25. (Ger., 23.4.26.) Dyeing. 11,287. Apr. 27. (Ger., 27.4.26.) Dyeing. 11,499. Apr. 29. (Ger., 29.4.26.)

VI.—Complete Specifications

*10,818 (1927). Chem. Fabr. Milch, and Lindner. Dyeing or printing with mordant dyestuffs. (269,917.)

*10,952 (1927). L.-G. Farbenind. Dyeing and printing cellulose esters and ethers. (269,934.)

*11,061 (1927). L.-G. Farbenind. Manufacture of wetting agents. (269,942.)

VII.—Applications

Ashcroft. Extracting alumina, potash, lime, etc. from silicates. 11,350. Apr. 28.

British Dyestuffs Corp., Ltd., Payman, and Piggott. Removal of free chlorine acid bromine from fluid mixtures 11,256. Apr. 27.

Craig, Kirkham, and Spence & Sons. Treatment of siliceous materials. 11,309. Apr. 28. Preparation of silica from silicate solutions. 11,310. Apr. 28.

Gaillard. 11,384. See XVI.

Johnson (L.-G. Farbenind.). Production of alkali metal nitrates. 11,051 and 11,482. Apr. 25 and 29.

Liljenroth. Treating material containing magnesium. 11,138. Apr. 26. (Sweden, 15.1.27.)

Liljenroth. 11,007 and 11,096. See XVI.

Metallwerk Plansee Ges. Production of molybdic and tungstic acid. 11,157. Apr. 26. (Ger., 26.4.26.)

VII.—Complete Specifications

782 (1926). Johnson (L.-G. Farbenind.). Manufacture of iron carbonyl. (269,625.)

1771 (1926). Simonis, and Liquid Air, Ltd. Liquid air oxygen-producing plant. (269,661.)

13,997 (1926). Uhde. Synthetic production of ammonia. (253,122.)

18,972 (1926). West Virginia Pulp & Paper Co. Converting alkali sulphides into alkali sulphites. (260,552.)

20,784 (1926). Stevens, Norris, and Watson. Purification of zinc sulphate solutions preparatory to electrolysis. (269,776.)

20,787 (1926). Stevens, Norris, and Watson. Removal of phosphorus from metal-bearing solutions. (269,778.)

20,788 - 9 (1926). Stevens, Norris, and Watson. See X.

*8943 (1927). Metallbank u. Metallurgische Ges. Treating lithium-containing silicates. (269,878.)

*10,669 (1927). Urbain Corp. Recovery of phosphorus and hydrogenated compounds thereof. (269,908.)

*10,827 (1927). Gaillard. See XVI.

*11,157 (1927). Metallwerk Plansee Ges. Production of molybdic and tungstic acid. (269,947.)

VIII.—Application

Quartz et Silice. Drawing silica glass etc. 11,455. Apr. 29. (Fri., 4.5.26.)

VIII.—Complete Specifications

25,951 (1925). Webster. Kilns for burning clay products etc. (269,344.)

837 (1927). Soc. Anon. des Manuf. des Glaces et Prod. Chim. de St.-Gobain, Chauny, & Cirey. Glass. (264,495.)

IX. Applications

Aerocrete (Foreign), Ltd., and Nicol. Production of porous concrete etc. 11,356. Apr. 28.

Iwanowski and Turski. Impregnation of wood etc. 11,382. Apr. 28.

X.—Applications

Cunningham and Huggins. Treatment of tin-bearing materials. 11,277. Apr. 27.

Drums, Ltd., and Jessop. Cleaning metal surfaces. 11,527. Apr. 30.

Garnett, Holden, and Smith. Refining nickel alloys etc. 11,075. Apr. 25. Magnetic alloys. 11,584. Apr. 30.

Guggenheim Bros., Macgowan, and Smith. Flotation processes. 11,441. 11,445. 11,448. 11,464. Apr. 29. (U.S., 3.8.26 and 24.1.27.)

Parker Rust Proof Co. Rust proofing etc. 11,035 - 6. Apr. 25. (U.S., 10.5.26.)

Rey. Ferrous metals. 11,172. Apr. 26. (Fr. 27.4.26.)

Smith. Treatment of ores containing platinum. 11,184. Apr. 26.

X—Complete Specifications

2033 (1926). Johnson (L.-G. Farbenind.). Manufacture of pure iron. (269,677.)

19,697 (1926). Tottman. Solder for aluminium and aluminium alloys. (269,771.)

20,786 (1926). Stevens, Norris, and Watson. Acid extraction of metals such as zinc and vanadium. (269,777.)

20,788—9 (1926). Stevens, Norris, and Watson. Recovery of vanadium solutions. (269,779—80.)

22,178 (1926). Electrolytic Zinc Co. of Australasia. Treatment of zinc ores for recovery of zinc by electrolytic deposition. (258,575.)

*6882 (1927). Jessup. Preparation of magnesium and alkaline-earth metals. (269,864.)

XI.—Applications

Electric Furnace Co., Ltd. (Northrup). Electric induction furnaces. 11,162—3. Apr. 26.

Tainton. Electrolysis. 11,490. Apr. 29.

Zimmermann. Production of insulating materials. 11,353. Apr. 28.

XI.—Complete Specifications

26,081 (1925). Cellino. Electrical cell. (241,898.)

1041 (1926). Harrison and Campbell. Electric batteries. (269,633.)

14,078 (1926). Pfanhauser, and Langbein-Pfanhauser-Werke. Galvanic baths. (269,753.)

20,784 (1926). Stevens, Norris, and Watson. See VII.

22,178 (1926). Electrolytic Zinc Co. of Australasia. See X.

XII.—Applications

James. Manufacture of soap. 11,465. Apr. 29.

Tillisch. Vitaminising fats. 11,114. Apr. 26. (Ger., 28.4.26.)

XII.—Complete Specification

*8082 (1927). Anc. Etab. Pellerin. Apparatus for melting fatty substances. (269,873.)

XIII.—Applications

Alcock. Manufacture of white pigment. 11,286. Apr. 27. Bunnay. Waterproofing etc. composition. 11,080. Apr. 26.

Coles. Producing white lead. 11,313. Apr. 28.

Johnson (L.-G. Farbenind.). Production of cellulose ester resin lacquers. 11,480. Apr. 29. Production of coloured coating-lacquers. 11,481. Apr. 29.

Laporte, Ltd., and Weber. Manufacture of white pigment. 11,286. Apr. 27.

XIII.—Complete Specification

235 (1926). Imray (Soc. Chem. Ind. in Basle). See XX.

XIV.—Application

Head. Treatment of rubber latex. 11,526. Apr. 30.

XIV.—Complete Specifications

2498 (1926). Stevens. Manufacture of vulcanite. (269,693.)

13,159 (1926). Porritt, Dawson, and Research Assoc. of British Rubber and Tyre Manuf. Preservation of goods of rubber etc. (269,745.)

XV.—Complete Specifications

16,716 (1926). Manfred. Production of artificial horn. (269,761.)

17,164 (1926). L.-G. Farbenind. Manufacture of chromium-magnesium preparations suitable for tanning. (255,087.)

19,912 (1926). Mathieson Alkali Works. Tanning-processes. (256,979.)

XVI.—Applications

Gaillard. Obtaining superphosphates. 11,384. Apr. 28. (Spain, 25.10.26.)

Liljenroth. Treating raw phosphate etc. 11,007 and 11,096. Apr. 25 and 26. (Sweden, 31.12.26 and 8.1.27.)

XVI.—Complete Specification

*10,827 (1927). Gaillard. Increasing the richness of superphosphates. (269,921.)

XIX.—Applications

Aische. Preparation of feeding-meals. 11,088. Apr. 26.

Bakes, Galloway, and Thaysen. Treatment of vegetable matter. 11,577. Apr. 30.

Tillisch. 11,114. See XII.

XIX.—Complete Specifications

29,686 (1925). Hunt. Making a self-preserving acid milk product. (269,610.)

2074 (1926). Munday. Sterilisation, pasteurisation, etc. of milk and other liquids. (269,678.)

*10,842 (1927). Avanzi. Preparation and preservation of fish and other products. (269,923.)

XX.—Applications

British Dyestuffs Corp., Ltd., Bunbury, and Shepherdson. 11,146. See IV.

Etabl. Poulenc Frères, and Fournau. Manufacture of ortho-chloro-para-aminoglycineamidephenylarsinic acid. 11,080. Apr. 25. (Fr., 21.10.26.)

L.-G. Farbenind. Making dihydroxyacetone. 11,186. Apr. 26. (Ger., 26.4.26.)

Inray (L.-G. Farbenind.). Manufacture of cyclic ketones of the aromatic series. 11,187. Apr. 26.

Soc. Chem. Ind. in Basle. Manufacture of derivatives of substituted quinoline carboxylic acids. 11,603. Apr. 30. (Switz., 30.4.26.)

XX.—Complete Specifications

235 (1926). Inray (Soc. Chem. Ind. in Basle). Manufacture of condensation products of urea, or a derivative thereof, and formaldehyde. (246,126.)

779 (1926). Hohn. Production of a chloride capable of reaction from pinene or purified turpentine oil. (269,624.)

1549 (1926). Newbery, and May & Baker, Ltd. Manufacture of unsymmetrically acylated amino derivatives of arylarseno compounds. (269,647.)

1930 (1926). Dicker (Deutsche Gold- und Silber-Scheideanstalt). Iodising pyridine derivatives. (246,501.)

2306 (1926). Râth. Production of 2-amino-5-iodopyridine. (246,842.)

2561 (1926). Putart. Synthesis of methyl alcohol and liquid hydrocarbons. (247,178.)

8672 (1926). I.-G. Farbenind. Manufacture of nucleal-alkylated or nucleal-cyclo-alkylated arylsulphonic acids. (250,241.)

*10,852 (1927). Chem. Fabr. vorm. Sandoz. Preparation of gall acids. (269,925.)

*11,186 (1927). I.-G. Farbenind. Making dihydroxyacetone. (269,950.)

XXI.—Complete Specifications

27,428 (1926). Wade (Wadsworth Watch Case Co.). Photographic processes. (269,806.)

*10,740 (1927). Klaver. Manufacture of photographic negatives and prints. (269,912.)

XXIII.—Application

Pennell. Purification of trade waste. 11,409. Apr. 29.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number: *Austria*: Chemicals, printing machines (439). *British India*: Steel boiler tubes (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1.). *Canada*: Zinc sheets, glaziers' diamonds (432). *Germany*: Vegetable, mineral and animal oils and fats, oilseeds, oil-cakes, fish-meal, waxes (447). *Greece*: Metals, paper, printing inks, dyes, copper, tin, electric cable (450). *New Zealand*: Artificial silk (437). *Poland*: Leather, leather chemicals (452). *Spain*: Pharmaceutical chemicals, patent medicines

(456). *South Africa*: Wrought iron chain (A.X. 4626). *United States*: Creosote oils, coal tar, coal tar pitch, tar acid, cresylic acid, solvent naphtha and benzol (464); Glassware (465); Mining and engineering machinery (467).

News from Advertisements

A lecturer in chemistry is wanted by the University of Witwatersrand, Johannesburg, South Africa (p. viii).

A part-time research organiser is required by the Research Fund Committee of the Institute of Brewing (p. viii).

Two advertisers offer sets of the JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY for disposal (p. viii).

Several patents are offered for negotiation (p. viii).

A mineral analyst, with foreign and colonial experience of buying ores, desires responsible appointment (p. viii).

A laboratory is required in London (p. viii).

PUBLICATIONS RECEIVED

LISTER CENTENARY EXHIBITION AT THE WELLCOME HISTORICAL MEDICAL MUSEUM. Handbook, 1927. Pp. 216. London: Wellcome Historical Medical Museum, 1927.

THE WELLCOME HISTORICAL MEDICAL MUSEUM. Pp. 118. London: The Wellcome Foundation, Ltd., 1927.

SPECTROSCOPY. By E. C. C. Baly, C.B.E., M.Sc., F.R.S. Third edition. In four volumes. Vol. II. Pp. vi + 398. Text-books of Physical Chemistry, edited by Sir W. Ramsay, K.C.B., F.R.S., and F. G. Donnan, C.B.E., M.A., Ph.D., F.R.S. London: Longmans, Green & Co., Ltd., 1927. Price 18s.

THE INITIAL STAGES OF GASEOUS EXPLOSIONS. Part I.—Flame Speeds during the Initial "Uniform Movement." Part II.—An Examination of the Supposed Law of Flame Speeds. By W. A. Bone, F.R.S., R. P. Fraser, and D. A. Winter. Part III.—The Behaviour of an Equimolecular Methane-Oxygen Mixture when fired with Sparks of Varying Intensities. By W. A. Bone, F.R.S., R. P. Fraser, and F. Witt. Proceedings of the Royal Society, A. Vol. 114, 1927. Pp. 402—449. London: The Royal Society, 1927.

PUBLICATIONS OF THE INSTITUTION OF GAS ENGINEERS, 28, Grosvenor Gardens, Westminster, London, S.W.1:—Gas Fellowship, 1926, Report. Influence of the Ash Constituents in the Carbonisation and Gasification of Coal. Part II.—Gasification of Special Cokes in Steam. By C. B. Marson, Ph.D., M.Sc., A.I.C., and J. W. Cobb, C.B.E., B.Sc. Pp. 604—652.—Fifteenth Report of the Gas Investigation Committee. Examination of Products of Combustion from Typical Gas Appliances.—Part I, Aeration of High-Pressure Lighting Burner. Pp. 100—181.—Sixteenth Report of the Gas Investigation Committee. Studies in Carbonisation. Part I.—Influence of Size of Coal. Pp. 162—229.

DIE TROCKENTECHNIK. GRUNDLAGEN, BERECHNUNG, AUSFÜHRUNG UND BETRIEB DER TROCKENEINRICHTUNGEN. By M. Hirsch. Pp. xiv + 366. Berlin: J. Springer, 1927. Price 31.80 r.m.

CHIMIE INDUSTRIELLE. LA GRANDE INDUSTRIE CHIMIQUE LES MÉTALLOÏDES ET LEURS COMPOSÉS. LES MÉTAUX ET LEURS SELS. INDUSTRIES ORGANIQUES. By Paul Baud. Second edition. Pp. xii + 1022. Paris: Masson et Cie, 1927. Price 100 fr.

DIE UNIVERSALITÄT DER GRAVITATION IN DEN GRÖSSTEN UND KLEINSTEN SYSTEMEN. By Dr. H. Koller-Aeby. Pp. 104. Basel: Benno Schwabe & Co., 1927. Price 8 fr.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUST

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Manufacturers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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EDITORIAL

Empire Day

OFTEN in the past we have turned aside respectfully but determinedly from contributions which have related in verse how Carbazide when Iodide. With thoughts of Empire Day, of the Imperial Conference and the Colonial Governors' Conference, of the significance of the tour of the Duke and Duchess of York in Australasia in our mind, and with Anzac Day just past, we may be forgiven for longing for the soul of a Homer in order to write a worthy epic of Empire. The very materialism of much of a chemist's work compels him, happily enough, to consort with Art, Music and Poetry even though he may be merely a dilettante. Chemistry is not without its romance, its beauty—truth is beauty, beauty truth but its incidence upon humanity must be largely materialistic. So it is then that the function of the chemist in Empire development must be preponderatingly, but not by any means entirely, utilitarian. But it is no ignoble destiny, and provided we play our part well, we may be content to leave the song of Empire to be voiced by those more fitted to the task and put away vain regrets. Even in the comparatively early stages of the development of a new land, the products of the chemist, the metallurgist and the chemical engineer are of value to the pioneer for the construction of his railroads and bridges, his habitations and his townships, and for their maintenance. The development of mineral wealth and general natural resources, and the transformation and safe transit of natural products are matters in which the chemist and chemical engineer are vitally interested, whilst pastoral and agricultural occupations cannot long be carried on at full efficiency without insecticides and chemical manures even in virgin territory. The British chemical industries, through such agencies as Imperial Chemical Industries, Ltd., which reach to the uttermost corners of the Empire, are able to take their part in Empire development, but the time comes when internal chemical industries are created within the countries of the Great Commonwealth. Anyone who has glanced even casually through our recent Canadian number must realise the force and implication of this remark, and what has happened in Canada will be repeated in other Empire countries. Already in New Zealand, for instance, there is the seed of a second Shawinigan, for the New Zealand Nitrates Syndicate has been formed to

harness water power in the region around Dusky Sound and Deep Cove. With enormous amounts of cheap electrical power available it is inconceivable that development will cease at the production of nitrogenous fertilisers, and we may reasonably anticipate the growth of a large chemical industry making such products as demand electrical power in quantity at a cheap rate for their economical manufacture. We have but to remember the variety of chemicals made around Shawinigan Falls in Canada to realise the potential productivity of many of the Empire countries. For many years to come, however, the Mother Country may influence Empire chemical development in a very important manner, namely, by the "export" of research. The valuable work of the Department of Scientific and Industrial Research will bear fruit throughout the Empire, and this the more quickly and certainly if a workable scheme of co-operation between the home country and the countries of the Empire be put into operation. We have long advocated this in another place, and we note with satisfaction that it is to receive consideration at the Colonial Governors' Conference now in session. Many of the problems being studied under the control of the Department of Scientific and Industrial Research concern Empire life and industry as intimately as they do our own, and the results of research may be applied with equal profit. The savings possible in electric power transmission recently demonstrated by the Electrical Research Association, the work of the Stone Preservation Committee, the possibility of growing tung and perilla oil in the Empire, and the general improvement in the yield of palm products, the best means of shipping apples from Australia to this country, and the more general questions of food preservation by cold storage or canning, and indeed a score of examples which might be selected, indicate the value of research, carried out in this country, to the Empire at large. The results of such research would be useless, however, unless known far and wide to all likely to profit from their application, and it is to be hoped that it will not be long before an effective organisation for the dissemination of acquired knowledge throughout the countries of the Empire will be in operation. It will not be easy to create a detailed scheme, for even within the comparatively narrow limits of a single works' organisation we have

known the difficulties in applying to the full the definite results of a research department, but we are confident it can and will be done. The effective co-operation which has existed for some time between this country and the United States in fundamental coal research may provide a type of working base upon which we may shortly see erected an important and influential Empire Organisation for Scientific and Industrial Research.

Stone Preservation

It was our good fortune quite recently to visit several of our mid-county cathedrals and historic churches in the company of a rising young artist, who told us much of engaging interest about the art and craft of stained glass. It was gratifying to learn that both ancient and modern British stained glass productions—not to be thought of as mere pictures in glass—could claim the highest artistic merit. It was, therefore, with a certain sense of regret that we, as a humble member of a profession which justly claims to serve humanity in almost every phase of its complex civilisation, had to point out many instances of disintegrating stonework and decaying woodwork. Both plain majestic workmanship and beautiful or bizarre carvings of bygone artist craftsmen showed unmistakable signs of the action of time and circumstance, and we were not consoled until we read the recently issued Report of the Stone Preservation Committee which was appointed in 1922 "to report to the Building Research Board of the Department of Scientific and Industrial Research in regard to the best methods by which decay in building stones, especially in ancient structures, may be prevented or arrested, having regard to their function and to their original tooled surface." We recollect from articles which have appeared in our own columns that there are many recognised causes of stone decay, amongst which may be mentioned wind erosion, expansion and contraction with change of temperature, the freezing of water within the porous stone, the slow solution of calcium carbonate by water containing dissolved carbon dioxide, bacterial attack and, under modern conditions, the conversion of calcium carbonate in limestones and the like into sulphate through the agency of sulphur dioxide in the air and sulphuric acid, sulphurous acid and ammonium sulphate dissolved in rain water. Calcium sulphate formation is a two-headed giant of destruction, for not only can it be dissolved away so that in a sense rain water may actually be a solvent for stone, but also the production of sulphate crystals within the stone leads to powerful disintegrating forces being set up. How best can the ravages largely incident upon the presence of sulphur acids in present-day atmospheres be minimised? It would appear that the individual grains of porous stone must be coated with a protective layer so placed as not to diminish the porosity of the stone. Anything which tends to close the pores of the stone such as coatings of cement—not in any case aesthetically desirable—is dangerous. We may recall an interesting experiment of Professor Laurie's in which a piece of sandstone was coated with vaseline except on one upright face, so that the sample represented as far as possible the condition of stone in a wall. When this stone was played upon with a jet of water and allowed to dry, fresh crystals of salt, previously soaked into the

stone, were formed on the surface so that by repetition of the surface washing, the salt was entirely removed from the stone. On covering the free face with a layer of portland cement, however, crystallisation took place behind the cement, which was detached with simultaneous rotting of the stone. Many materials in solution may be deposited around the grains of stone without affecting materially its porosity, and the results of much careful experimentation are given in the report of the Stone Preservation Committee. Amongst these are paraffin wax of various melting points, silicate of soda, colloidal barium sulphate and synthetic resins of the phenol-formaldehyde class. The last-named appear to possess considerable interest, for although organic in nature, they are more resistant to acids and salts and to "organic" decay than ordinary natural rosin or colophony which, in solution in alcohol, has shown satisfactory results in the preservation of many stones. Professor Laurie reported in 1925 that experiments with rosin solutions upon sandstone had been in progress for some seven years, and that in no instance had scaling occurred, whilst in most cases rapid decay of the stone had not been observed. The synthetic resins seem to offer better coating means than rosin—which cannot, of course, be used upon limestone on account of the formation of lime soaps—but the deposition of a thin film of insoluble silica would appear to provide an almost ideal method of stone preservation. By the use of silicon ester, now a commercial product shown at recent exhibitions by Messrs. Albright & Wilson, of Birmingham, transparent layers of hydrated silica can be deposited upon the stone grains, rendering them almost immune from chemical or bacterial attack, and yet not affecting substantially the porosity of the stone as a whole. Silicon ester, made by the action of alcohol upon silicon tetrachloride, is a liquid which mixes readily with volatile solvents, and the solutions may be applied readily to stonework. The action of air and moisture brings about the necessary decomposition to hydrated silica. We have found no reference to extended experiments with silicon ester in the report of the Stone Preservation Committee, although on account of our real or fancied pressure of work, we have not been able to study the report exhaustively—and we wonder if the chemists of Messrs. Albright & Wilson, who have recently given us undeniable proof of their progressive outlook in other directions, could enlighten a large and interested public upon the value of silicon ester in stone-preservation. Finally, what has become of such materials as magnesium fluosilicate, which came so much into prominence a year or two ago, following glowing reports of their value upon the Continent? Was it Professor Desch who advocated its use in this country upon the basis of its reaction to form magnesium and calcium fluorides and silica within the stone treated? The preservation of the stonework of our beautiful and historic buildings is a matter which commands the attention of all. Spread throughout the Empire there are stately buildings which merely need that stitch in time in place of the nine which we in this country must make—and in the end it is the chemist's responsibility. The Building Research Board has instituted and reported the results of much valuable work, but in the matter of stonework preservation and renovation much still remains to be done.

DRIERS AS APPLIED TO PAINT AND VARNISH

By CLAUDE E. WATSON

(Concluded)

With the lead compounds, it is found that litharge is soluble at a lower temperature than red lead and gives a much paler solution, but when the oil with litharge is carried to the same heat as the red lead oil, the colour is practically the same. However, in a drying test, the litharge oil carried to 450° F. for 30 mins. dried fastest, the litharge oil carried to 400° F. for 30 mins. came next, while the red lead oil was the slowest. All three samples showed a sediment in the bottom. This is due to the lead compounds separating out of solution, a peculiarity of lead driers, which can be lessened to a great extent by high temperature or long heating, preferably the latter, because, as demonstrated with litharge, the solution becomes more stable. For this reason many prefer to use red lead, claiming that, because it requires more heating to get it into solution, therefore the solution will be more stable, but from the above experiment this does not seem to be the case. In our practice, we used litharge because we found that by regulating our heat we could get paler solutions than when using red lead. However, in two other samples the resinate and linoleate of lead were used, and it was found that they go into solution on heating at 350° F. for 30 mins., the resulting oil containing less sediment and drying faster than either the litharge or red lead oil.

We will now examine the manganese driers. Eleven different samples were prepared with the different manganese compounds so that each sample contained the same percentage of the element calculated as metal. When manganese dioxide was heated to 475° F. for 30 mins. there was practically no solution, but when heated to 500° F. for 30 mins. some of the metal had gone into solution. When these samples were poured on glass it required 36 hrs. for the former to dry, and 16 hrs. for the latter. Using manganese carbonate, we get very interesting results. It is claimed that using this material as a drier will give pale oils. Tests showed that when heated to 475° F. for 30 mins. the oil is pale, but there is sediment, i.e., drier that did not go into solution; when carried to 500° F. for another 30 mins. the oil is darker and there is still some of the drier not in solution; heating to 600° F. for an additional 15 mins. causes the drier to go into solution, but the resulting oil is very dark. Instead of carrying to the higher temperatures a sample was held at 475° F. for 8 hrs. with continual stirring; there was still a slight sediment, and the oil was very dark. When these samples were poured on glass it required 17 hrs. to dry the first two; 19 hrs. to dry the third, and 16 hrs. to dry the fourth. The third was slower drying because the film was very heavy, due to polymerisation at the high temperatures used. The fourth sample was polymerised to a certain extent, and gave a heavier film than the first two, but, because there was more drier in solution, it dried faster. It is quite apparent from this that manganese carbonate, if taken into proper solution, will not give pale oil. The same applies to some samples of manganese hydrate. With the acetate, it requires 30 mins. at 380° F. to give an oil which dries in 15 hrs.

With the resinate and linoleate, we find entirely different results; they go into solution on heating at 350° F. for 30 mins., and the linoleate gives the palest solution; when poured on glass they were both dry in 13 hrs. Here again the linoleate and resinate give better results than the other manganese compounds.

Upon testing the cobalt compounds it was found that the oxide is practically insoluble even at 600° F. There was very little change in colour of the oil, while the unaffected oxide had settled to the bottom. When poured on glass this oil was a little faster in drying than the original oil without drier. The acetate goes into solution on heating at 380° for 30 mins., but leaves some sediment, and when poured on glass required 13 hrs. to dry. The linoleate and resinate go into solution on heating at 350° F. for 30 mins., and dry in 12 hrs. There is no difference in colour with the last three, but it is still shown that the linoleate and resinate are the best driers.

From the foregoing tests, I believe that I am justified in saying that while there are still a few places, especially in varnish making, where some of the raw materials are essential, the use of the linoleates and resinates in the majority of paint and varnish work is the best practice where quality and uniformity are required.

Since the lead driers are too slow by themselves, and yield tacky films, whilst the manganese and cobalt driers by themselves yield films which have surface-dried, they are very rarely used alone. To get efficient driers it is essential to use combinations either of lead and manganese, lead and cobalt, or lead, manganese and cobalt. It is very rare that manganese and cobalt are used in combination, because for most work it is very unsatisfactory. We find that best results are obtained with combinations which contain lead in the highest percentage. We make different kinds of driers, but our main driers are a concentrated lead drier, using lead resinate, a combination drier using lead resinate and manganese linoleate, and a concentrated cobalt drier using cobalt linoleate. We know the proportion of metal present, and therefore can make any combinations necessary to give proper drying results. You will no doubt wonder why I say that lead should be present in the highest percentage. We proved this in both our paint and varnish.

For some years we had trouble through a certain exterior paint losing its gloss after a few months of weathering, while a certain exterior varnish would persist in checking and cracking after comparatively short periods of exposure. We were using the best of materials in both of these products, and could not understand why they should not stand up better than they did. We checked over everything, testing it very carefully, until we eventually came to the drier.

The drier used in the paint was made by dissolving manganese dioxide and litharge in oil, and then thinning this with turpentine. The drier contained lead in the highest proportion, but we found that, when added to linseed oil and then allowed to stand for a long period, there was considerable light-coloured precipitate on the bottom of the container. Upon examining this, it was found to consist of lead compounds which had separated from the oil. This left the oil with a drier that contained

a greater proportion of manganese than should be present with the lead that was left. When the oil was tried for drying time, it was found to be somewhat slower drying than when first made, and when it did dry the effect of the manganese present was apparent because it was surface dry. We, therefore, rightly concluded that the same process was taking place in the paint; because it dried mostly on the surface this part of the film would break down much more rapidly, and, therefore, cause the paint to become dull. After several tests on driers we made one from lead resinate and manganese linoleate in the proportion of ten to one, calculated as metal, because we found this to give a film which dried throughout, and therefore held its gloss for much longer periods.

The drier used in our varnish was a different proposition; here lead was incorporated by using litharge on the down heat, and instead of manganese we used cobalt, which was employed as a liquid cobalt linoleate solution put into the varnish after it was thinned. The two elements were present in about equal proportions. We had no trouble with precipitation of lead in this case; the trouble was due to an excess of cobalt, which caused the film to surface dry, leaving the lower portions more or less unoxidised, with the consequence that as the surface became harder and harder, it eventually contracted so much that the under layer, being softer, was unable to hold it in place, and it cracked.

I have already mentioned that the lead driers have a tendency to separate upon standing. This is a peculiarity which it is almost impossible altogether to overcome. However, with great care it can be held to a minimum. Manganese or cobalt give very little trouble in this respect. The reason for this is that when the lead drier is added to oil the lead will combine with the stearates and other saturated acids present in the oil, and these compounds being insoluble will gradually appear as a cloud in the oil, and upon standing will eventually precipitate. This fault is more apparent when the drier has been made from litharge, red lead, or lead linoleate and oil. When resin or resins are present, the precipitate is greatly reduced because the lead compounds of the saturated fatty acids are more soluble in the rosin acids. For this reason lead resinate finds an extended use, but here care must be exercised to obtain normal lead resinate and not basic lead resinate, because the latter, while soluble in hot resin or resins, is not soluble in oils or volatile thinners.

At the beginning I made reference to the care which should be exercised in the use of driers. It has been proven that 0.04% of cobalt, 0.1% of manganese or 0.67% of lead calculated as metal when used alone and in proper solution is enough to dry linseed oil in from 12 to 16 hrs. These are practically the optimum amounts of the metals which should be used. To use more than these amounts, except in the case of lead, will not give faster drying. Lead up to 1% shows faster drying, but leaves a very tacky film, whilst manganese, if used much over the optimum amount, will retard drying.

In making paint and varnish we endeavour to avoid excess driers and, since we always use combination driers in our products, do not experience any difficulty in keeping any one metal below its optimum percentage,

but there are times when we do experience trouble in keeping the metals properly balanced owing to the many variables which enter both in the making and using of these materials.

It was found that raw linseed oil with 0.38% lead and 0.038% manganese, or 0.38% lead and 0.034% cobalt, or 0.38% lead, 0.019% manganese and 0.017% cobalt calculated as metal, would dry in 5 hrs. at 70° F. It did not make any difference whether these materials were used as resinates or linoleates, only it was noted that it required longer heating to get the linoleates into proper solution. When the above percentages are reduced by $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$ and $\frac{1}{4}$, respectively, the drying times were 5½ hrs., 7 hrs., 10 hrs., and 16 hrs. at 70° F. It will no doubt seem that 5 hrs. is quite rapid drying; however, when the same oil is tested at 60° F. it requires 10 hrs. before it is dry. You may imagine, then, how slow-drying the oil with the reduced drier would be. This brings me to one of the most uncertain variables we have to deal with, namely, temperature. It is from this source that most complaints come regarding slow-drying paint or varnish. It is impossible to make paint or varnish products which will work satisfactorily at all temperatures. If made to dry in from 8 to 10 hrs. at 60° F., it is too fast-drying at 70° F., while if made to dry in 8 to 10 hrs. at 70° F., it is far too slow-drying at a temperature of 55° to 60° F. This trouble is much more apparent on interior painting than on exterior work because of two more variables which enter, namely, ventilation and sunlight. Poor ventilation means poor drying. To prove this statement a board was painted on both sides with the same paint. This board was hung up inside, so that one side was within an inch of the wall while the other side was exposed to the room. It was found that the side next to the wall required 4 hrs. longer to dry than the other side. The reason is simple enough. The air over one side was changed rapidly while the air over the other side was not. It is partly through this that a paint will dry faster outside than inside with the same temperature.

The greatest reason for the paint drying faster outside, as a rule, is sunlight. On a bright sunny day, paint will dry much more rapidly than on a dull, humid day, even though the temperature is the same. This is owing to the accelerating effect which the ultra-violet rays of sunlight have on the drying of paint and varnish.

There are two other variables which affect the use of our product, thickness of film, and the surface over which it is applied. The former depends entirely upon the individual applying the material, but a thick film will require much longer to dry than a thin film, and when the film is dry it will break down much more rapidly owing to surface drying. Therefore, the best practice is to apply thin films.

The surface is a very important source of complaint at times. Traces of any grease, wax, paraffin oil, etc., will in varying degrees slow up the drying of paint or varnish films. For this reason, washing soda and not soap should be used to clean off grease spots, while benzine will remove wax and oil from painted or varnished surfaces. Different surfaces will influence the drying of the same material, that is, wood, metal, canvas, etc.

practically all require paints made specifically for the purpose.

The following three variables also enter into the making of the product: the kind and quality of oil, the pigments used, and the length of time that the drier has been mixed with the oil.

The kind and quality of the oil refers to whether it is linseed, china wood, perilla, fish, or soya bean, and whether it is an old oxidised oil, a blown oil, a polymerised oil, a fresh raw oil, or a boiled oil. Many combinations of the above oils are used. Wood oil and perilla are generally used as polymerised oils; linseed, fish, and soya bean oils are used in all forms. The last two are very slow-drying and require special combination of the driers, which generally contain higher percentages of cobalt than is necessary for the other oils.

The pigments used have a considerable bearing upon the drying of paint. To test this, paints were made up using the same oil throughout and the following pigments: para-nitroaniline red, silica, asbestine, barytes, white lead, lithopone, zinc oxide, ochre, chrome green, ultramarine blue, antimony oxide, carbon black, iron oxide, umber, lead chromate (yellow), and Chinese blue. These paints were made of the same consistency, so that when applied we would get the same thickness of film. The drying times ranged from 6 hrs. for lead, zinc, and lithopone, to 26 hrs. for Chinese blue at 70° F. Para red, silica, asbestine, and lead chromate do not affect drying. Ochre, chrome green, ultramarine blue, antimony oxide, and carbon black slow up drying somewhat because they required practically 9 hrs. to dry. Iron oxide, umber, barytes, and Chinese blue slow up drying considerably, the first requiring 13 hrs. to dry, the next two 17 hrs., and the last 26 hrs. It is quite apparent that some pigments inhibit the drying reaction. This may be due to preferential adsorption of oxygen by the pigment, or it may be due to some impurities in the pigment which poison the catalysts.

A last factor which has a bearing on drying time is the length of time that the drier has been mixed with the paint or varnish. To add drier and then use the material immediately is poor practice, because it requires time for the drier to combine with the oil to cause efficient drying. We usually allow at least 12 hrs. when the drier is added cold. But, wherever possible, we prefer to combine the oil and drier with heat, and then store in tanks ready for use. Manganese and cobalt combine quite rapidly, whereas lead combines quite slowly in the cold. Therefore, when the material is used shortly after adding dryer the result will be slow drying, and the drying that does take place will be surface drying.

Keeping the variables in mind, it is not hard to understand why we are tempted at times to use excess driers or combinations of driers which we know will not give best results, in order to make our products dry under diverse conditions to suit many people who do not, and will not, take these factors into consideration when using paint or varnish. If your product is slow-drying, no matter what other qualities it has, you are immediately condemned.

The choice of driers is a matter which has to be carefully considered, especially in products for interior

use. In white paints, very light colours, or white enamels, it is best to avoid manganese drier and use a combination of lead and cobalt, because manganese causes much more rapid yellowing, owing to the fact that it causes the ultimate oxidation product to form much more rapidly than do the other driers. It also gives a pink cast to the whites when first applied.

In closing, I wish to thank the Harshaw, Fuller & Godwin Company, of Cleveland, and the Dominion Linseed Oil Company, of Montreal, for their co-operation, which has assisted materially in developing the experimental work of this paper.

THE INTERNATIONAL CONFERENCE ON BITUMINOUS COAL AT PITTSBURGH*

By DR. R. LESSING

In the summer of 1926, when the social and industrial life of this country was threatened by the most gigantic struggle in its economic history, and the contending parties were waging the fierce fight for hours and wages, with little regard for the fundamentals of the industry, the high-minded President of the Carnegie Institute of Technology, at Pittsburgh, Pa., Dr. Thomas Stockham Baker, undertook the organisation of an International Conference for the consideration of the scientific and technical aspects of coal and its utilisation. In doing so he was mindful of the principle laid down by our own Royal Commission on the Coal Industry (1925) in the final conclusion of their monumental Report, according to which they gave pride of place amongst the three chief lines of advance towards prosperity in the industry, to the greater application of science to the winning and using of coal.

The coal problem is essentially a world problem, and no phase of it can be duly considered without regard to its international aspect. The United States of America, in spite of its vast natural resources, its geographical advantages, its financial independence and its present unprecedented prosperity, is by no means free from anxiety in the development of its own coal industry, and in its turn has been faced for the past four months with the possibility of a coal stoppage arising out of the termination, on March 31 last, of the existing mine wages agreement, known as the Jacksonville agreement. In America, as in this country and on the Continent of Europe, the expansion of industrial activity hardly keeps step with the advances made in the more efficient and more economical utilisation of coal; this factor, coupled with the competition of other sources of energy, calls a temporary halt to the increase in the output of coal from the world's mines, which are continually threatened with the possibility of over-production. Thus, a double incentive is given to the intensified study of the coal problem, on the one hand by the consumer, who is forced by progressively keener competition to more and more stringent economies in his coal requirements for the supply of energy or raw materials, and on the other, by the producer, who is compelled to compensate a shrinking or non-expanding volume of output by the

* Read at a joint meeting of the London Section and the Fuel Section on April 4.

cheapening of production, and the enhancement in value of his product.

The conference was organised to take stock of the existing knowledge of practical fuel technology, to acquaint workers on the other side of the Atlantic with the work done in Europe in this branch, and to stimulate research on the coal problem in America. It must be recognised that in America industrial research has reached a high order, both quantitatively and qualitatively, and that it is contributing in no small degree to the phenomenal prosperity which that country enjoys at the present time. The proposal to hold a conference on coal fell, therefore, on fertile soil, and as a proof of the enthusiasm with which the idea was received, it may be mentioned that the conference was attended by over 1700 persons, among whom were official delegates from 162 colleges, learned societies and governmental bodies in the United States and ten foreign countries, quite a number of "captains of industry," and most of the leading fuel technologists and research workers of America.

The conference constituted a fine tribute to the organising ability and power of President Baker, who had the loyal support of the staff of the Carnegie Institute of Technology. Enthusiasm was the keynote of the meetings occupying morning, afternoon and evening sessions during the four days from November 15 to 18, 1926, in which an almost overwhelming mass of useful scientific and technical information came forth.

It is hardly possible to give within the time available even a brief résumé of the 43 papers submitted—or of the discussions, opened in every case by a specialist of the subject; their contents are about to be published in full,[†] and it will therefore suffice to sketch the outstanding features and to follow the general trend of thought given to the various groups of subjects.

The conference was opened by an address by Dr. Baker, who dwelt on the need for the scientific treatment of coal utilisation. He foresees that in less than a generation the present methods of shipping coal to be burned in its raw state under boilers hundreds of miles from the mines will appear to have been primitive and rudely unscientific. To this end research must be encouraged as a national duty, and far-sighted men of affairs must perceive that something more than financial resources is necessary for commercial progress. Modern business demands two kinds of capital, money, and technical and scientific knowledge. A well-organised and well-directed staff of research men can achieve results in a business way which cannot merely be secured by great credits.

Dr. Baker's statesmanlike pronouncement emphasised what must impress any unbiassed student and observer of American industrial life, that, contrary to the current European belief, its rapid development is not entirely or exclusively due to unrestricted financial liquidity, helpful and comforting though this factor may be, but largely to hard and unremitting work and the steadily increasing adoption of scientific methods.

COAL SUPPLIES

The list of papers presented was appropriately headed by a comprehensive statement on the quantity, quality, and distribution of American coals by Dr. M. C. Campbell, of the U.S. Geological Survey. Although about 50% of the visible coal supplies of the world is located in the United States, Dr. Campbell recognises the need of conserving these resources, and particularly of utilising coals of low "rank" available in many regions where high freight rates prohibit the shipment of better coals. The coal classification adopted was illustrated by representative analyses of the coals of various ranks occurring in the numerous fields. To realise the variety of coals available in America, it must be remembered that, on the basis of an assumed ash content of 8%, their fixed carbon varies from 25% to 90%, the moisture from 45% to 1%, and the calorific value from 6000 to 14,500 B.Th.U. Dr. Campbell's detailed discussion of the different varieties occurring in practically all fields will be found useful as a permanent record for future reference.

COAL RESEARCH

Though it may be taken for granted that all the material submitted to the Conference was the outcome of an immense amount of research, two papers dealt specifically with the aspects of coal research itself on national lines. Dr. C. H. Lander gave an account of British research on fuel utilisation. He described the organisation of the Department of Scientific and Industrial Research in general, and of its Fuel Division in particular, and the work done at the Fuel Research Station at Greenwich. This work is too well known to require more than casual mention here, but it should be stated that the results of this work, which, after the early years of organisation and preparation, is only now beginning to make itself felt, are greatly appreciated, beyond the confines of the Empire, by those interested in fuel matters. Dr. Lander gave a detailed account of the physical and chemical survey of British coals, of work on the problems of carbonisation at high and low temperature, steaming in vertical gas retorts and carbonising tests in horizontal retorts. An historical account was given of the work on low-temperature carbonisation done at Greenwich, and the tests carried out on commercial plants were detailed. The new Bergius plant and researches carried out in co-operation with other bodies and individuals were mentioned.

Mr. A. C. Fieldner, the Superintendent of the Pittsburgh Experiment Station, U.S. Bureau of Mines, in a suggestive paper on the practical value of fundamental coal research dwelt on the meagre support given to it until recent years. He cited British coal research as a concrete example of the fundamental work he had in mind, a compliment which we in this country must appreciate all the more as coming from the chief of an institution which in its twenty odd years of existence has led other countries in producing an immense amount of valuable data, standard methods of testing, and practical suggestions in mine-safety work and in all branches of fuel utilisation. Mr. Fieldner proposed a programme of coal research, taking as his model the extensive programme of research on petroleum which the American Petroleum

[†] "Proceedings of the International Conference on Bituminous Coal. New Developments in Utilisation." Published by the Carnegie Institute of Technology since the paper was read.

Institute was enabled to undertake by two grants of \$250,000 each from John D. Rockefeller and the Universal Oil Products Company. Fieldner finds that 22 out of the 31 projects for research on petroleum are applicable to coal and its products. While much of this work has already been done by individual investigators, and in recent years by organised groups in America, England, France and Germany, these research institutions in the aggregate represent but a modest beginning, and their total annual expenditure is small compared with the money lost each year on futile commercial experimentation.

OTHER PAPERS

The papers incorporating practical proposals or reporting actual achievements dealt with the following phases of the fuel problem: Liquefaction of coal; powdered coal; low-temperature carbonisation; gas manufacture; smokeless fuel; coal tar; fertilisers; power production; and mineral constituents of coal.

The trend of present-day thought in fuel matters, as exemplified by these contributions, showed a distinct bias towards the conversion of coal into oil and the application of solid fuel in powder form. At first sight it might seem surprising that America, the land of prolific petroleum production, should show such vivid interest in the problem of producing oil from coal.

The reason must be sought in the astounding growth of mechanical road transport. Rating the 20,000,000 automobile engines in the United States at the conservative average of 20 h.p. each, a combined capacity of 400,000,000 h.p. is obtained, which, according to reliable statistics, is about one-half of the capacity of all the power-developing equipment in the country, and three times that installed on the railways. Fortunately, motor-car engines are run under full or even partial load for a very small average period out of the 24 hrs., say, about 3% of their capacity. Even so, the consumption of motor fuel is so large and so rapidly increasing that the problem of procuring future supplies is a very serious one, even if allowance for a large addition by cracking of heavy oils is made. Hence the intense interest taken at the Conference in the liquefaction of coal, the synthesis of hydrocarbons, and the recovery of liquid fuels by carbonisation.

LIQUEFACTION OF COAL

Dr. F. Bergius gave an account of the conception, elaboration and translation into a practical process of his method of direct liquefaction of coal by means of hydrogenation. He restated the considerations which guided him in his early work, viz., that it was necessary to strike a balance between the addition of hydrogen to the coal substance and its destructive distillation. Within a certain range of temperature the velocity of hydrogenation is greater than that of the carbonising reaction, but at higher temperatures the latter is faster and, finally, yields coke instead of oil, even at pressures under which the hydrogen is brought into the closest contact with the coal. When treated at 300–350°, a kind of high melting pitch is produced, which by continued treatment at 420° and under 200 atm. pressure is liquefied, giving a yield of from 40% to 70% of oil, according to the kind of coal used. From an average

bituminous coal, 15% of motor spirit, 20% of middle oil, 6% of lubricating oil, and 8% of fuel oil can be obtained. Dr. Bergius recounted the engineering difficulties which had to be overcome, involving years of research and large financial risks. He also showed that economically "Berginisation" may be considered in combination with other processes. By using coal tar or primary tar as the oily medium for preparing the coal paste fed into the autoclave instead of the oil or tar made in the process, it may be hydrogenated to form Bergin products. Again, the gas liberated in the process may be used as town's gas and a Bergius plant may be combined with an ordinary gas works or coke ovens. The coke produced would be converted into water-gas and hydrogen, and the final products of the combination would be oil and a gas of high calorific value.

Prof. Franz Fischer attacks the problem of liquid fuel supply from a different angle. In his paper he gave an excellent, concise summary of the previous work on catalytic reactions of carbon monoxide under high pressure, referring to the manufacture by the Badische Company of methanol and to his own method to produce synthol and synthin. Considerable interest was shown in Fischer's account of his and Tropsch's work on the synthesis of petroleum products from water-gas at atmospheric pressure. The simplicity of the method by which, according to the selection and preparation of the catalyst, and the control of temperature, the production of methane may be suppressed in favour of liquid hydrocarbons of varying boiling range, is very considerable, and outweighs, according to Fischer, the greater bulkiness of catalyst chambers required. Any gases containing carbon monoxide and hydrogen, e.g., water-gas, producer gas or blast furnace gas may be used as raw material. Fischer proposes, in the first instance, a single passage of water-gas over the catalyst, when 100 g. per cb. m. of solid, liquid and readily-liquefiable hydrocarbons is obtained and the use of the permanent gas, which has a high calorific value, for the ordinary town supply, alone or in admixture with coal gas or water-gas.

General G. Patart, the French Inspector-General of Explosives, presented a carefully-prepared survey of the work on the production of liquid fuels from coal, and particularly of his own process for the catalytic synthesis under pressure of alcohols from water-gas. Photographs of the semi-commercial plant at Vitry-sur-Seine were shown, which is the model of larger installations to be erected in France and America. Patart's proposals also embrace, as do those of Fischer and Bergius, the suggestion that these processes should be grafted on the ordinary gas works routine. The water-gas of special composition required for alcohol synthesis is to be taken from the ordinary water-gas generator, whilst the residual gases after removal of the alcohol are returned into the ordinary gas mains.

The dictum of the late Sir George Beilby that "the existing gas works certainly ought to be the natural nursery for the development of low-temperature carbonisation" applies, therefore, in the view of such pioneers as Bergius, Fischer and Patart to their respective methods of liquefaction or synthesis.

POWDERED COAL

The high heating efficiencies obtainable by the combustion of gaseous and liquid fuels have stimulated the desire to confer similar advantages on solid fuels by burning them in finely subdivided form, so as to present to the oxygen a surface many times that of an equal volume of lump coal, and thus induce rapid combustion. H. Kreisinger dealt with the latest achievements of powdered coal firing practice. Refractory furnace walls subject to slagging by coal ash had to give way to water or steam-cooled walls, which permit much greater turbulence and hence more intensive combustion and higher temperatures. A favourite form of water-cooled wall is constructed of fin tubes which form, for instance, the front wall of the high-pressure boiler at Lakeside, Milwaukee. The details of this giant boiler, designed to generate steam at a pressure of 1200 lb. per sq. in., and developing in actual work 1340 lb. pressure, are as follows:—

Hourly evaporation ..	240,000 lb.
Total water heating surface ..	30,070 sq. ft.
Superheating surface ..	930 "
Reheating surface ..	933 "
Air heating surface ..	40,320 "

The steam generated is superheated to a temperature of 720° F. It is then expanded in a high-pressure turbine to 300 lb. pressure and 420° F., and passed through the reheater, where it is heated to 720° F. and discharged into the main steam line of the plant to be used in the other large turbines.

In Wood's steam generator, erected at the works of Taylor Bros., Ltd., at Manchester, a large part of the boiler forms four high metal tube walls built round the furnace, in which the tangential arrangement of the eight burners produces turbulence of such intensity that 40,000 B.Th.U. can be liberated per cu. ft. of combustion space per hour.

The contribution by W. E. Trent, though not recording commercial achievements, was highly suggestive. According to him, coal may be readily disintegrated in a pulveriser, in which small steel balls are electrically vibrated 60 times per second through an amplitude of $\frac{1}{8}$ in., to pass a 300-mesh screen and even to smaller sizes. Thus finely-divided coal may be pumped through pipes without air as a carrying medium, by heating it so as to liberate water vapour or primary products of decomposition. It is then said to be in a state of great mobility, somewhat on the lines of Leidenfrost's phenomenon. Trent suggests carbonising ultra-fine coal powder flowing through retorts, as it were, in liquid form.

Prof. A. H. White recorded a laboratory investigation on the instantaneous carbonisation of powdered coals on the lines of the work on "cenospheres" of Newall and Sinnatt in this country.

The commercial elaboration of this problem in the McEwan Runge plant was described in an interesting paper by Dr. W. Runge. The plant, which is the third in order of progressive development, is erected at Lakeside on the premises of the Milwaukee power station. It consists of two retorts superimposed one on the other, each about 6 ft. 9 in. in diameter and 40 ft. high, with a funnel-shaped top. They are heated internally by burning coal gas in auxiliary combustion chambers connected tangentially with the bottom of the retorts, coal being dried and preheated in the upper

retort and carbonised in the lower. The coke is only partially cooled and pumped still warm to the boiler house. The plant, which is designed for a throughput of 8 tons per hour, is an extremely interesting one, and, provided removal of dust by the gases and caking of the coke powder can be avoided, the process should be a promising preliminary to the direct burning of the uncarbonised coal powder.

LOW-TEMPERATURE CARBONISATION

The problem of low-temperature carbonisation of compact coal as distinct from powder agitates the mind of American fuel technologists no less than that of their European confrères, as was manifested by the dozen papers presented to the conference on the subject. Contrary to the opinion held in some quarters that the provision of a smokeless fuel is of particular interest only to this country on account of the open domestic fire peculiar to the British home, it is found that this desideratum applies to America with equal force. True, domestic heating appliances there are of a kind producing less smoke, but the happy circumstance that anthracite or "hard coal" is available in enormous quantities—the annual output is about 60,000,000 tons as against 5,000,000 tons in England—has brought about the preferential use of smokeless fuel, at any rate in the Eastern States. The high market value which this commodity commands has created a desire among the producers of bituminous coals, and particularly those of the Middle-West, to enhance the value of their product by converting it into a robust smokeless fuel, and incidentally recovering by-products. As a large section of the American public has been educated to appreciate the advantages of smokeless fuels, the problem is perhaps an easier one there than in this country.

The economic aspect of low-temperature carbonisation was ably discussed by Dr. Horace C. Porter, whose conclusions tally closely with those submitted to the Samuel Commission by the Director of the Fuel Research Board and given in evidence by the writer.

The paper by Prof. S. W. Parr, the doyen of American coal investigators, was of particular interest, partly on account of its attractive historical preamble, and partly because the practical process he outlined is based on the thermal pre-treatment of coal (in a rotary drum), a feature which is the keynote of a number of the proposed methods.

Time does not permit more than a casual mention of the various types of plant or process. T. V. McIntire described his process, based on Smith's Carbocoal plant, which is in active and fairly successful operation at Fairmont, West Virginia. Coal is carbonised while agitated in a primary retort, and the semi-coke is briquetted and reheated to 1000°—1200° F. in a secondary retort.

Harald Nielsen gave a full account of the English L. and N. process and its internally heated rotary retort, and emphasised its capacity of yielding a true primary tar containing good lubricants in its higher fractions, together with a semi-coke which has been successfully burned in powder form.

Other forms of rotary plants described were C. B. Wisner's Carbocite retort, in which the coal is rolled into coke balls. W. A. Darrah's externally heated drum,

based on the German Thyssen process, and the K.-S. double drum type, described in a paper by Dr. F. Mueller (not read).

R. B. Parker dealt with the Bussey plant of the internally heated shaft type, similar to Maclaurin's retort and fitted with a reciprocating water-cooled cutter-bar discharge mechanism, interlocked with the coal-feeding device at the top of the shaft.

E. H. Piron's description of the Piron-Caracristi process of carbonising a thin layer of coal on a conveyor heated by a lead bath is valuable as a faithful account of failure. The difficulty of avoiding leakage of molten lead and mechanical troubles led to the shutting down of the two plants at the Ford Motor Works at River Rouge and Walkerville, but it is intended to have an improved smaller plant erected in Italy. The semi-coke obtained in a thin crust does not meet the requirements for a robust smokeless fuel, but could, after pulverisation, be used for boiler firing.

F. C. Greene described the Greene Laucks retort, in which the coal is propelled upwards by means of an ingeniously designed worm screw. One of these plants has been in operation on Illinois coal, and an improved pattern is to be erected, which incorporates some interesting engineering problems.

GAS MANUFACTURE

Mr. G. M. Gill gave a comprehensive survey of the present methods of British gas-making practice and the economies of the gas industry.

W. H. Fulweiler addressed himself to the subject of water-gas manufacture, dealing particularly with the pier process for gasifying coal, in which the fuel bed throughout its cross-section is kept active by a refractory pier in the centre of the generator, thus avoiding an uncarbonised core.

C. J. Ramsburg showed the construction and method of working of an entirely automatically operated water-gas producer with mechanical charging and clinkering mechanism.

SMOKELESS FUEL

The general proposition of "smokeless fuel" was developed by Mr. O. P. Hood, of the Bureau of Mines, whilst Mr. Osborn Monnett showed that the smoke problem in towns is in a large measure due to the low-temperature domestic fire. The city of St. Louis provides a school for instructing householders and their staff in the proper management of heating appliances.

COAL TAR

The papers on coal tar form a useful complement to those presented at the same time to this Society at the Manchester Tar Conference. The majority of authors treated the problem more from the economic than the technical side. M. Jean Bing gave a picture of the French tar industry in relation to that of other countries. S. R. Church, J. M. Weiss and R. M. Crawford described various phases of American tar disposal. They unanimously condemn the inadequate utilisation of coal tar in America. A large portion of coke-oven tar is burned in steel works, although, according to Crawford, a preliminary extraction of tar acids would be remunerative, whilst large quantities of tar are converted into tar coke in discarded beehive ovens.

Dr. Y. Oshima read a paper on the origin of coal-tar naphthalene, and gave experimental support to his theory for its formation from phenols.

G. Egloff called attention to the cracking of primary tar from low-temperature carbonisation of coal by the Dubbs process, which promises considerable supply of motor fuel of high anti-knock properties.

FERTILISERS

One section of the Conference was entirely devoted to the consideration of the production of fertilisers from coal, and the aspect of coal as a source of ammonia and its relation to the world's agricultural requirements was discussed in a series of papers by F. G. Cottrell, H. A. Curtis, L. C. Jones and C. J. Brand as representing the governmental, academic and industrial points of view.

POWER PRODUCTION

A subject of intense interest to us in view of the establishment of the Electricity Board and the coming reorganisation of the coal mining industry is Mr. G. A. Orrok's communication on "Mouth of mine power stations." On the basis of concrete examples, he discusses the advantages of proximity of power stations to the fuel supply and to the point of consumption of current, but considers that an adequate water supply is the deciding factor.

MINERAL MATTER IN COAL

I had the privilege of submitting to the Conference a paper on "Coal and its mineral matter," the only contribution dealing with this problem. Coal ash forms one of the most serious obstacles to high efficiency in fuel utilisation, and is the fundamental factor of distinction between solid and liquid or gaseous fuel. I endeavoured to show the differences in composition and distribution of the ash-forming components of coal, and to trace the part they play in its formation, winning, preparation, cleaning and utilisation. The economic significance of coal ash is beginning to be realised, and the catalytic influence which inorganic compounds exert on all processes of combustion, carbonisation and hydrogenation is slowly but surely finding recognition.

The Conference proved an unqualified success, and the general tenor of the contributions it called forth gave weight to the opinion that we are on the threshold of a new era in the utilisation of coal, and that the possibility foreshadowed of refining the natural product, of concentrating its intrinsic values, and of applying it in novel ways, is rapidly changing our conception of its potentialities, and makes one realise that we are witnessing the beginning of a revolution in the application of our principal source of energy.

CANADIAN PULP AND PAPER INDUSTRY

The Kipawa mill of the Canadian International Pulp and Paper Co., which supplies the greater part of the pulp for rayon manufacture in America, and also exports it to many other countries, is situated on the Ottawa river, at Temiskaming, Quebec, 230 miles above the city of Ottawa. This mill has a daily capacity of 250 tons highest grade sulphite pulp. The company has 4000 sq. miles of Crown-leased lands tributary to the Kipawa mill, the wood being almost exclusively spruce.

SOCIETY OF CHEMICAL INDUSTRY

President : FRANCIS H. CARR, Esq., C.B.E.

FORTY-SIXTH ANNUAL MEETING

to be held in

Edinburgh, 4th to 9th July, 1927

PROGRAMME OF ARRANGEMENTS

Monday, July 4

8 to 10 p.m. The North British Station Hotel. Informal Reception by the Chairman, W. A. Williams, Esq., and Committee of the Edinburgh and East of Scotland Section, followed by *Conversazione*. (Light refreshments will be served.)

Tuesday, July 5

9.30 a.m. Committee Room, University Union Council Meeting.

10 a.m. - Debating Hall, University Union. Welcome by the Lord Provost of the City of Edinburgh. Welcome on behalf of Edinburgh University by the Vice-Chancellor, Sir J. Alfred Ewing, K.C.B., F.R.S. Annual General Meeting of The Society of Chemical Industry (for Members only). Presentation of the Society's Medal to Lieut.-Colonel G. P. Pollitt, D.S.O.

11 a.m. - Debating Hall, University Union. Address by the President, Francis H. Carr, Esq., C.B.E., on "Industrial Chemistry and Progress in Medicine." A panoramic photograph will be taken in the quadrangle of the Medical Buildings, The University, immediately after the President's Address.

1.15 p.m. - The North British Station Hotel. Luncheon by invitation of The Edinburgh and East of Scotland Section. Representatives of the Edinburgh Town Council and of the Universities of Edinburgh, St. Andrews, and Aberdeen will be present.

3.45 p.m. - Garden party in the Zoological Park. Charabancs will leave Waterloo Place at 3.30. Return journey can be made at any time by tram-car from Park gates.

8.30 to 1 a.m. Palais de Danse, Fountainbridge. Reception by the President, and Dance.

Wednesday, July 6

10 a.m. - Medical Chemistry Classroom, Medical Buildings, The University. Joint Meeting with the Biochemical Society. Subject of discussion: "The Physiological and Industrial Aspects of the Chemistry of Carbohydrates." Chairman, Professor G. Barger, F.R.S. Papers will be read by:—(1) Professor W. N. Haworth, D.Sc., Ph.D., "Structural Relationships in the Carbohydrate Group"; (2) Professor A. R. Ling, M.Sc., F.I.C., "Recent Advances in our Knowledge of the

Polysaccharides"; (3) C. G. Lambie, Esq., M.B., Ch.B., F.R.C.P.E., "The Intermediary Metabolism of Carbohydrates"; (4) C. J. Fox, Esq., Ph.D., and L. Hall, Esq., Ph.D. (Cross and Bevan Laboratories), "Cellulose from the Industrial Standpoint."

10 a.m. - Midwifery Classroom, Medical Buildings, The University. Meeting of The Chemical Engineering Group. Chairman, F. Heron Rogers, Esq., M.I.Mech.E., M.I.Chem.E. Paper will be read by J. L. A. Macdonald, Esq., D.S.O., D.Sc., "Some Aspects of the Manufacture of Fibrous Cellulose." By kind permission of William Harrison, Esq., LL.B., Chairman of The Inveresk Paper Company, Limited, and associated Companies, a section of the film showing the activities of these Companies will be exhibited. This section shows "The Production of Esparto Paper from the Raw Material to the Finished Product." Discussion.

2.15 p.m. - University Chemistry Department, King's Buildings. (1) Lecture by Professor J. Read, University of St. Andrews, on "Natural Sources of Energy in Australia."; (2) Visit to University Chemical Laboratories. Charabancs will leave Waterloo Place at 2 p.m., returning from King's Buildings at 3.45 p.m.

2.15 p.m. - Visit to Edinburgh Corporation Gas Works, Granton. Charabancs will leave Waterloo Place at 2 p.m., returning from Granton at 3.45 p.m.

4 p.m. - Reception by invitation of The University Court in the Upper Library Hall, Old University Buildings.

7.15 for 7.30 p.m. - The North British Station Hotel. Annual Dinner of the Society. (Tickets, 12s. 6d. exclusive of wines.)

Thursday, July 7

10 a.m. - Medical Chemistry Classroom, Medical Buildings, The University. Lecture by the Society's Medallist, Lieut.-Colonel G. P. Pollitt, D.S.O., on "The Development of the Synthetic Nitrogen Industry in Great Britain."

11 a.m. - Midwifery Classroom, Medical Buildings, The University. Lecture by Monsieur Ernest Fournet, Pasteur Institute, Paris, on "Chemo-therapy in Relation to Tropical Diseases."

11 a.m.—Medical Chemistry Classroom, Medical Buildings, The University. Coal Cleaning Conference. To be held under the Joint Auspices of the Society of Chemical Industry (Fuel Section), the Institution of Gas Engineers, and the Coke Oven Managers' Association. Chairman, C. H. Lander, Esq., D.Sc. Papers will be read by:—(1) Dr. W. R. Chapman and Professor R. V. Wheeler, D.Sc., F.R.S., "Comparison of Processes for Cleaning Coal"; (2) Walter Guider, Esq., "Froth Flotation applied to a Baum Washer"; (3) F. S. Sinnatt, Esq., M.B.E., M.Sc., F.I.C., "A Consideration of Certain Problems encountered in the Preparation of Coal for the Market"; (4) C. W. H. Holmes, Esq., M.Met., "Notes on the Cleaning of Coal with Special Reference to Pneumatic Separation."

2.15 p.m.—Coal Cleaning Conference (*continued*).

2.45 p.m.—Visit to the Paper Mills of Messrs. James Brown & Co., Ltd., Penicuik. Charabancs will leave Waterloo Place at 2.15 p.m., returning from Penicuik at 5 p.m.

2.45 p.m. Visit to Castle Mills, Edinburgh, the works of The North British Rubber Co., Ltd. Charabancs will leave Waterloo Place at 2.30 p.m., returning from Castle Mills at 4.45 p.m.

p.m. City Chambers, Edinburgh. Reception by the Lord Provost and Magistrates of the City of Edinburgh.

Friday, July 8

Excursions:—(1) Whole-day excursion to Melrose, Abbotsford, Dryburgh, and Peebles. Tickets, including lunch and tea, 15s. Charabancs leave Waterloo Place at 10 a.m. (2) Afternoon excursion to Forth Bridge and Inchcolm. This excursion is limited to 90. Tickets, including tea, 6s. Charabancs leave Waterloo Place at 2 p.m. (3) Visit to Refinery of Messrs. Scottish Oils, Ltd., Grangemouth. Charabancs leave Waterloo Place at 2 p.m., returning from Grangemouth at 5.30 p.m. Evening: If a sufficient number of members apply for tickets (8s. each), a dance will be arranged for 8.30 to 1 a.m. Conducted tours of Old Edinburgh will be arranged on Thursday and Friday.

Saturday, July 9

The following excursions will be arranged if a sufficient number of members apply for tickets:—(1) Gleneagles Golf Course. Tickets 10s., including green fees. (2) St. Andrews (including visit to Chemical Laboratories of the University). Railway fare, 5s. 6d.

NOTICES

APPLICATIONS FOR TICKETS

Applications for tickets should be sent at the earliest possible date to The Honorary Secretary of the Edinburgh and East of Scotland Section, Dr. W. T. H. Williamson, 13, George Square, Edinburgh. Forms for this purpose will be issued to members in a few days. The application must

in every case be accompanied by the appropriate remittance for tickets and fares.

Members are kindly requested not to apply for tickets to any works if they are interested in a competitive business.

Members are entitled to bring guests to any of the Meetings except the Annual Business Meeting of the Society, to be held on July 5 at 10 a.m. In the case of the luncheon by invitation of The Edinburgh and East of Scotland Section, a member of the Society of Chemical Industry may bring only one guest.

The Local Committee will endeavour to meet all requirements, but accommodation at some of the functions is strictly limited, and tickets for these will be allotted in order of application.

Ticket-holders are specially asked to bear in mind that at functions for which tickets are issued **these tickets must be produced on admission.**

HEADQUARTERS IN EDINBURGH

The Office of the Society during the Meetings will be in The North British Station Hotel, Princes Street, Edinburgh, and members are requested to attend there on their arrival to register their names and receive their tickets for the various functions.

Members may have their letters sent to them "C/o The Society of Chemical Industry" at the office address given above.

REDUCED RAILWAY FARES

The Railway Companies of Great Britain (except the Metropolitan, the Metropolitan District, and London Electric Railway Companies) have agreed to issue tickets at the ordinary single fare and one third (minimum fare, 1s.) for the double journey to persons travelling to Edinburgh to attend the Meetings. Tickets will be available from Saturday, July 2, to Saturday, July 9, and will be obtainable at the time of booking on **production of a Voucher which will be supplied on application to Dr. W. T. H. Williamson, 13, George Square, Edinburgh.**

It is urgently requested that all persons going by rail to Edinburgh for the Meetings will take advantage of this concession. Members travelling to Edinburgh on more than one occasion during the Meetings may obtain the reduced fare for each journey, and such members are requested to apply for as many vouchers as they can possibly use.

ACCOMMODATION

No bedrooms are now available in The North British Station Hotel. A list of other hotels was published in CHEMISTRY AND INDUSTRY for February 4, 1927 (p. 105).

Single-room accommodation for both men and women is still available in The University Hostels. Immediate application for such should be made to Dr. W. T. H. Williamson (address as above).

The Women Students' Common Room in the Medical Buildings of the University will be reserved as a **Reading and Writing Room** for the use of members.

ENQUIRIES

It is requested that all communications regarding the Annual Meeting should be sent to Dr. W. T. H. Williamson (as above).

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

MEMBERS ELECTED

May 13, 1927

- Bakes, William E., 64, Wellington Road, Charlton, London, S.E.7. Research Chemist.
- Bilton, Percy, Rock Cottage, Cottage Lane, Ormskirk Oil Chemist.
- Borden, Edmund G., c/o Henry L. Doherty & Co., 60, Wall Street, New York, N.Y., U.S.A. Patent Attorney.
- Honig, Dr. Ing P., Sugar Experiment Station, Paseroean, Java, D.E.I. Director.
- Oldham, W. D., 148, Philips Park Road, Beswick, Manchester. Works Chemist.
- Robertson, Robert B., 116, West Regent Street, Glasgow, C.2. Commercial Manager.
- Robinson, Charles S., Nobel House, Stevenston, Ayrshire. Chemical Engineer.
- Shaw, Dr. W. S., Scientific Dept., United Planters' Association of Southern India, Nellakota Experimental Station, Devarshola P.O., Nilgins, India. Tea Scientific Officer.

CALENDAR OF FORTHCOMING EVENTS

- May 24. ROYAL PHOTOGRAPHIC SOCIETY, 35, Russell Square, W.C.1, at 7 p.m. *Scientific and Technical Group*. (1) "Inherent fog in photogravure and a method for its elimination," by H. Mills Cartwright and F. J. Tritton. (2) "Optical and photographic properties of a series of typical cyanine dyestuffs," by F. M. Hamer and O. Bloch.
- May 28. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, *Associates' and Students' Section*. The Mining Institute, Neville Hall, Newcastle-upon-Tyne, at 3 p.m. "Variable speed gears and their application for colliery purposes," by W. S. Armstrong. (Illustrated by lantern slides.)
- May 31. ROYAL PHOTOGRAPHIC SOCIETY, 35, Russell Square, W.C.1. "The development of chloro-bromide papers" and "The exposure of colour-screen plates," by E. A. Bierman.
- June 9. OPTICAL SOCIETY. *Ordinary Meeting*. Imperial College of Science and Technology, Imperial Institute Road, South Kensington, S.W., at 7.30 p.m.
- June 14 to 17. INSTITUTION OF ELECTRICAL ENGINEERS. Summer Meeting at North-Eastern Centre. Numerous visits to Works. Registration Office, The Central Station Hotel, Newcastle-upon-Tyne.
- June 15. ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY, Northampton Polytechnic Institute, 81, John Street, Clerkenwell, London, E.C.1., at 8.15 p.m. "Electrorefining of silver," by E. Downs.
- June 15. SOCIETY OF GLASS TECHNOLOGY. Meeting at Sheffield.
- June 17 & 18. ASSOCIATION OF ECONOMIC BIOLOGISTS. June Meeting, The South-Eastern Agricultural College, Wye.
- June 18. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS. General Meeting, at 2.30 p.m.
- June 29. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2., at 4 p.m. Annual General Meeting.

SOCIETY OF GLASS TECHNOLOGY

The Tenth Annual General Meeting was held in Sheffield on April 27, the President, Mr. Walter Butterworth, Senior, M.A., in the chair.

Mr. W. Butterworth was re-elected President, and the following officers were elected:—Vice-Presidents: H. A. Bateson and W. J. Rees, B.Sc.Tech. Ordinary Members of Council: J. D. Cauwood, M.Sc., F. Graves Clark, Miss V. Dimpleby, M.Sc., G. V. Evers and W. W. Warren, A.M.I.C.E., A.M.I.E.E.

Hon. Treasurers: General, J. Connolly; American, F. C. Flint, B.S. Hon. Secretary: Prof. W. E. S. Turner, D.Sc. Auditors: C. S. Davey, D. Wood, F.S.A.A.

At the Ordinary General Meeting which followed, a discussion on furnace efficiency was inaugurated by Prof. W. E. S. Turner, in a paper entitled "A brief review of furnace developments."

Prof. Turner stated that his intention was to survey the present position of furnace practice in this country and abroad as the basis for considering possible lines of advancement in the future.

Dealing with the operation of pot furnaces in this country, data were given of numerous furnaces engaged upon various types of work, some of the observations dating back to 1916. It was evident from the figures that (a) a saving in fuel was obtained by the newer types of recuperative or regenerative furnaces; (b) heavy expense was incurred by the practice of founding only once a week; (c) the fuel consumption was greatly increased when the eye of the furnace had worn big. The efficiency of modern British pot furnaces compared favourably with those of Germany.

Among the improvements effected during the last few years in furnace design were (1) greater compactness; (2) better utilisation of waste heat; (3) the introduction of tangential burners; and (4) sillimanite sieges. The type of ware made, greatly affected the efficiency, while mutual consideration of the problem by masters and men of methods of working should result in greater output at less cost.

Passing to the consideration of tank furnaces, Prof. Turner gave data of numerous tanks working for hand operation, for semi-automatic bottle machines, for mixed automatic and semi-automatic machines, and for fully automatic machines. Very few data were available relative to Continental practice, but from figures quoted by H. Maurach in 1925 the results obtained in Germany were probably not as good as those reached in this country. Speaking generally, tank furnace practice on the Continent had not reached the British attainment, which was now equal to anything yet achieved in America.

The main sources of economy with a view to increasing efficiency were indicated. Among the problems which still required more thorough examination were:—

- (a) Design of ports. End ports in some cases appeared to give longer life to tank blocks;
- (b) Bridges, the form of the basin, and whether there should be one or two dog-houses;
- (c) Depth of the refining end of the tank, whether it should be less than at the melting end;
- (d) Utilisation of waste heat; and

(e) Increased insulation in various parts of the furnace, crown, side walls, &c.

In conclusion, Prof. Turner referred to a suggestion made by Mr. B. P. Dudding that it would be a good thing to see how far it was possible by a national exchange of information to develop furnace operation to a fuller stage. The Department of Glass Technology of Sheffield University had recognised the importance of the problem, and several series of systematic measurements had already been carried out by members of the staff, at the request of some manufacturers. Work on these lines had been carried out in Germany since 1920, when an institution was set up to study the problems of furnaces and fuel in the glass industry. Similar systematic furnace measurements were needed in this country, since the sound lines for real progress must rest on measured data.

THE INSTITUTE OF METALS

Sir Henry A. Miers, F.R.S., delivered the seventeenth annual May Lecture before the Institute of Metals, at Storey's Gate, Westminster, S.W.1, on Wednesday, May 11.

He recalled in the address experiments made 20 years ago by himself and Miss Isaac, which seemed at that time to show that when a solution is cooled below its saturation temperature it passes into a "metastable" state in which crystals can only be produced by introducing a fragment of the dissolved substance or of one isomorphous with it, and that at a lower temperature it passes into a "labile" state in which crystals may appear spontaneously. Later investigations have shown that in the metastable state crystallisation can also be produced by shock.

The author, however, considers that his experiments record the normal behaviour of crystallising liquids and that crystallisation only takes place with some degree of supersaturation or undercooling. In his experiments there was always a sudden outburst of crystal growth at a definite temperature.

Little importance is ascribed to undercooling by most geologists in their speculations concerning the crystallisation of molten magmas, but to many metallurgists it is a very important factor. The structure of alloys is in many cases attributed to a suspended crystallisation of this nature; not only as they solidify from the molten state, but also during the crystalline changes which take place in the solid alloy with change of temperature, for example, in steel and in magnetic alloys.

ROYAL SOCIETY

At the Royal Society *Conversazione*, held on May 11, some interesting applications of ultra-violet radiation to chemical analysis were shown by A. A. King. The contamination of crystals of mercuric chloride by crystals of mercurous chloride and vice versa was rendered plainly visible by exposure of the crystals to ultra-violet radiation, when the mercuric salt exhibited a blue fluorescence, while the mercurous salt appeared orange. Stages in the purification of the impure salt could be readily followed by the change of colour of the fluorescence.

The use of ultra-violet radiation enables quantities of arsenic as small as 0.00001 milligram to be detected and estimated quantitatively. The Gutzeit method is used for the preparation of a mercury-arsenic stain upon filter paper sensitised with pure mercuric chloride. In ultra-violet radiation unchanged mercuric chloride fluoresces blue, whilst the mercury-arsenic stain stands out as a black disc. This contrast is used to detect arsenic stains which are quite invisible in ordinary light.

The presence of impurities in water is made plainly visible by transmission of ultra-violet radiation through the water. Even the purest conductivity water, under these conditions, scatters a small amount of fluorescent radiation.

The metallography of solid mercury and dilute amalgams of tin was demonstrated by Dr. W. Rosenhain and A. J. Murphy. The samples shown were prepared by solidification in liquid air or carbon dioxide snow, and etching in an aqueous solution of hydrochloric acid (freezing point -86° C.). During manipulation and examination the metal or alloy is maintained solid by immersion in liquid air, or carbon dioxide snow and acetone. Condensation of moisture on the specimen and microscope objective is prevented by enclosing the specimen and lens in a chamber through which passes a stream of cooled, dried air. Samples of iron, manganese and chromium containing impurities which were detectable only spectrographically, and silicon and beryllium of purity 99.95% and 99.8% respectively were exhibited by the National Physical Laboratory.

Sir Robert Hadfield exhibited a number of samples of manganese, non-corrodible, heat-resisting and non-scaling steels, including the non-corrodible steel possessing a tensile strength of 45–50 tons per square inch which is being used in the restoration of St. Paul's Cathedral, replacing the original wrought iron tie bars used by Wren.

A beautiful new type of electric discharge discovered by Dr. Irving Langmuir was exhibited by the British Thomson-Houston Co., Ltd. The usual type of mauve-coloured discharge is produced in a hot cathode discharge tube containing argon. Tungsten vapour is liberated into the gas from the cathode employed. If after the tube has been in operation for a little while the discharge is momentarily interrupted, a cloud of blue luminescence is seen to leave the cathode, and a yellow colour develops on the outside of the discharge, which now becomes extremely sensitive to a magnetic field, incandescent particles of tungsten being precipitated from the discharge and travelling across the discharge when a magnet is brought near the tube. The device has obvious possibilities as an advertising device, and we anticipate its advent on our streets after the manner of use of the familiar Neon tubes.

A form of thermostat employing the phenomenon of the loss of magnetic properties by magnetic materials over certain temperature ranges was exhibited by F. J. Campbell Allen and A. E. Salisbury.

A method of measuring the vacuum in electric lamps, due to P. Selényi, was shown by the General Electric Co. The residual gas in a vacuum lamp is ionised by the discharge between the ends of the lamp filament. The resulting conductivity of the gas increases the capacity

of the condenser formed by the filament and the exterior surface of the glass bulb. This capacity forms part of a circuit maintained in oscillation by a Neon lamp, and the amount of residual gas is indicated by the frequency of the oscillations.

The same firm demonstrated some new applications of gas-filled photoelectric cells, designed by Dr. N. R. Campbell. The novel feature of these demonstrations is that voltages higher than those required to pass a spark discharge through the cell are employed. Under these conditions the discharge is ordinarily unstable, but can be stabilised by a thermionic current limiter connected in series with the cell. The current is then intermittent, and the frequency of intermittence depends upon the intensity of the light incident upon the cell. Changes of this frequency serve to determine the intensity of illumination. The device finds application in the transmission of pictures by radio-telegraphy and in the measurement of feeble illuminations such as that due to stars etc. In the former case an initial frequency of about 5000 is used, whilst in the latter the initial frequency is about 1 per sec., and changes are made audible in a loud speaker.

Sir Robert Robertson exhibited a large rock salt prism of length of face $5\frac{1}{2}$ inches and height $4\frac{3}{4}$ inches made at the Government Laboratory from a nearly perfect piece of rock salt. The refracting angle of the prism is $60^{\circ} 0' 49.5''$.

CORRESPONDENCE THE LIFE OF FABRICS

SIR,—Mr. C. M. Whittaker takes exception (*CHEMISTRY AND INDUSTRY*, May 6, 1927, p. 425) to an assumption that the average life of laundered fabrics is five years, contained in a statement on page 41 of the pamphlet "Co-operative Industrial Research."

This very approximate estimate was reached after taking into account the varied types of articles sent to laundries. It was also connected with the frequency with which these articles are washed. It is obviously difficult to obtain any exact basis for calculation, but if an average of between 50 and 100 washes is assumed, then a period of five years corresponds to a mean rate between 10 and 20 washes per annum.

Of all the types of articles sent to a laundry, sheets and collars form but two sections out of many; although the life of collars is less than five years, the life of sheets certainly approaches and often exceeds that period; and the life of many articles greatly exceeds it. Hence the not unreasonable value of five years, taken as an average life, and affording some means of estimating the value, to the public, of any change in the average duration of existence of its linen.

It happens, however, that the point as to whether the average life is five years or less, does not greatly affect the value of the estimate made. It is stated that "if the average life of these fabrics is five years, the annual depreciation is of the order of £2,000,000. If, as a result of the adoption by these launderers of the improved methods suggested by the Association, the life of the fabrics is lengthened by no more than 5%, the customers will effect a saving of nearly £100,000 annually." The object of this is to show the magnitude

of the economy which is possible. Clearly, if, as Mr. Whittaker thinks, the average life is shorter than that stated, the annual depreciation is greater, and, consequently, the possible annual economy is still greater than the figure which is mentioned.

Yours faithfully,

R. G. PARKER,

Director of Research,

British Launderers' Research Association

THE COMMERCIAL POSITION OF ETHYLENE GLYCOL

SIR.—I have read with interest interspersed with surprise two communications concerning the manufacture and uses of ethylene glycol that appeared in recent numbers of *Seifensieder Zeitung* (53 (1926), 595 and 818). According to Grossman's article, the first cited, there is doubt in Germany respecting the commercial success of the manufacture of ethylene glycol in the United States; and in the note next referred to, "X" says that "it is necessary to warn against hopes that ethylene glycol can fully and completely take the place of glycerol," and that, in the explosives industry, "ethylene glycol will never be able to displace glycerol." Since these and other statements of Grossmann and of his anonymous colleague may have given rise to incorrect conclusions in the minds of the readers of their letters, I will present an accurate description of the technologic status of ethylene glycol in the United States.

The investigational work that has eventuated in the present activities of the Carbide and Carbon Chemicals Corporation, the manufacturer of ethylene glycol ("prestone") and of other derivatives of the olefine gases (e.g., diethyl sulfate, ethylene dichloride, isopropyl alcohol, and ethylene chlorhydrin), was begun at Mellon Institute in 1914 by Dr. G. O. Curme, jr., whose brilliant research achievements during particularly the following six years constitute a series of very notable contributions to industrial chemistry. Dr. Curme and his co-workers, the late Dr. H. R. Curme, Mr. E. W. Reid, and Dr. C. O. Young, have described some of the general results of their studies in a group of papers (*Chem. and Met. Eng.*, 25, (1921), 907—909, 957—959, 999—1000, 1049—1050 and 1091—1092). After passing through various experimental stages of gradually increasing size and efficiency, the processes of making ethylene glycol and other related compounds were first operated successfully on the commercial scale in the summer of 1925.

Ethylene glycol has therefore been manufactured commercially for almost two years by the Carbide and Carbon Chemicals Corporation, which is a unit of the Union Carbide and Carbon Corporation, 30, East 42nd Street, New York, N.Y. The production of ethylene glycol at this Corporation's South Charleston, West Virginia, plant was more than 5 million lb. in 1926, and there is every indication that the total output of the chemical in 1927 will be much greater than that. It is evident from these facts alone that the manufacture of ethylene glycol has already taken a definite place in American chemical industry.

The researches conducted at Mellon Institute supplemented by extensive practical experience make it clear that ethylene glycol is not a mere substitute for glycerol, but is actually superior to glycerol in many of its com-

mercial applications. For example, as an "anti-freeze," ethylene glycol will depress the freezing-point of water approximately 20% more than an equivalent quantity of glycerol.

It will interest European explosives specialists to learn that every large explosives manufacturer in the United States is now using ethylene glycol in dynamite. Ethylene glycol may readily be nitrated and its inclusion in dynamite gives a freeze-resistant ("anti-freeze") product, without diminution of sensitivity, which is not the case with polymerised glycerol, used hitherto for the same purpose. For further information, the reader is referred to an article on glycol dinitrate, by Mr. W. H. Rinkenback, of the Bureau of Mines, which will appear in *Chemical and Metallurgical Engineering*.

Because of the nature of the process of manufacturing ethylene glycol, its price does not follow the glycerol market. The Carbide and Carbon Chemicals Corporation has set the price at about 30 cents a lb. for spot quantities; this price has not varied during the whole of the past year, whereas the cost of c.p. glycerol has ranged from 25 cents to 35 cents a lb. It is understood that large consumers buying ethylene glycol on a contract basis have secured prices considerably lower than 30 cents a lb.

I know that the American producer of ethylene glycol has no intention of competing directly with glycerol manufacturers. The Carbide and Carbon Chemicals Corporation takes the view that both ethylene glycol and glycerol have their specific uses. Rather than attempt to capture the greater part of the glycerol market, this Corporation has announced that it will accept only that portion of the business that wants a superior article at a stable price. After this point has been reached, the officers say, the Corporation's manufacturing activities will be directed toward the production of other compounds such as ethylene glycol mono-ethyl ether ("cellosolve"), which has already reached an important position as a solvent in the manufacture of lacquers.

I am, Sir, etc.

EDWARD R. WEIDLEIN, *Director*,
Mellon Institute of Industrial Research,
University of Pittsburgh
Pittsburgh, Pa., U.S.A.

PERSONAL AND OTHER ITEMS

Sir Joseph Thomson has been elected Honorary Professor of Natural Philosophy, and Sir Ernest Rutherford Professor of Natural Philosophy of the Royal Institution.

Dr. H. W. Dudley, of the National Institute for Medical Research, has recently been appointed by the Committee of the Biochemical Society to represent it on the Federal Council of Pure and Applied Chemistry in succession to Prof. J. C. Drummond.

On May 17 the Lord Chancellor, Viscount Cave, unveiled at Oxford, armorial windows in the Ashmolean Museum commemorating distinguished Oxford men of science of the seventeenth century, including Sir Christopher Wren and Dr. Plot, Oxford's first professor of chemistry.

Dr. E. K. Rideal and Prof. J. C. Drummond have accepted an invitation to take part in the advanced

courses and in the daily conferences arranged by the Institute of Chemistry of the American Chemical Society.

Dr. C. S. Myers, F.R.S., the director of the National Institute of Industrial Psychology, has received the honorary degree of D.Sc. on the occasion of the commemoration of Founder's Day at Manchester University.

Sir Josiah Stamp will deliver the Rede Lecture at Cambridge on June 8, his subject being "On stimulus in the economic life."

Dr. M. O. Forster, F.R.S., has returned to England from India on holiday.

Mr. L. W. Bristowe has been elected Master of the Armourers' and Brasiers' Company, and Mr. T. E. L. Oakley Master of the Woolmen's Company.

Sir Samuel Hardman Lever and Sir Alexander Gibb have been elected directors of the Dunlop Rubber Company.

Mr. John Parke Jackson has been appointed as an additional member of the board of the Salt Union, Ltd. Mr. Jackson has been connected with the Union for 27 years, and occupies the positions of head of the Coastwise and Continental Sales Department and foreign representative.

Dr. R. H. Pickard, F.R.S., has been elected to the Senate of London University.

Mr. J. E. Purvis has been reappointed University lecturer in chemistry and physics at Cambridge.

Mr. J. Y. Macdonald, B.A., of University College, London, has been appointed to a lectureship in the chemistry department, United College of St. Salvator and St. Leonard, University of St. Andrews.

The directors of Sensible Heat Distillation, Ltd., are offering a scholarship of £250 a year to the Imperial College of Science, South Kensington, for the study of matters concerning the investigation of primary oils from British bituminous coals under Prof. W. A. Bone, in the Department of Fuel Technology.

Lady Ramsay has made a gift of chemical apparatus to the Wycombe Royal Grammar School from the laboratory of the late Sir William Ramsay.

Mr. J. E. Spurr has resigned from the editorship of the *Engineering and Mining Journal*.

The North of England Gas Managers' Association celebrated its Jubilee on May 5 at Newcastle.

Under the name of "Sociedad Quimica Mexicana," a new chemical society has been founded in Mexico, with Dr. F. Lisci as first president. The objects of the society are wide, including an employment bureau, means for helping members financially, and a library and laboratory, as well as the advancement of chemistry and the publication of an official organ, the *Revista Quimica*.

The late Mr. T. Whitaker, a director of the Bradford Dyers' Association, left £22,599.

The late Mr. R. Hendry, J.P., formerly head dyer and analytical chemist at the Kilncraigs works of Messrs. Patons & Baldwins, left £15,909.

From Germany the following deaths are announced : Dr. R. Hagenbach-Burckhardt, formerly general director of the Höchst Farbwerke ; Prof. Tschermak, emeritus professor of mineralogy at Vienna University ; Prof. W. Filehne, who was one of the first to introduce antipyrin and pyramidon to medical use.

Reported Negotiations between British and German Chemical Industries

The Board of Imperial Chemical Industries, Ltd., has issued the following statement :—" The statements which have appeared in the press regarding alleged negotiations between Imperial Chemical Industries, Limited, and the Interessen Gemeinschaft Farbenindustrie, A.G., purporting to give the scope of such negotiations and intimating that an agreement is likely to be reached within a short time, are inaccurate and entirely unauthorised. The facts are that only preliminary discussions have taken place between the two companies, with a view to examining the question of closer co-operation in the various fields of chemical activity."

Research Scholarships tenable in Germany

Five Research Scholarships tenable at certain German universities will be available for the year 1927-28. Each student will receive free maintenance (or an equivalent allowance) and free tuition. Candidates should be male graduates of an English University, and should send their applications to the Anglo-German Academic Board through the Vice-Chancellor of their University ; graduates of Oxford, Cambridge, and London through the Head of their College. Applications must include a statement of the research work the candidate proposes to undertake, and must be submitted not later than May 21.

Safety First Order

The Home Secretary announces that he has provisionally approved the issue of an order requiring the institution of special safety arrangements in the chief accident producing industries, including, amongst others, blast-furnaces for smelting iron ore, various types of engineering works and large foundries. Opportunity is given for those interested to submit observations on the proposals.

Third Census of Production (1924). Matches

The following data are extracted from the " Preliminary Reports " of the Third Census of Production (1924) :—During the year 1924 the production of matches in Great Britain amounted in value to £4,371,000, and in 1907 the output of the United Kingdom as a whole was valued at £855,000, the large increase in value being due to a great extent to the Excise Duty which has been imposed since 1907. The rate of duty in 1924 was 5s. per 10,000 matches in boxes not exceeding 80 matches and one third less for matches in excess of 80 in the box. During the fiscal year ended March 31, 1925, the quantity of matches retained for home consumption was 7,078,000 standard gross. The quantities retained for use and consumption in the United Kingdom were less in the first quarter of 1925 than in the first quarter of 1924 by 78,000 standard gross. There were thus 7,156,000 standard gross retained for consumption in the year 1924. The exports on drawback and clearances free of duty amounted in

the year 1924 to 342,000 standard gross. Thus the quantities charged to duty and cleared free of duty in the year 1924 were, roundly, 7,498,000 standard gross, including 119,000 standard gross in Northern Ireland. In 1925 the quantities presented for clearance in Great Britain were approximately 500,000 standard gross less than in 1924, and in 1926 a further decrease of approximately 500,000 standard gross was recorded. In 1924 the total production of matches in Great Britain was 7,230,000 standard gross ; exports amounted to 302,000 standard gross, and imports entered for home consumption totalled 5,611,000 standard gross. The total quantity of matches, therefore, available in the United Kingdom for consumption during the year 1924 may be estimated at about 126,600 millions. The net output of the factories and workshops in Great Britain covered by the above statement amounted in value to £3,448,000, which represents a net output per person of £675, compared with £96 in 1907. The number of persons employed in the industry during 1924 was 5108, against 4256 in 1907. The total capacity of engines engaged in the industry in 1924 was returned as 5413 h.p., compared with 1591 h.p. in 1907. The capacity of the electric generators at factories in 1924 was 2348 kw., and in 1907 116 kw.

Canadian Exports of Pulp and Paper

Canada's exports of pulp and paper for 1926 were valued at \$173,491,635, as compared with a total of \$154,555,951 for the year 1925, an increase for the past twelve months, according to the Dominion Bureau of Statistics, of \$18,935,684, or over 12 per cent. Exports of wood-pulp were valued at \$52,077,122 and exports of paper at \$121,414,513, an increase over 1925 of \$4,145,217 in the value of pulp exports and of \$11,790,467 in the value of paper exports. The greatest increase was shown in the exports of newsprint, which rose from 1,401,655 tons, valued at \$98,945,337, in 1925, to 1,731,986 tons, valued at \$114,090,595, in 1926, an increase of 330,331 tons in quantity and \$15,145,258 in value. Exports of pulpwood were somewhat smaller in 1926, the total being 1,391,738 cords, valued at \$14,067,030, as compared with 1,423,502 cords, valued at \$14,168,935, in 1925.

Carbide in Tasmania

At the end of February, 1925, the Tasmanian Government foreclosed on Carbide & Electro-Products, Ltd., at Electrona. It then adopted the Soderberg continuous electrode process, which was stated to effect a saving of 33% in electrode consumption and an increased production of 15%. At a later date a British company was given an option for the purchase of the works. In March last the Australian Commonwealth Carbide Co. was registered in London with a nominal capital of £200,000 to purchase the works. A sum of £52,000 has been received by the Government on account, the total purchase price being £140,000. Although this means a loss of £14,000, the Government will benefit later as the company will purchase a large amount of hydro-electric power and will start production on a large scale.

Second International Conference on Bituminous Coal

A second international Conference on Bituminous Coal will be held at the Carnegie Institute of Technology

in November, 1928, according to an announcement by Dr. Thomas S. Baker, president of the institution. The statement is contained in the recently issued volume of proceedings of the first conference held from November 15 to 18, 1926. President Baker states that the second conference will be planned to uncover whatever new information is made available during the coming two years regarding various problems in the use of soft coal.

The first conference was called by President Baker for the purpose of finding new uses for bituminous coal, and especially to discuss the problem of liquefying coal to supplement the petroleum oil supply of the world. More than 1700 delegates, including representatives of thirteen different countries, attended. The speakers included Dr. Friedrich Bergius and Prof. Franz Fischer, who have successfully liquefied coal; General Georges Patart and Jean Bing, of France; Dr. C. H. Lander, Geoffrey M. Gill, Harald Nielsen, and Dr. R. Lessing, of England; and several other well-known foreign scientists in addition to a long list of prominent American engineers and men of affairs and science.

Sulphuric Acid in the U.S.A.

During the period July-December, 1926, fertiliser manufacturers in the United States produced 810,326 tons of sulphuric acid and consumed 972,806 tons in the manufacture of 1,805,691 tons of acid phosphates containing 30,613,000 units (of 20 lb.) of available phosphoric acid. The output of acid by fertiliser makers equalled 83.3% of the consumption. Compared with the same period of 1925, production of acid phosphates during the last half of 1926 declined by 11.8%, sales decreasing by 11.1%.

Paint and Varnish in the U.S.A.

From an official census of the U.S. paint and varnish industry during the second half of 1926, it appears that 581 establishments (a gain of 5%) reported production. Firms grinding white lead and zinc oxide decreased in number, but there was no important change in the number of firms grinding other paints. Production of paste paints was 212,536,900 lb., a decrease of 5%, and the output of ready-mixed paints decreased by 4%, whilst sales of paints and varnishes decreased in about the same proportion. 372 firms (a gain of 25%) reported the manufacture of varnishes other than pyroxylin products, which were produced by 138 firms, an increase of 60%. Pyroxylin products constituted 15.7% of the total output of varnishes, and sales of pyroxylin products, in proportion to production, declined by 3% below the 1925 figures, though doubled in volume.

Franco-German Potash in the U.S.A.

The French and German potash syndicates have agreed to amalgamate their selling organisations in America and carry them on jointly from May 1. There are other agreements in regard to the rationing of the exports of the two industries and to price regulations. The amalgamation of the organisations has now been made the occasion of a suit by the United States Government under the anti-trust regulations for the vetoing of the formation of the sales organisation, and for prohibiting "any similar agreement or any increase of the price of potash in the United States." The

opinion is, however, finding frequent expression that this action has been taken solely to secure a price reduction, or a guarantee of a stable price for French and German potash.

Synthetic Methanol in France

The Etablissements Kuhlman is erecting a plant at Loos, near Lille, for the manufacture of synthetic methanol by the Patart process. It is expected to begin production at the rate of 1½ tons daily in June.

Italian Dyestuffs Agreement

In order to expand production, obviate competition and control sales, the Fabbriche Italiane Materie Coloranti Bonelli has made an agreement covering production and sales of intermediates and dyes with the group—said to be the Società Italiana del Gas of Turin—which controls the S.I.P.E. Cengio, the Italica and Schiapparelli concerns, and the Unione Produttori e Consumatori Materie Coloranti Artificiali, the last-named company being responsible for the distribution of reparatory dyestuffs. The capital of the Bonelli concern has been increased from 45 to 60 million lire.

Proposed Chemical Merger in Italy

It is announced in the *Financial Times* that negotiations are in progress between the Società Italiana del Gas, the Società Italiana Prodotti Esplosivi and the Società Materie Coloranti Bonelli, which are amongst the principal chemical producing companies in Italy, with the object of arriving at co-ordination of manufacture through inter-locking capital arrangements. The scheme is approved by the Government, and it is expected that the Treasury will contribute financial support in order to make the venture successful and so render Italy independent of foreign markets.

Bergius Process

The A.G. für Kohlenveredlung und Kohlenverflüssigung has been founded, with a capital of 5 million marks, to exploit the Bergius process for the liquefaction of coal. The licensees of the Bergius patents in Germany are the I.-G. Farbenindustrie and the Gesellschaft für Teerverwertung.

German Tetralin Combine

The Ges. für Teerverwertung, the Rütgerswerke A.-G., the Klockner Werke A.-G., the J. D. Riedel A.-G. and other German companies have combined to form a new company, the Deutsche Hydrierwerke A.-G. (Dehydrog), with a capital of 4 million marks, with the object of controlling the manufacture of tetralin. The process and plant used has been purchased from the J. D. Riedel A.-G.

Notes from Germany

It is stated that sales of German potash are increasing. Sales in January amounted to 190,000 tons, as against 94,000 tons in January, 1926, and 165,000 tons in January, 1925, and, according to present results, February should be a record month.

Noddack and Berg, speaking recently before the German Chemical Society, announced that they have prepared 1 mg. of rhenium as the oxide from 10 kg. of gadolinite. The oxide sublimes at 300° C. and gives a colourless solution in hydrochloric acid. The sulphide is grey in colour, and is insoluble in ammonium sulphide.

REVIEWS

PHOTOSYNTHESIS. By H. A. SPOEHR. American Chemical Society Monograph Series. Pp. 393. New York: Chemical Catalog Co., Inc., 1926. Price \$6.50.

One of the most fascinating problems has always been the mechanism whereby the living green plant achieves the photosynthesis of its complex products from carbon dioxide, water, and soluble nitrates. The subject is discussed in this volume by an author who has done much to advance our knowledge in this field. As he himself says, much of the speculation regarding the manner in which the green plant utilises solar energy has, unfortunately, not been restrained by a knowledge of certain facts concerning the process. Whilst it is true that our knowledge of many phases is still incomplete, yet there are certain well-established facts which cannot be disregarded in any consideration of the problem. The author has, in the main, emphasised the results of experimental investigation rather than the conclusions drawn from observations in the field, or by empirical methods.

The subject is dealt with in seven chapters, of which the first contains an historical introduction and a general discussion of the conversion of solar energy by means of green plants and trees. The second chapter deals with the nature of photosynthesis as determined by observations of gaseous interchange and the formation of organic matter. The two next chapters are devoted to the products of photosynthesis, and the methods of measuring photosynthetic activity. Then follow chapters on the chemistry of photosynthesis and its energy relations, and in the last is found an account of chlorophyll and the chloroplasts.

Under each heading is given a full account of the observed facts, together with very complete references to the literature, this being a distinguishing feature.

The book as a whole is admirably put together, and the author has undoubtedly achieved a great success in presenting the subject in a manner that is both interesting and learned. The value of the book is increased by the constructive criticism which the author gives from time to time, and the impression gained on reading it is one of keen satisfaction at finding the subject so well treated from both a broad and a deep outlook. E. C. C. BALY

A LABORATORY BOOK OF ELEMENTARY ORGANIC CHEMISTRY. By ALEXANDER LOWY, Ph.D., and WILMER E. BALDWIN, M.S. Pp. ix + 182. New York: John Wiley & Sons, Inc.; London: Chapman and Hall, Ltd., 1926. Price 15s.

This book represents the laboratory part of the elementary course of organic chemistry of the University of Pittsburgh, and is intended to teach the technique of organic chemistry, which it does in rather an elaborate and detailed fashion. The book is large in size, the pages measuring 11 in. \times 8 $\frac{3}{4}$ in., and is therefore not very convenient for carrying about. The book commences with much good advice regarding general methods of work, and, if precept were sufficient for the purpose, should turn out a generation of almost perfect chemists. After some notes relating to fires and accidents in the laboratory, methods of purification of organic compounds, determination of physical constants, and methods of

distillation are dealt with. Some 36 other experiments then follow, covering the field of elementary organic chemistry. The special features of the book are (1) the profusion of illustrations of chemical apparatus of all sorts, both simple and large scale, relating to experiments in hand; (2) the very precise character of the instructions given for the various experiments; and (3) the addition after each chapter of a questionnaire to be written up by the student to show that he has properly understood the experiment he has been engaged on. These pages are perforated so that they can be torn out and handed to the demonstrators. Accepting the point of view from which the book is written, it must be described as remarkably complete, but I am inclined to think that the results obtained by a somewhat simpler method would be equally satisfactory. T. S. PATTERSON

FERTILISERS—THEIR SOURCES, MANUFACTURE AND USES. By HERBERT CAVE. Pitman's Common Commodities and Industries Series. Pp. xii + 116. London: Sir Isaac Pitman & Sons, Ltd. 1926. Price 3s.

The author is to be congratulated on the production of "a little book presenting a general non-technical account of the sources, manufacture and uses of fertilisers."

Greatest attention is paid to the three principal groups, the phosphatic, nitrogenous and potassic fertilisers, and the functions of each group are briefly reviewed. The chapter on mineral phosphates deals with the development of the supply, and clearly indicates the influence which the exploitation of the North African phosphate has had upon the American industry. It is unfortunate that only a passing reference is made to the results which have been obtained by using the finely-ground raw mineral phosphates.

The statement, on page 27, dealing with the effect of calcium fluoride on the citric solubility of open-hearth fluorspar basic slag is rather misleading, as the calcium fluoride is present in combination with tricalcium phosphate as the mineral *apatite*.

The Chilean nitrate industry and the production of by-product sulphate of ammonia are discussed, and a concise account of the manufacture of atmospheric nitrogen compounds is given.

Various substances, such as bone manures, guanos, meat and fish meals, farmyard manure and lime are mentioned in Chapter 7, but the statement made on page 80 that only the "free lime is of any use for removing acidity in the soil" is one which is scarcely warranted. A chapter is also included on the utilisation of fertilisers in agriculture, which should prove useful to those readers unfamiliar with farm practice, a commendable feature being the exhortation to farmers and others to conduct trials to ascertain the requirements of the particular soil under observation.

A useful chapter, entitled "Commercial information," deals with the valuation of fertilisers and the Fertilisers and Feeding Stuffs Act and its proposed amendment.

The appendices, dealing with the world production of various fertilisers, form a valuable compilation, and will prove useful for reference purposes.

D. N. McARTHUR

PARLIAMENTARY NEWS

Dutiable Chemicals (Postal Packets)

In a written answer to Mr. Meller, Mr. McNeill stated that there was a general prohibition against the importation of dutiable articles by the letter and sample posts. Articles thus imported were liable to forfeiture. *Bona fide* trade samples of dutiable chemicals were, however, in practice admitted on payment of duty and a fine. It was not possible to waive the prohibition in favour of chemicals and admit them free of any charge. There was no objection to the importation of dutiable chemicals by the parcel post, provided that the contents of the parcel were duly declared by the senders, and chemicals so imported were delivered on payment of duty.—April 26.

Sugar-Beet Industry

In reply to Commander Bellairs, Mr. Guinness stated that the area under sugar beet in France and Great Britain in 1926 was 513,000 acres and 129,000 acres respectively. The 1927 figure for Great Britain would, it was estimated, exceed 200,000 acres. The financial assistance given to the British beet industry was laid down in the British Sugar (Subsidy) Act, 1925, and as regarded sugar, amounts during the period of the highest rate of subsidy ending September 30, 1928, to 19s. 6d. per cwt. on sugar exceeding 98° polarisation. Excise duty amounting to 7s. 4d. per cwt. was paid by the home manufacturer as compared with the Customs duty on foreign sugars of 11s. 8d. per cwt. As far as he knew, no direct subsidy was enjoyed by the old-established sugar industry in France. The French producer was, however, protected by a Customs duty on foreign sugars which amounted at the current rate of exchange to 6s. 10d. per cwt. on sugar exceeding 98%₀. Colonial and indigenous sugars did not pay this duty. On all sugars in France of home, colonial or foreign origin an internal consumption tax of 10s. 3d. per cwt. was levied.—April 26.

Coal Slack (Oil Production)

The Duchess of Atholl informed Mr. Hurd that the National Physical Laboratory does not conduct tests of coal slack. Experiments had shown that it was possible to produce oil from British coals comparable in efficiency with imported oil, but no pronouncement could be made as yet as to the possibility of doing this under commercial conditions. Further information on this question could be had from recent reports of the Department of Scientific and Industrial Research, notably Fuel Research Technical Paper No. 17, and the Annual Report of the Fuel Research Board for 1925.—May 3.

Coal (Oil Extraction)

In reply to Mr. Thurtle, the Duchess of Atholl stated that there were several processes of extracting oil from coal. Tar, from which oils were produced, was obtained commercially in gasworks etc. in Germany as in this country. Low-temperature carbonisation processes had long been employed for the extraction of oil from brown coal in Germany, and oil was now being produced on a commercial scale in Germany by the hydrogenation of brown coal.—May 5.

Dyestuffs (Imports)

Sir P. Cunliffe-Lister informed Lieut.-Commander Kenworthy that the value of finished dyestuffs obtained

from coal tar, imported into the United Kingdom in 1926, was £876,529, and in the first three months of 1927, £290,308.—May 10.

COMPANY NEWS

BRITISH DRUG HOUSES, LTD.

The annual general meeting was held on May 4, Mr. C. A. Hill, Ph.C., B.Sc. (chairman and managing director), presiding. In moving the adoption of the report and accounts for the year to December 31, 1926 (cf. CHEM. AND IND., May 6, 1927, p. 426), the chairman said that the profit of £16,864 had been arrived at after charging every expense, including certain items quite properly charged to revenue, and yet of an extraordinary or non-recurrent nature, which it was anticipated that 1926 would have to bear. In February, 1926, he estimated that the profit available, after making due provision for prior charges, would suffice to pay a dividend of not less than 7½% on the ordinary shares, and anticipated that in the near future the ordinary shares would be on a 10% basis. He still had that same confidence and the same anticipation, but in February, 1926, he did not anticipate the serious and protracted industrial crises which followed and which so materially affected last year's results. The effect of the coal dispute on the company's profit and loss was that of a double pull—on the credit side, the general curtailment of business, the restricted buying power of the public and the effect upon industrial conditions generally, combined to depress the profits; whilst on the debit side, the company had to contend with the increased cost of home-manufactured goods and increased working expenses, due to the high cost of transport and the exorbitant prices paid for imported coal. Despite such increases in costs of manufacture and distribution, prices of the company's own products were not advanced. Had the conditions during last year been normal, the accounts would have shown a very different result. Reference was made to the work of the B.D.H. laboratories, and the striking discoveries in the domain of biochemistry and the research on vitamins. An encouraging increase in the turnover for the first three months of 1927 was recorded.

CASSEL CYANIDE CO., LTD.

An interim dividend has been declared of 3d. per share, less income tax at 4s. in £, payable on June 2.

BRITISH CELANESE, LTD.

In order to acquaint shareholders with the progress and prospects of the company and to give time for proper consideration of the problems arising out of the situation which has arisen with regard to future control, a detailed statement of the balances of the profit and loss accounts month by month has been issued. It shows net profits for the first three months of 1927 of £35,288, £46,354, and £61,831 respectively, against corresponding losses for 1926 of £18,884, £19,719, and £1564. There is an increasing demand for the company's products at satisfactory prices. In March, 1927, for the first time a profit was made in all departments without exception, and the total net profit for the month is considerably higher than any other in the company's history, not excluding the months of ficti-

tiously high profit just before the institution of the silk duties. The extensions to the spinning plant will, when completed, increase the company's spinning capacity by about 25%.

BENZOL AND BY-PRODUCTS CO., LTD.

Presiding at the seventh annual general meeting, held on April 19, Sir A. Henry McMahon, chairman, said that the business of the company was primarily that of a colliery, and subject to all the vicissitudes of the coal trade. The general strike and the coal dispute had caused a total stoppage of all colliery working for seven months, of which five fell within the year under review. During 1925-26 their production of coal, coke, sulphate of ammonia, pitch and benzol was in almost every case little more than half that of the previous year, which in itself was one of the worst ever experienced in the history of the coal trade.

The report for the year ended September 30, 1926, states that after making full allowance for depreciation and all other expenses, there was a loss of £12,097, compared with a loss of £9470 for 1925. With £12,111 brought forward, and £1060 written back from income tax reserve, £13,171 is available. After deducting the loss and transferring £521 to sinking fund account, there remained a profit of £553, which will be carried forward. Since the settlement of the coal dispute, trade had considerably improved, and the directors felt able to recommend payment on April 1, 1927, of one year's arrears of dividend of 6% on the preference shares. This left one year's 6% cumulative preference dividend still in arrears.

One or two facts connected with the business which seemed to justify confidence in the future were, firstly, that operations were restarted after the enforced stoppage with the advantage of thoroughly overhauled, and, where necessary, renewed machinery and plant; secondly, it was hoped that the new mining shaft in place of the previous upcast shaft would be working by June next, which would greatly increase the output of a superior grade of coal with reduced overall getting costs. Thirdly, the acquisition of the Upholland Colliery and its 35 coke ovens was proving the success anticipated.

ALLEN-LIVERSIDGE AND CO., LTD.

A dividend has been declared on the preference shares at the rate of 6½% per annum (less tax) for the six months ended April 30, 1927.

AMALGAMATED ANTHRACITE COLLIERIES, LTD.

At a meeting of shareholders on May 10, the scheme for amalgamating with the United Anthracite Collieries, Ltd., and other companies, was unanimously approved. The scheme provides for the nominal capital of the company being increased to £5,000,000 and for the issue of bonus shares in the proportion of one for every ten shares held. United Anthracite Collieries and its subsidiary companies and also the subsidiary companies of Amalgamated Anthracite Collieries are to be wound up. With the liquidation of these concerns the Amalgamated Anthracite Collieries would take over the entire assets and would primarily be an operating company with the direct management of its twenty-four collieries and its various selling organisations.

BURT, BOULTON, AND HAYWOOD, LTD.

It is proposed to increase the authorised capital of this company to £720,000 by the creation of 100,000 new ordinary shares of £1 each, and to issue in the immediate future 50,000 of the new shares.

BRYANT AND MAY, LTD.

The net profit for the year ended March, 1927, was £387,212, compared with £334,920 for 1926. After placing £106,202 to reserve and allocating £20,000 to employees' funds, £72,415 was carried forward (against £74,452), after paying a dividend of 12½% (same).

VICKERS, LTD.

The report for 1926 shows a net profit of £562,284, compared with £120,973 for 1925, which, having regard to the dislocation of trade resulting from the coal dispute, the directors do not consider unsatisfactory. Preference dividends absorbed £418,190, leaving £144,093, which, with £190,775 brought forward, makes a total of £334,868. The directors do not recommend the payment of any dividend on the ordinary shares, but propose to place £200,000 to reserve fund, carrying forward £134,868. The board has secured the services of Mr. G. G. Sim as secretary. Mr. F. C. Yapp has been appointed a member of the Armaments and Shipbuilding Management Board, and Mr. Alex. Williamson and Mr. George Vickers have been elected special directors, located at Sheffield. Mr. Vincent C. Vickers resigned his seat on the board last June.

NON-INFLAMMABLE FILM CO., LTD.

The statutory meeting was held on April 28, 1927, at Herbert E. Blain, C.B.E., chairman, presiding. He said it would be recognised that the Company made available a British non-inflammable film where flammable film supplied from abroad had had a practical monopoly; that it should widen enormously the possibilities of the use of the film in many directions where its former flammable defects proved a barrier; that it should materially cheapen splinterless glass for many useful purposes; and that acetate of cellulose plays a very important part in the manufacture of artificial silk, besides a number of other uses to which it might be applied which were only beginning to be studied. Summarising the company's progress to date, the chairman said that alterations had been made to existing works and additional equipment had been provided, so that the regular output of film might be commenced. Having regard to the rumours which had been circulated that the company could not turn out satisfactory film at its works, the company had made a film wholly at its works, and had had it printed by one of the largest picture-producing companies in this country, which had no interest whatever in the company. They reported as follows: "We have found the results quite satisfactory. The material perforates perfectly, the stock appears to be of very high grade in regard to wearing quality and strength, and its photographic quality appears to be fully equal to standard." The Board was pursuing a very careful policy, and was planning carefully the foundations for what it hoped would be a noteworthy new industry.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial. Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid. £5 -£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P. Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s. £4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5 -£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined). £10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor. 9d.—10d. 16½ Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals.—8½d.—9d. per lb. Crude 60's, 2s. 6d. 2s. 8d. per gal.
 Acid Cresylic, 99/100. 2s. 8d.—2s. 9d. per gal. Steady, 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality. 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 8d.—2s. 3d. per gal., ex works in tank wagons.
 Toluole. 90%, 1s. 9d. to 2s. 0½d. per gal. Pure, 1s. 10d.—2s. 3½d. per gal.
 Xylol.—2s.—2s. 4d. per gal. Pure, 3s. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naptha.—Crude, 8½d.—9d. per gal., according to quality.
 Solvent 90/160, 1s. 10d.—1s. 11d. per gal. Solvent 95/160, 1s. 6d.—1s. 7d. per gal. Solvent 90/190, 1s. 1½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—70s.—80s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4d. per lb.
 m-Cresol 98/100%.—2s. 8½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—2s. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene. 66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 3d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylydine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%. £39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d. 2s. 6d. per lb.
 Acid, Benzoic B.P.—2s. 2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum 1s. 3d. per oz.; 500 oz. lots.—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7d. per lb. Less 5%. Advancing.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed. 8s. 3d. per lb.
 Acid, Salicylic. B.P. 1s. 3½d. 1s. 4d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric. 1s. 3½d. per lb. Less 5%. Firm market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d. 1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal £24 per ton, Powder £25 per ton. carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 4d.—2s. 5d. per lb. Potassium.—1s. 11d.—2s. per lb. Sodium.—2s. 2d.—2s. 3d. per lb. All spot.
 Calcium Lactate.—1s. 3½d.—1s. 4½d. per lb.
 Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 11½d., per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½% in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 3d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb.; Detached cryst., 14s. 6d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—11s. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. per lb.
 Phenazone.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 97s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferriyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17. 5d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s. per lb. spot.
 Saccharin.—55s. per lb. Very limited inquiry.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—7s. 6d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—11s.—12s. per lb., according to quantity.
 Natural.—14s. 9d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
 Aubepine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb.
 Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. 6d. per lb.
 Citronellol.—14s. 6d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—10s. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol. 9s. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. 6d. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—9s. 9d. per lb.
 Rhodinol.—30s. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—14s. 3d. per lb.
 Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 1d. per lb., Ceylon, Puro, 1s. 10d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—8s. 9d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 16s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than July 9th, 1927, are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on May 26th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I. Applications

Holmes & Co., Ltd., Cooper, and Henshaw. Drying gases. 1,691. May 2.
 I.-G. Farbenind. Manufacture of catalysts. 12,124.
 1,240. May 5 and 6. (Ger., 27.11.26.)

Power Specialty Co. Fractionating-tower. 11,871. May 3. (U.S., 5.5.26.)

Rowlands. Separating and filtering apparatus. 11,897. May 4.

I.—Complete Specifications

2070 (1926). Simon-Carves, Ltd., and Robinson. *See* 11. 3812 (1926). Crushing or grinding machines. (247,943.)
 5192 (1926). Moore and Campbell. Electrically-heated kilns. (270,035.)
 8674 (1926). Allgem. Kommerzges. A.-G., and Mannesmann. Separating the solid and liquid constituents of a material. (270,066.)
 13,539 (1926). Godel. Recovery of gases and vapours by solid absorbents. (270,099.)
 14,775 (1926). Haddan (Oliver Continuous Filter Co.). Pulp thickeners or filters. (270,108.)
 17,255 (1926). Fulton. Heating and drying apparatus. (270,122.)
 25,281 (1926). Visco-Engineering Co., Ltd., and Smith. Air and gas filtering apparatus. (270,157.)
 25,738 (1926). I.-G. Farbenind. Manufacture of linings for vessels to resist acids. (260,575.)
 25,993 (1926). Smith and Hayes. Pulverising-mill. (270,159.)
 *10,920—1 (1927). Urbain Corp. Separation of gases from mixtures. (270,286—7.)
 *11,050 (1927). I.-G. Farbenind. Producing solid materials in a state of fine dispersion. (270,293.)
 *11,600 (1927). Kocour. Determining the strength of solutions. (270,338.)
 *11,607 (1927). Theisen. Apparatus for treating gases with liquids. (270,340.)

II.—Applications

Arnold (Standard Development Co.). Treatment of heavy hydrocarbons. 11,746. May 2.
 Bervoets. Manufacture of mineral oils from peat etc. 11,744. May 2. (Holland, 1.5.26.)
 Bloxam (Allgem. Ges. f. Chem. Ind.). Treatment of gasoline etc. 12,323. May 7.
 Bookey and Lyne. Apparatus for manufacturing gas. 11,750. May 3.
 Callender, King, and Mardles. 11,936. *See* XII.
 Coppée et Cie. Coke oven. 11,700. May 2. (Belg., 4.9.26.)
 Donner. Converting hydrocarbons. 11,803. May 3.
 I.-G. Farbenind. Pulverulent fuels for internal-combustion engines. 11,658—7. May 2. (Ger., 7.5.26.) Conversion of hydrocarbons. 11,658. May 2. (Ger., 7.5.26.) Production of hydrocarbons. 11,659. May 2. (Ger., 10.5.26.)
 McLeod. Oil-cracking process. 11,632. May 2.

II.—Complete Specifications

1661 (1926). Urbain. Manufacture of absorbent carbon. (269,961.)
 1814 (1926). Kohlenveredlung Ges. Cracking or fixing of the illuminating constituents of coal gas. (246,490.)
 2070 (1926). Simon-Carves, Ltd., and Robinson. Draining and concentrating coal and other slimes. (269,967.)
 2562 (1926). Patart. *See* XX.
 2889 (1926). Allgem. Kommerzges. A.-G., and Mannesmann. Treatment of peat. (269,993.)
 2894 and 3039 (1926). Fairweather (Urbana Coke Corp.). Coking coal. (269,994 and 270,003.)
 3152 (1926). Power-Gas Corp., and Rambush. Production of water gas and coal gas. (270,009.)
 19,725 (1926). I.-G. Farbenind. Removal of benzol from gases containing the same. (257,906.)
 *10,178 (1927). Bataafsche Petroleum Maatsch. Treatment of cracking or sludge residues. (270,274.)

*10,475 (1927). Tormin. Carbonising fuels. (270,277.)
 *11,347-8 (1927). I.-G. Farbenind. Conversion of hydrocarbons of high boiling-point into compounds of lower boiling-point. (270,313-4.)

*11,378 (1927). Lederer. Producing gas. (270,318.)

*11,744 (1927). Bervoets. Manufacture of mineral oils from peat, lignite, etc. (270,349.)

III.—Applications

Bünge. Separation of neutral constituents from crude tar etc. 11,806. May 3. (Ger., 21.3.27.)

Bünge and Macura. Working up crude tar. 11,962. May 4. (Ger., 8.2.27.)

III.—Complete Specification

10,725 (1926). I.-G. Farbenind. See II.

IV.—Applications

British Celanese, Ltd., Bader, and Green. 11,644. See XX.
 British Dyestuffs Corp., Ltd., Bainbridge, and Payman. Intermediate compounds for preparation of dyestuffs. 11,709. May 2.

Carpmael (I.-G. Farbenind.). Reducing aromatic amino compounds. 11,994. May 4. Manufacture of dyestuffs. 11,995, 11,997. May 4.

Chem. Fabr. van der Grinten, and Grinten. Manufacture of diazo-types. 11,846. May 3.

I.-G. Farbenind. Manufacture of azo dyestuffs. 11,844-5. May 3. (Ger., 31.5.26.) Manufacture of naphthalene etc. condensation products. 12,10.3. May 5. (Ger., 30.6.26.)

Imray (I.-G. Farbenind.). Manufacture of dyestuffs. 12,125-6. May 5.

Johnson (I.-G. Farbenind.). Manufacturing reduction products of vat dyestuffs etc. 11,990. May 4.

Soc. Chem. Ind. in Basle. Dyestuffs. 11,728. May 2. (Switz., 30.4.26.)

Yava Works, Ltd. (Arnot). 11,706. See XX.

IV.—Complete Specifications

32,759 (1925). I.-G. Farbenind. Manufacture of condensation products of the anthraquinone series. (245,165.)

32,911 (1925). Chem. Works (Sandoz). Production of azo dyestuffs for dyeing cellulose esters. (245,758.)

2258 (1926). Fabr. Chem. Production, and Kraus. Manufacture of sulphurised derivatives of phenols and naphthols and their application as mordants. (269,970.)

2259 (1926). Fabr. Chem. Production, and Kraus. Manufacture of sulphurised derivatives of naphthols. (269,971.)

*11,288 (1927). I.-G. Farbenind. Manufacture of mordant dyestuffs. (270,308.)

*11,728 (1927). Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. (270,348.)

*11,844 (1927). I.-G. Farbenind. Manufacture of azo dyestuffs. (270,351.)

*11,845 (1927). I.-G. Farbenind. Manufacture of a yellow azo dyestuff. (270,352.)

V.—Applications

British Celanese, Ltd., and Ellis. Treatment of materials containing cellulose derivatives. 11,645. May 2.

I.-G. Farbenind. Protecting materials from moth. 12,104. May 5. (Ger., 13.7.26.)

Nobel Industries, Ltd. (Du Pont de Nemours & Co.). Cellulose ester compositions. 12,128. May 5.

Robins. Non-explosive films of cellulose etc. 11,898. May 4.

Singer and Wolff. 11,738. See XIII.

V.—Complete Specifications

9534 (1926). Soie de Chatillon Soc. Anon. Italiana. Maturation of alkali cellulose. (250,617.)

23,092 (1926). Peace and Carnegie. Treating jute fibres. (270,150.)

*11,589 (1926). Laucks, Inc. Cellulose fibre product. (270,335.)

VI.—Application

Hunt. Open bleaching-kiers. 12,268. May 7.

VI.—Complete Specifications

29 (1926). Brandwood (Holton). Treatment of yarns with fluids. (269,954.)

1631 (1926). Brit. Celanese, Ltd., Ellis, and Goldthorpe. Dyeing, printing, or stencilling of acetyl cellulose. (269,960.)

2258 (1926). Fabr. Chem. Production, and Kraus. See IV. 9802 (1926). Silver Springs Bleaching and Dyeing Co., and Hall. Dyeing furs, hairs, skins, and feathers. (270,075.)

15,433 (1926). Darco Sales Corp. Treating dye effluents. (262,382.)

*11,287 (1927). I.-G. Farbenind. Dyeing. (270,307.)

*11,499 (1927). I.-G. Farbenind. Dyeing with vat dyestuffs. (270,328.)

*11,567-8 (1927). I.-G. Farbenind. Treatment of fibrous materials and textiles. (270,333.4.)

VII.—Applications

Carpmael (I.-G. Farbenind.). Concentration of acetic acid solutions. 11,996. May 4.

Coles. 12,278. See XIII.

Meyerhofer. Production of soluble hydrates. 11,837. May 3. (Ger., 19.5.26.)

Odling and Street. Treatment of slag for production of aluminium sulphate etc. 11,970. May 4.

Pease. Manufacture of potassium phosphate etc. 11,725. May 2.

Permutit A.-G. Production of chromyl chloride. 11,805. May 3. (Ger., 5.5.26.)

VII.—Complete Specifications

29,982 (1925). Ashcroft. See X.

5497 (1926). Johnson (I.-G. Farbenind.). Manufacture of active silica. (270,040.)

21,086 (1926). Philips' Gloeilampenfabr. Separating hafnium and zirconium. (258,243.)

223 (1927). Norsk Hydro-Elektrisk Kvælstofakt. Production of granulated dust-free nitrate of lime (264,480.)

895 (1927). Aluminum Co. of America. Production of sodium aluminate. (264,823.)

986 (1927). Meyer and Meyer. Manufacture of copper sulphate. (264,510.)

VIII.—Applications

Bennion, Clarke, and Plant. Ovens for firing pottery. 12,152. May 6.

Brenley. Manufacture of refractory materials. 12,067. May 5.

U.S. Metals Refining Co. Magnesite refractories. 12,149. May 6. (U.S., 8.6.26.)

IX.—Applications

Marks (Polysius). Manufacture of aluminous cement. 12,211. May 6.

Pardoe. Making bricks etc. 11,908. May 4.

IX.—Complete Specifications

2376 (1926). Ros and Barton. Colouring cements, plasters, etc. (269,974.)

2403 (1926). Westrum. Manufacture of bituminous concrete. (269,975.)

3284 (1926). Cuse. Making concrete. (270,013.)

X.—Applications

Bury and Walker. Recovery of lead and zinc. 11,832. May 3.

Cernik and Stoces. Plants for extracting gold from sea water. 11,804. May 3.

Eaton. Chromium plating machines. 11,648 and 11,650. May 2. Electrodeposition of chromium. 11,649. May 2.

Fletcher. Surface hardening of metal. 11,856. May 3.

Kelly. Alloys. 11,637. May 2.

Metropolitan-Vickers Electrical Co. Ltd., and Sumpter. Surface hardening of metal. 11,858. May 3.

Morris Motors (1926), Ltd., Richardson, and Smart. Case hardening etc. iron etc. 11,954. May 4.
 Odling and Street. 11,970. See VII.
 Schiffer. Production of steel. 11,815. May 3.
 Webster. Acid-resisting alloy. 12,243. May 6.

X.—Complete Specifications

29,082 (1925). Ashcroft. Recovering constituents of metallic salts for use in treatment of ores etc. (269,749.)
 1498 (1926). Murakami. Shaft furnaces for reducing iron ores. (269,959.)
 8100 (1926). White (American Magnesium Corp.). Refining calcium and magnesium and their alloys. (270,060.)
 21,057 (1926). Metropolitan-Vickers Electrical Co., Ltd. Chromium plating. (258,242.)
 21,349 (1926). Zahn & Co., and Wickop. Extracting chromium ore. (270,143.)
 *31,533 (1926). Krupp A.-G. Making chromium steel free from annealing brittleness. (270,247.)
 *11,172 (1927). Rey. Ferrous metals. (270,298.)

XI.—Applications

Automatic and Electric Furnaces, Ltd., and Coleman. Electric furnaces. 11,987. May 4.
 British Thomson-Houston Co., Ltd. Treating filaments. 12,078. May 6. (U.S., 10.5.26.)
 Eaton. 11,648—50. See X.
 Edison Swan Electric Co., Ltd., and Webster. Electric cells. 11,868. May 3.
 Pettinelli. Electric storage batteries. 11,847. May 3.

XI.—Complete Specifications

2430 (1926). Koningsveld, and Ever Ready Co. (Great Britain), Ltd. Dry batteries. (269,977.)
 2782 (1926). Deodato. Electric accumulators. (256,569.)
 5192 (1926). Moore and Campbell. Electrically-heated kilns. (270,035.)
 13,936 (1926). Croud (Jessup and Moore Paper Co.). Electrolytic cells. (270,104.)

XII.—Applications

British Thomson-Houston Co., Ltd. Oleaginous compositions. 11,964. May 4. (U.S., 4.5.26.)
 Callender, King, and Mardles. Oils. 11,936. May 4.
 I.-G. Farbenind. Production of soap-like preparations. 12,295. May 7. (Ger., 15.5.26.)
 Martens and Watty. 11,711. See XIX.

XII.—Complete Specifications

28,988 (1925). Eichengrün. Dissolving or extracting fats, oils, etc. (243,030.)
 2652 (1926). Powling. Recovery of fats, oils, etc. (269,985.)
 5292 (1926). McKenna (Dunman and Legg). See XVII.
 12,695 (1926). Leroudier. See XIX.
 15,736 (1926). Allbright-Nell Co. Rendering fat and oil containing solids of animal origin. (253,952.)
 26,544 (1926). Schou. Manufacturing soap. (266,291.)
 *11,114 (1927). Tillisch. Vitaminising fats. (270,296.)

XIII.—Applications

Coles. Production of litharge. 12,278. May 7.
 I.-G. Farbenind. Production of colour lakes. 12,294. May 7. (Ger., 10.5.26.)
 Singer and Wolff. Production of cellulose lacquers etc. 11,738. May 2.

XIII.—Complete Specification

2363 (1926). Griffiths Bros. & Co., London, Ltd., and Britton. Manufacture of resin-like bodies. (269,973.)

XIV.—Application

Rubber Latex Research Corp. Stabilised latex. 12,326. May 7. (U.S., 3.1.27.)

XV.—Applications

Beer. Production of tanning-agents. 11,739. May 2.
 Chem. Fabr. Worms. Production of tanning-agents. 11,739. May 2.

XV.—Complete Specifications

*9633 (1927). Röhm & Haas A.-G. Tanning with metallic salts and salts of silicic acid. (270,267.)
 *10,523 (1927). Technicolor Motion Picture Corp. See XXI.

XVII.—Applications

Rak. Batteries for continuous diffusion of sugar etc. 12,321. May 7.
 Treuhand Ges. Bartmann & Co. 12,183. See XIX.

XVII.—Complete Specification

5292 (1926). McKenna (Dunman and Legg). Extracting wax from filter-cake or residue of cane sugar manufacture. (270,036.)

XVIII.—Complete Specification

27,378 (1926). Weber. Manufacture of yeast. (264,795.)

XIX.—Applications

Martens and Watty. Manufacture of margarine. 11,711. May 2.
 Treuhand Ges. Bartmann & Co. Treatment of cereals. 11,660. May 2. (Ger., 6.5.26.) Treatment of materials containing starch. 12,183. May 6. (Ger., 17.5.26.)

XIX.—Complete Specifications

32,664 (1925). Nanji and Paton. Manufacture of pectin products. (269,952.)
 4569 (1926). Seligman. Sterilising and preserving liquids. (270,030.)
 7484 (1926). United Yeast Co., Ltd., Salmon, and Jackson. Preservation of liquid eggs. (270,052.)
 12,695 (1926). Leroudier. Manufacture of oleomargarine. (252,369.)
 *11,114 (1927). Tillisch. See XII.

XX.—Applications

Boedecker. Preparation of mono-ethyl ethers of proto-catechuic aldehyde. 12,189. May 6. (Ger., 24.1.27.)
 British Celanese, Ltd., Bader, and Green. Manufacture of organic compounds. 11,644. May 2.
 Carpmel (I.-G. Farbenind.). 11,994. See IV.
 Chem. Fabr. vorm. Schering. Manufacture of aminomethylmercaptosulphonic acid etc. 11,998. May 4. (Ger., 5.5.26.)
 Glover. Cancer toxin and antitoxin. 12,209. May 6.
 Macallum. Manufacture of diacetyl 3:3'-diamino-4:4'-dihydroxy-5:5'-diiodoarsenobenzene etc. 12,003. May 4.
 May & Baker, Ltd., and Stickings. Manufacture of arylarsinic acids. 11,864. May 3.
 Yava Works, Ltd. (Arnot). Preparation of condensation products from amines. 11,706. May 2.

XX.—Complete Specifications

27,355 (1925). Branco. Preparation of artificial medicinal waters. (269,660.)
 2560 (1926). Patart. Synthetic production of higher alcohols. (247,177.)
 2562 (1926). Patart. Method for simultaneously synthesising methanol and liquid hydrocarbons. (247,932.)
 11,987 (1926). Newbery, Paxon, and May & Baker, Ltd. Manufacture of unsymmetrical arylarseno-compounds. (270,091.)
 18,578 (1926). Dyk. Polymerised vinyl-chloride modification. (260,550.)
 *10,743 (1927). Raschig. Process for the production of chlorthymol. (270,283.)
 *11,603 (1927). Soc. of Chem. Ind. in Basle. Manufacture of derivatives of substituted quinoline carboxylic acids. (270,339.)

XXI.—Applications

I.-G. Farbenind. Protective layers for photographic films. 11,727. May 2. (Ger., 1.5.26.) Manufacture of photographic plates etc. 11,980. May 4. (Ger., 12.8.26.)
 Pereira. Photography. 12,333. May 7.

XXI.—Complete Specifications

*10,522 (1927). Technicolor Motion Picture Corp. Preparation of coloured reproductions by imbibition. (270,279.)

*10,523 (1927). Technicolor Motion Picture Corp. Hardening gelatin films and surfaces. (270,280.)

*11,727 (1927). I.-G. Farbenind. Protective layers for photographic films. (270,347.)

XXIII.—Complete Specifications

3233 (1926). Amos. Tanks and apparatus for aerating sewage etc. (270,012.)

15,433 (1926). Darco Sales Corp. *See* VI.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Earthenware (Commercial Bureau, Australia House, Strand, W.C.2. Ref. No. 412). *Belgium*: Asbestos packing, metal packings and valves (478). *British India*: Steel (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Brazil*: Artificial silk yarns (495). *Canada*: Iron and steel, metals (475). *Egypt*: Vegetable oils, chemicals (492). *Greece*: Coal tar (B.X. 3511). *Rumania*: Non-ferrous metals, tinplate,terne plates, black corrugated sheets (491). *South Africa*: Glass water containers (B.X. 3500); varnish, enamel (B.X. 3499); brass piping, brass and copper sheets (A.X. 1667). *United Kingdom*: Metal alloys (23060/27).

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during March, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 606, of which 479 were from merchants or importers. To these should be added 10 cases outstanding on February 28, making a total for the month of 616. The total number of applications received during April was 624, of which 496 were from merchants or importers. To these should be added 26 cases outstanding on March 31, making a total for the month of 650. These were dealt with as follows:—**Granted**—560 (of which 527 were dealt with within 7 days of receipt); referred to British makers of similar products—56 (of which 49 were dealt with within 7 days of receipt); referred to Reparation Supplies available—5 (all dealt with within 2 days of receipt); outstanding on April 30, 1927—29. Of the total of 650 applications received 581, or 89%, were dealt with within 7 days of receipt.

British Standard Specifications

The British Engineering Standards Association has issued British Standard Specification No. 277—1927 for Ready Mixed Linseed Oil Paint (Oil Gloss), Zinc Oxide, and No 278—1927 for Ready Mixed Linseed Oil Paint (Oil Gloss), Tinted Paints (Zinc Oxide Base). They contain clauses regulating the composition, together with standard reception tests, for the purchase

of these materials, and appendices giving methods of carrying out the tests. These specifications have been prepared at the request of the paint manufacturers by a committee representative of both the buying and manufacturing interests, and as in the case of all British Standard Specifications, they will be reviewed as experience of their working or progress in the industry renders it necessary, and revised issues will be published from time to time. Amongst other specifications in hand which will be published as completed are the following:—Painting materials—red oxide of iron oil paste, Class 1 and 2, lead chromes, prussian blues, lithopone, lithopone oil paste, carbon black, mineral black, vegetable black, lamp black and gold size. Copies of the new specifications (Nos. 277 and 278—1927) may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

Monel Metal

We learn that G. & J. Weir, Ltd., have formed a subsidiary company under the same name in Paris, with a capital of 1,000,000 francs, to market monel metal in France and its colonies and protectorates, Belgium, and Switzerland.

News from Advertisements

A chemist is wanted by malt extract manufacturers (p. viii).

Copies of the JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY, and of the CHEMICAL SOCIETY are offered for sale (p. viii).

A patent is offered for negotiation (p. viii).

PUBLICATIONS RECEIVED

FIRST ANNUAL REPORT, 1926. PHARMACOLOGICAL LABORATORIES. Pp. 7. London: Pharmaceutical Society of Great Britain. 1927.

REPORT OF THE LIVESSEY PROFESSOR (John W. Cobb, C.B.E. B.Sc., London and Leeds, F.I.C.) FOR THE SESSIONS 1924—25 AND 1925—26. Department of Coal Gas and Fuel Industries (with Metallurgy). Pp. 14. Leeds. The University, 1927.

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EDITORIAL

An Academy Portrait

We publish in this issue a reproduction of a portrait by Mr. T. C. Dugdale of our senior active chemist, Prof. H. E. Armstrong. We think he is our senior chemist as well, and he is perhaps our most active chemist, so our composite description is certainly well justified. Within the last few months he has attended numerous meetings, organised receptions and dinners, published a large and important book, written an interesting chapter on modern views of chemistry as part of a memorial volume dealing with Newton, and had his portrait painted for exhibition in the Royal Academy. His attendance at conversaziones and the opera is undiminished, and we believe that he spends his surplus time in cultivating his garden and in playing Schumann records on a singularly excellent gramophone. In conjunction with Mr. Barlow, who has also many years to his credit, he pursues his study of dodecahedral models which these two conjurors fit together to represent the complex organic compounds now engaging their attention. One such model has been included in Prof. Armstrong's portrait. It is, of course, possible to make a mental picture of the more or less impenetrable space which lies between the atomic nucleus and the outermost ring of electrons, to consider this volume as capable of close-packing, to endow its theoretical surfaces with faces, angles and corners, and to fit these imaginary faces together in a logical and geometrical system of three dimensions. To one who has abundant unsaturated affinities, a vivid imagination and still dexterous fingers, this is probably an agreeable diversion: to many of us it would be hard work. Whether the logical system devised by the professor is more rigid than the facts of organic chemistry require we do not know. If this is the case, so much the worse for the facts. We are amused to find that the professor has for thirty-seven years, to our knowledge, and possibly for many more years, been urging that solution in water is a matter of association rather than dissociation, and that during most of this period his rather solitary cry has made less noise than the numerous chemists who claimed that hydrochloric acid split up at once when introduced into water, and now the reviewer of his book claims that

Armstrong's view and the current view are so close that we have only to solve some simple problem of the nature of deciding whether soda-water is one word or two words connected by a syphon. When the ionists have decided whether the negative chloride radical is single or married or lives *à la carte*, then we shall know how much of the difference between them and Armstrong is merely a question of verbiage: all will be peace and the voice of the turtle will be heard in the land.

These questions of the structure of organic compounds and of the nature of salts in aqueous solution are of singular importance and difficulty. The evidence obtainable is not very abundant, and is by no means easy to interpret, and these are two good reasons why only few chemists spend much time discussing them. A close observer could find other reasons: chemistry is not merely an exact science like mathematics; it is also an art which, like making pastry or playing the piano, is not attainable by all. Some chemists are so clever with their fingers that they can perform feats in the laboratory beyond the powers of most of their contemporaries, and they very properly make use of their exceptional skill in synthesis and analysis rather than in speculation. Moreover, chemists have, we imagine, a method of making use of their theories, and the evidence for and against them, which is different from the methods of many other people. We think it was Sir William Pope who recently announced that to the chemist a theory was a tool rather than a creed. If we have wrongly attributed this paradox we offer our apologies, but in any event the statement expresses a truth. So long as the theory helps the chemist to understand, to prophesy, and to correlate hitherto isolated facts, he is satisfied with it, till some usurper rise, and he, too, mighty thoughtful, mighty wise, studies new lines, and other circles feigns. As speculations require no manual dexterity to discuss, and no profound knowledge to comprehend, they are dear to editors and also to that large body of amateurs who discover that many branches of chemistry cannot conveniently be acquired by an amateur. Chemistry is for the professional man, and it seems that even when the chemist is within measurable distance of his eightieth year he can still go on learning it and teaching it.

CHEMICAL FIRE EXTINGUISHERS*

By W. R. ORMANDY, D.Sc., F.I.C., M.I.Chem.E.

A very decided step in the history of civilisation dates from the time when men deliberately made use of fire, but though a useful servant, fire is a dangerous master, and the increased use of fire in all forms has led of necessity, with the advance of civilisation, to the adoption of means for fighting the uncontrolled action of fire.

It is interesting to glance at the losses arising from fire, as shown by the insurance statistics. In the United Kingdom fire loss during the period of ten years amounted to £80,595,000, this does not include the thousands of fires where the damage amounted to less than a thousand pounds per fire. In the last two years of the period under review, the losses were £12,878,000 and £14,616,000 respectively, amounts far in excess of any of the earlier totals during the same period. The loss of life amounted to 7,927, with additional thousands maimed and injured.

In America conditions are even worse. In the year 1925 it is estimated that over 14,000 persons were burned to death and 16,000 injured by fire in the United States. Of these, 80% were of the dependent class—that is, mothers, children, sick in hospitals, etc. The preliminary estimate of the fire loss in the United States for 1925 is over 570 million dollars—that is, over a thousand dollars a minute throughout the year. Over 60% of the fires takes place in homes, and it is interesting to follow the analyses of fire causes, as far as these are available. Carelessness with matches, cigars, cigarettes, etc. caused damage of over 30 millions; defective chimneys and flues, over 22 millions; accidents arising from stoves, flues, boilers and their pipes, over 21 millions; spontaneous combustion caused damage of over 17 millions, and sparks on roofs over 15 millions; carelessness with electrical appliances caused a loss of about 14½ million dollars, and nearly one half of all the electrical accidents arose from the use of the electric flat iron. The remainder were largely attributable to bad wiring. It is instructive to note that only 4% of the electrical losses arose in buildings which were wired according to the National Electric Code. These American statistics are taken from the paper by W. J. Rodgers, junr., read at the Sixth Annual Meeting of the Fire Chiefs of the Bethlehem Steel Corporation.

It may be of some interest to take a short backwards view over the progress of fire fighting in this country. At the time of the Great Fire of London (1666) the fire appliances then in existence consisted of brass-handled squirts and leather buckets. The squirt, having been filled by one man, was operated by another. It held about a gallon of water, and was very like an enlarged modern garden syringe.

The City of London was divided into four districts, and, according to the Act in 1667, each district was provided with two squirts and 800 leather buckets, together with a number of spades and pick-axes. Soon after this two rival engine-makers succeeded in perfecting a kind of fire engine, and one eventually made an engine capable of throwing a jet of water to a height

of 165 feet; this apparently put the other man out of business, for nothing more is heard of him. These engines, although on wheels, were usually placed on trucks with larger wheels, to get them more rapidly to the scene of the fire.

Owing to the slow progress made by fire appliances a "Fire Watch" or "Fire Brigade" was established in 1791, the work being for the most part undertaken by the insurance offices. Each company had its own engine and men, who wore an emblem of the offices on a badge displayed on their left arm. Their uniform consisted of a double-breasted jacket, knee-breeches and long boots, with an overcoat worn over the jacket.

In 1830 the insurance companies resolved to reorganise their forces by doing away with the separate establishments and combining the whole in one brigade. The London Fire Brigade (which to-day is known as the Metropolitan Fire Brigade) became an established fact in 1833. It was supported by ten of the insurance offices, who contributed to the expense of maintenance in accordance with the business they did. It existed in this manner for about 33 years, and although steam fire engines were introduced to them in 1835, it was almost at the end of their existence before they were adopted. In the early days of fire engines each office had its special "office" mark, which consisted of a plate of lead or other metal bearing their name or trade mark, which was placed on the front of the building of the insured person. Before the amalgamation of the various offices these plates were intended to decide which company's engine should attend in the event of a fire. It has been stated that in the earlier days a form had to be filled in and sent the nearest brigade, notifying them that their service were required.

The basic means employed for fire fighting are comparatively few in number. First, and most important, comes the use of water, which is regarded rather as a means for reducing the temperature at the source of the fire than as a means for the production of steam intended to extinguish the fire by preventing access of oxygen. In the second class are those bodies which are employed for the production of large bulks of preferably heavy vapours which smother the fire by preventing access of oxygen or by reducing the oxygen constituent of the gases, surrounding the fire to a point at which combustion is not readily carried on. A third means for fire fighting is the application of solid materials, such as sand, earth, or preferably bodies which give off non-inflammable gases when heated. The fourth and most modern means is that known as the Foam Method.

GROUP I

We will deal with these various groups one by one. In this short review it is intended only to deal with what may be called "portable" or "hand" means for fighting fires in their incipient stage. The various forms of what are known as "S and A" appliances (soda and acid) are among the best known and the most widely distributed. A solution of sodium bicarbonate is contained in a pressure-resisting vessel and sulphuric acid is contained in an internal vessel, which at desire can be caused to mix with the sodium bicar-

* Read at the meeting of the Chemical Engineering Group on May 6.

bonate solution, thus generating carbon dioxide, the pressure so produced serving to eject the liquid in a powerful stream. Such S and A appliances are made in 1- and 2-gal. sizes and up to a maximum of about 40 gals., in which case the containers are on wheels and can be handled by one or two men. These appliances must be considered as belonging to Class I, for, after all, the extinguishing medium remains the water, since the carbon dioxide contained in the liquid when it arrives at the fire is too small in quantity to be of any importance. Obviously such machines have to be made of a material which will resist sulphuric acid. For this purpose lead-lined vessels are almost entirely employed, and great care should be taken that the ratio of acid to alkali in the charges is as nearly theoretically correct as possible. Needless to say, such appliances are worse than useless for electrical fires, for the liquid, containing large quantities of sodium sulphate, is an excellent conductor of electricity. In any case, the results arising from the utilisation of a strong, even neutral, salt solution are sufficiently unpleasant under any conditions.

GROUP II

It would not be unreasonable to re-name Group II the "Carbon Tetrachloride Group" since, although other bodies are used to some extent, carbon tetrachloride is used in the overwhelming majority of cases. What is required is a material which shall produce from a given bulk of liquid the maximum quantity of a vapour which shall be heavy, non-combustible, and as stable to heat and the chemical conditions arising in a fire as possible. Having regard to the price, carbon tetrachloride has been found to fulfil the required conditions better than anything else, and hundreds of thousands, if not millions, of first-aid fire extinguishing appliances are in use all over the world making use of CCl_4 as their basic material.

For the most part, these appliances consist of a double-acting pump of about 1 quart capacity, the whole being so arranged that it will pump equally efficiently whether pointing downwards or upwards and will act until the entire contents are discharged. There is a considerable number of chlorinated carbon compounds which do not support combustion, but of them carbon tetrachloride is the most stable, and even in the presence of moisture less liable to form acid bodies deleterious to the metal of the container. The chemist is often astonished to find that in industrial processes chemicals are often required of a degree of purity even greater than he is accustomed to use in the laboratory. This is particularly true of carbon tetrachloride for use in fire-extinguishing appliances. The commercial product is always liable to contain carbon disulphide and traces of moisture, and both of these are immensely active in bringing about metallic corrosion. It is only by the use of CCl_4 of an extraordinary degree of purity that it is possible to get fire appliances filled with this product which after ten and fifteen years of inaction are found to be in perfect condition. Needless to remark, when the purchaser of such a fire appliance, after ejecting some of the carefully purified contents, fills up with tap water, the need not be astonished at the destruction which will inevitably arise.

The chemist will at once ask what happens to carbon

tetrachloride in contact with flames and carbonaceous or other material at a high temperature. This point has been very carefully studied both by A. H. Nuckolls, Chemical Engineer to the Underwriters' Laboratories, and by the Bureau of Mines, both of America. In the first place, since carbon tetrachloride freezes at a temperature which is very frequently reached in America, it is necessary there to add other bodies to lower the freezing point, and for this purpose up to 10% of chloroform is most frequently added. On the assumption that the depression of the freezing point follows the normal law, methyl alcohol would be expected to be a most efficient diluent, but in effect it turns out that the freezing point reduction caused by this material is only a fraction of that which would be expected, and one must assume, therefore, that methyl alcohol in solution in carbon tetrachloride is very heavily associated. The fact that chloroform has to be used as an anti-freeze material in cold countries is important in view of the discoveries of the investigators above referred to. It must be stated that both investigations were carried out in a manner which would represent the most dangerous conditions likely to arise in actual practice, such as a fire in a submarine, in a cellar, or a small room with no ventilation. It was proved in both cases that carbonyl chloride was produced in small quantities and chlorine only under exceptional circumstances, also in small quantities. Hydrochloric acid gas was invariably formed, but the quantity of chlorine and hydrogen chloride necessary to make themselves unpleasantly evident is very much less than that which forms a lethal dose. It would appear that chlorine is principally formed when red-hot iron comes in contact with the extinguishing fluid. The most dangerous ingredient is undoubtedly phosgene, and it is interesting to note that the quantities of this produced were very much greater when the carbon tetrachloride employed contained small quantities of carbon disulphide and/or chloroform, but that in no case, working with reasonably pure materials and under conditions which obtain in the majority of cases, was the production of these deleterious bodies in any way sufficient to justify the prohibition of use of what is undoubtedly one of the best fire extinguishing materials at present employed.

It may be of interest to note the method employed at the Underwriters' Laboratory for the detection and estimation of quantities of phosgene falling between 2 and 150 parts per million in the gases drawn off from the fire. For purposes of tests, gases were drawn through a solution of ammonia and the urea formed by the reaction, together with ammonium chloride, was extracted with amyl alcohol, in which ammonium chloride is insoluble; oxalic acid is then added and phosgene, if present, gives a crystalline precipitate of ammonium oxalate. For quantitative determination the fumes were drawn in known volume over granulated metallic antimony to remove chlorine and through a cold saturated solution of aniline. Under these conditions phosgene gives diphenylurea, insoluble under the conditions, which is simply washed, dried and weighed.

Attached to the report of the National Fire Protection Association on the "Behaviour of Carbon Tetrachloride"

under "Fire Conditions" is a table of the toxicities of air containing gases and vapours from fire extinguishers, together with the concentration at which these various bodies affect the eyes and throat.

In the summary and conclusions of the Bureau of Mines Report it is stated "It is not the intention of this paper to prescribe the use of carbon tetrachloride extinguishers which are excellent in stopping incipient fires, but rather to point out the danger which can occur with their application."

It is interesting to note that not only does purity of the carbon tetrachloride lead to immunity from corrosive action on the container, but it also tends toward the production of less noxious bodies in contact with flame and heated materials.

A very excellent fire extinguishing medium is methyl bromide, either alone or together with methyl chloride. It is, however, expensive, and owing to the low boiling point, very difficult to retain for any length of time in anything other than sealed vessels. Owing to the low boiling point, this material ejects itself under pressure from the vessel in which it is contained. Small glass tubes with capillary ends filled with methyl bromide are certainly wonderfully efficacious in the laboratory for the extinction of small fires arising from the breaking of flasks during the distillation of volatile inflammable liquids. The high price and the difficulties above mentioned are, however, likely to militate against the introduction of such bodies on any considerable scale.

GROUP III

It is obvious that the utilisation of solid materials, such as dried sand, is only possible under limited and special conditions. In the first place, it is obviously only possible where the fire is at a low level. Finely divided powders are certainly better than water to apply to petrol, paraffin and tar or inflammable liquids generally, unless the water supply is available in overwhelming quantities or can be used as steam in enclosed places. At one period dry powders contained in cases were recommended for fire extinguishing, and in 1916 the Government caused a Committee to report to them the result of "Experiments to test the value of dry powder fire extinguishers as compared with water and other first-aid appliances for extinguishing or effectively controlling fires such as are likely to be caused by bombs." The report of this Committee was handed in during April, 1916; their conclusions are certainly anything but favourable to the extinguishers tested.

Four different types of powder extinguishers were examined, and they were found to contain for the most part about 50% of sodium bicarbonate, the balance being finely ground chalk or other equally cheap filler. The analyses show that if the whole of the carbonic acid available on heating were given off suddenly in the fire, one cubic foot of gas would be formed for each pound of powder used. As a pound of water gives 1600 times its volume of steam, the relative value for fire extinction purposes is easily seen. It was pointed out that the cost of the contents of such powder fire extinguishers was about twopence. The report is a strong condemnation of the type of powder fire extinguisher, at one time largely advertised.

GROUP IV

The utilisation of a foam blanket consisting of very stable bubbles containing carbon dioxide is comparatively modern, and is a most interesting application of the laws of surface adsorption, a branch of chemistry to which much attention has been directed during the last ten years. In essence, the process consists in bringing together a solution of sodium bicarbonate and a solution of aluminium sulphate, which leads to the evolution of carbon dioxide and the setting free of colloidal alumina. To this solution certain organic materials are added, such as liquorice or saponin, which act as foam formers and stabilisers. In the earlier form of instruments sodium bicarbonate and the aluminium sulphate were in two separate packets, and the remaining material was generally supplied in solution in a tin. At a later date the organic matter in a solid finely divided form mixed with the sodium bicarbonate formed one charge and the aluminium sulphate the other. Small hand machines were made much on the lines of the soda and acid machine, as well as plant of the 30-40 gallon type on wheels, but for the protection of oil storage tanks and for use on the steamships where oil firing is employed, large permanent tanks were used, with or without thermostatic control. The latest advance is by the utilisation of processes which can be adapted to an existing water supply and which will give a continuous discharge of foam so long as the necessary dry admixture of chemicals is supplied to the plant. In effect a mixture of finely divided and very dry sodium bicarbonate and aluminium sulphate with the organic foam stabiliser is fed into a water supply at a rate proportional to the rate of water flow and foam thus produced in the water circuit itself. The foam is now made having such physical characteristics that it will adhere to vertical surfaces and the duration or life of the foam is much greater than was obtainable a few years ago. The Board of Trade have made it necessary for all oil-using steamers carrying passengers to have installed apparatus capable of giving a fire extinguishing layer of a given thickness over the whole of the boiler room floor. In a few cases, possibly to save expense, steamships have employed cylinders of liquid carbon dioxide which may be caused to discharge their contents on to the engine room floor. It should, of course, be borne in mind that a mere reduction of the oxygen content of the air is sufficient to render most bodies non-combustible, and it is not necessary entirely to exclude oxygen, but the higher the temperature and the more the fire has advanced, the smaller the percentage of oxygen which will continue to support combustion. In America and in this country very large electrical generating sets are frequently protected by carbon dioxide installations, and it is interesting to note that the voltage necessary to pass a spark through carbon dioxide is greater than that necessary through air. In some of the American installations, the carbon dioxide cylinders are contained in a frame which forms one scale of a balance, so that it is possible at any moment to know what weight of liquid carbon dioxide is contained in the stand and to check loss by leakage. As electrical fires are liable to smoulder, there is an ingenious device for permitting a slow evolution of carbon dioxide for a

period of some hours after the apparatus has first been called into action, and this delayed discharge is quite automatic. Clearly for the protection of large electrical units chiefly carbon dioxide and carbon tetrachloride installations come into question.

A great deal of work has had to be done in order to devise nozzles from which the liquid carbon dioxide could be discharged without freezing up the nozzle. At present a special design of Monel metal nozzle is used which appears to get over the difficulty. In marine use a very real difficulty arises from the extraordinarily low temperature at which the carbon dioxide gas is set free on the engine-room floor when it is released from the liquid carbon dioxide contained in the storage vessels.

General

The growing use of nitro-cellulose for paints, varnishes, films, combs, knife handles etc. has introduced new risks into daily life. In so far as nitro-cellulose is employed we have a product containing in itself a large amount of oxygen and capable of combustion without the employment of external oxygen from the air. The box of film, if combed out and ignited, can be plunged into a tank full of carbon tetrachloride and it will still continue to burn and to give off inflammable gases, and it will burn equally well covered with a heap of dry sand. Such continued combustion in the absence of external oxygen is, however, only possible when the film or objects are really violently aflame. Small cellulose fires are amenable to extinction if caught at an early enough stage. A similar difficulty arises in handling fires in which nitrates or chromates are concerned, for here again the oxygen is contained within the material itself. Attempts to extinguish a mass of burning sodium by means of carbon tetrachloride were also doomed to failure, for the sodium combined with the chlorine and set the carbon free, and the fire, if anything, was a greater success after treatment than before.

A POSSIBLE NEW FACTOR IN THE CHEMICAL MECHANISM OF MUSCULAR CONTRACTION*

BY P. EGGLETON AND M. G. EGGLETON

Since the discovery by Harden and his colleagues of the importance of phosphates in the fermentation of glucose by yeast, the possibility has had to be considered that phosphates may play a similar rôle in the breakdown of carbohydrates which is known to accompany muscular contraction. In a study of the significance of phosphates in this connexion we have obtained some results which seem to suggest that the problem contains complications not previously suspected. It was found¹ that resting voluntary muscle contains a substance, apparently an ester of phosphoric acid, which, owing to the rapidity with which it gives rise to inorganic phosphate in acid solution, had been hitherto confused with inorganic phosphate; for the estimation of phosphate in muscle is usually carried out in strongly acid solution.^{2,3} When a satisfactory technique had been found for the separate estimation of this substance and true inorganic phosphate, it was shown

that the substance disappeared rapidly (though never completely) from an isolated muscle during a tetanus, with a simultaneous appearance of inorganic phosphate in addition to the appearance of lactic acid. Subsequent recovery of the muscle in an atmosphere of oxygen led to a rapid reconstitution of this substance (with a corresponding disappearance of inorganic phosphate). This reconstitution was much more rapid than the oxidative removal of lactic acid.⁴ These facts led us to apply the name "phosphagen" to this substance pending an examination of its chemical nature.

In view of the work of Meyerhof on the "fermentation" of carbohydrates by cell-free muscle extracts, and his demonstration of the part played by the intermediate formation and decomposition of hexosephosphates it seemed possible that we had discovered some labile hexosephosphate which might be the precursor of the lactic acid which is formed during exercise. The ratio of phosphagen disappearing, to lactic acid formed, was quite consistent with this view. Our attempts to isolate phosphagen therefore resolved themselves into the isolation of the hexosephosphates of muscle, and up to a point the results tended to confirm this idea. If the proteins are removed from a muscle by the use of trichloroacetic acid, and the filtrate is neutralised with barium hydroxide (to pH 8), a precipitate is obtained which consists chiefly of barium phosphate: it contains no phosphagen. The addition of an equal volume of alcohol brings down a further precipitate which contains all the phosphagen of the muscle, as would be expected if phosphagen were a hexosemonophosphate. An examination of this precipitate showed it to contain carbohydrate in combination with phosphoric acid. However, only half of the phosphorus present was usually in the form of phosphagen. By a process of systematic fractionation (according to solubilities in aqueous alcohol) the phosphagen phosphorus could be concentrated in the more soluble fraction of this material. It was at this stage that it became doubtful whether we were dealing with a hexose derivative at all, for the purer we obtained the phosphagen (as judged by the increasing proportion of labile phosphorus) the smaller grew the optical rotation and the copper-reducing power of the material. In this manner we obtained a preparation having the following constitution:—

Phosphagen phosphorus ...	6.3%
Total phosphorus ...	7.95%
Barium ...	36%
Copper reduction (Folin's method) ...	11% (as glucose)
Optical rotation ...	+3° (mercury green light).

At this stage further fractionation was abandoned owing to its inefficiency. An effort was made to isolate the organic moiety of the phosphagen molecule. A preparation of phosphagen containing 60% of its phosphorus in the labile form was dissolved in decinormal hydrochloric acid and allowed to stand overnight. Barium phosphate was slowly precipitated, and after 12 hrs. no phosphagen could be detected. After removing unchanged barium salts by precipitation with alcohol, and evaporating the filtrate *in vacuo*, a crop of crystals was obtained which accounted for about 15% of

* Communicated from the Department of Physiology and Biochemistry, University College, London

of the weight of the material taken. The crystals were well-formed rhombic prisms, melting at 256° C. Recrystallisation from hot water did not change the melting point. This substance dissolved in about 100 pts. of cold water, but was very soluble in hot water; it was insoluble in all the common organic solvents. Dried *in vacuo* over sulphuric acid it became amorphous, and lost about 11% of its weight.

At this point our attention was directed (by a private communication from Prof. A. V. Hill) to a paper read by Fiske in April, in which he described a substance resembling phosphagen in its properties, which he stated to contain creatine. An examination of the crystals we had isolated gave confirmation of Fiske's statement. The substance, after boiling with dilute acid, yielded a crystalline picrate identical in appearance and melting point with creatinine picrate (m.p. 212–213°), and its melting point was not lowered by admixture with the latter. The original crystals were found to contain 29% nitrogen.

Distribution of creatine and phosphagen in successive stages of isolation of phosphagen

Creatine (in millimoles) present in			Phosphagen (in millimoles of P) present in		
Insoluble fraction.	"Phosphagen" fraction	Soluble residue.	Insoluble fraction	"Phosphagen" fraction	Soluble residue
	10.40			2.94	
0.07	1.56	8.14	1.77	1.84	0.32
0.08	0.92	0.51	0.05	0.87	0.13
0.44	0.36	0.02	0.38	0.31	Trace
		(hydrolysis)			
Trace	Trace		Trace	Trace	Trace

* This fractionation was carried out with 25% alcohol instead of 15%, thereby bringing down some of the phosphagen in the "insoluble" fraction.

The possibility had to be considered, however, that free creatine might have been associated with the phosphagen fraction through similar solubilities. A fresh preparation was therefore made from muscle, in which the distribution of creatine and phosphagen phosphorus was followed at every stage. The results furnish a strong indication that one molecule of creatine is intimately associated with each atom of phosphagen phosphorus. It will be seen from the diagram that the protein-free muscle extract with which we started happened to contain about three molecules of creatine (estimated by Folin's method) to each atom of phosphagen phosphorus. In the first crude phosphagen precipitate this ratio had fallen to less than 1:2, the excess of creatine appearing in the aqueous-alcoholic filtrate. Two successive fractionations reduced this ratio to 1:07. At this stage we had 207 mg. of a substance containing 5.1% phosphagen P and 7.3% creatine N. When this material was hydrolysed as described earlier, the phosphagen phosphorus was nearly quantitatively recovered as barium phosphate (see diagram), and the creatine which had been associated with it now appeared quantitatively in the aqueous-alcoholic filtrate.

As early as 1914 Folin⁵ expressed the view that in living muscles creatine probably exists in a combined form, a combination broken down after death. Further, it has been shown by Beker⁶ and others that creatine is most abundant in voluntary muscle, less so in cardiac muscle, and present only in traces in plain muscle. We have shown in an earlier paper that the same is true for the distribution of phosphagen. We therefore think it reasonable to suppose that creatine is associated intimately with that complex which we have designated phosphagen, and that, therefore, creatine has a part to play in the chemical phenomena accompanying muscular contraction and recovery.

In conclusion, we wish to record our gratitude to Prof. J. C. Drummond for his generous advice and help in this work.

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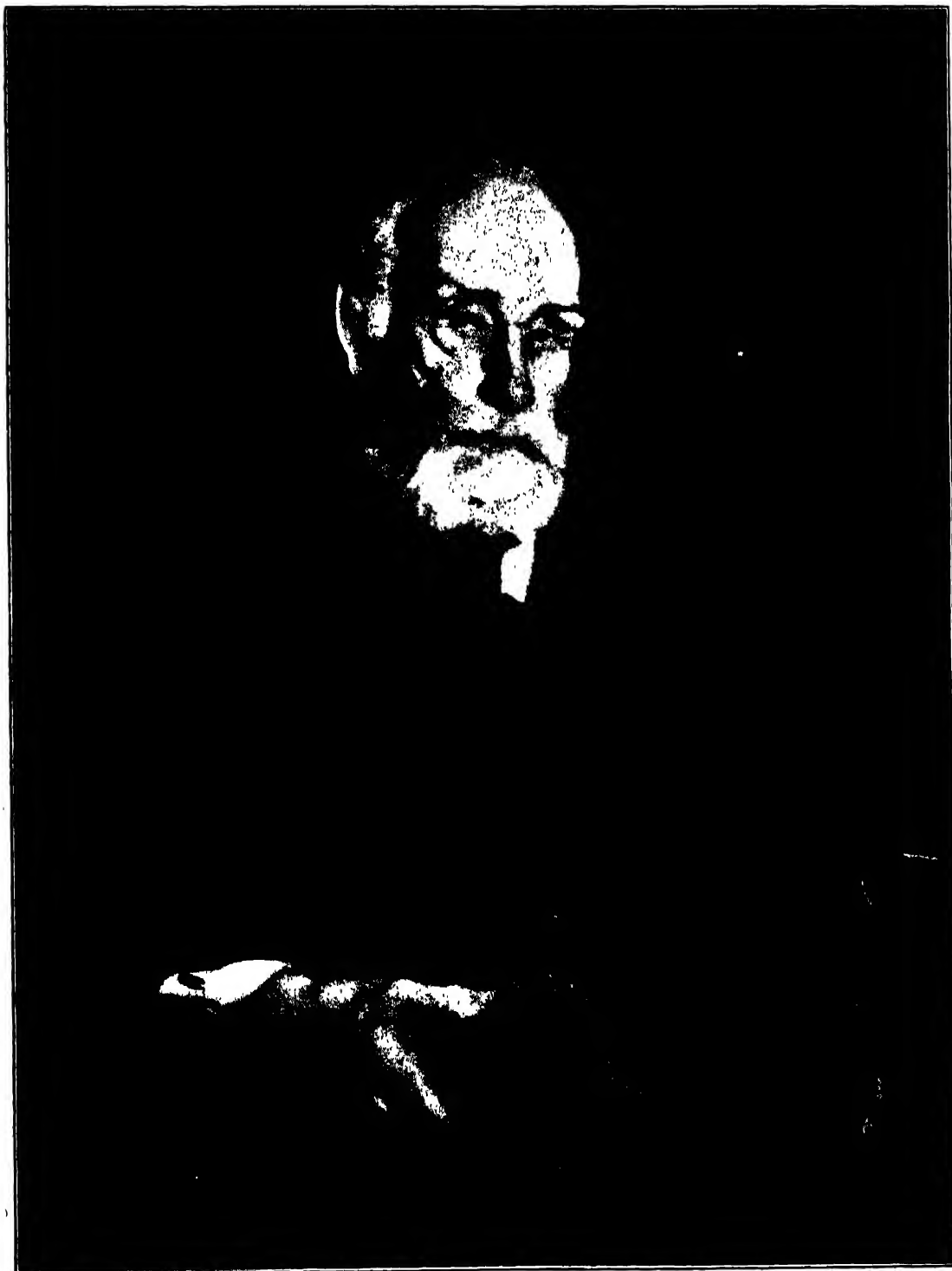
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CANADIAN INDUSTRIAL NOTES

The Dominion Bridge Company is erecting a plant costing about \$300,000, at False Creek, Vancouver, B.C., for the fabrication of steel products. British Columbia is not a steel-producing province.

Canada's export of rubber goods in 1926 had a total value of \$25,620,462, an approximate increase of 10% over the exports of 1925, when they amounted to \$17,135,892. Pneumatic tyre casings, valued at \$14,645,309, formed the chief item. Great Britain was the principal direct purchaser of casings, taking about 18% of the total exports by volume. Argentina, New Zealand, Brazil and Australia followed in order, and these five markets took almost 50% of the casing exports by volume. The value of the inner tube exports was \$2,567,105. The chief markets were the same as the casings, except that Brazil and New Zealand exchanged positions. Solid tyre exports were unimportant, amounting in value to \$312,526. Great Britain and Japan were the most important purchasers with goods valued at \$44,512 and \$32,836 respectively.

The year 1926 was one of the best which the Steel Co. of Canada has experienced in its history. Manufacturing profits were \$3,247,606, as compared with \$2,825,606 in 1925. Income from investments brought the total to \$3,644,291. This was disbursed as follows:—Sinking fund \$292,269, depreciation \$760,208, bond interest \$362,601, and preferred dividends \$454,741. These charges left the sum of \$1,774,470 available for dividends on common stock, as compared with \$1,363,567 in 1925 and \$1,069,768 in 1924. The common dividend absorbed \$805,000, leaving a balance of \$969,470 from which was transferred \$100,000 to a new reserve for employees' welfare and benefit, and the balance credited to profit and loss account, which now stands at \$10,163,054. Total assets of the company are given as \$51,549,893.



Portrait of **PROFESSOR H. E. ARMSTRONG, LL.D., F.R.S.**, by Mr. T. C. Dugdale
Exhibited at the Summer Exhibition of the Royal Academy

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING, 1927

July 4 to 9

In accordance with the provisions of By-Law 68, notice is hereby given that the Annual General Meeting of the Society of Chemical Industry will be held in the Debating Hall, University Union, Edinburgh, on Tuesday, July 5, 1927, at 10 a.m.

A detailed programme with form of application for tickets for the various functions is being issued to members.

In accordance with the provisions of By-Law 23, notice is hereby given that the following Members of Council retire from their respective offices at the forthcoming Annual General Meeting:—

Mr. Francis H. Carr, C.B.E., *President*: Dr. E. Frankland Armstrong, F.R.S., Prof. J. W. Hinchley, Prof. J. C. Philip, F.R.S., and Sir Richard Threlfall, K.B.E., F.R.S., *Vice-Presidents*: Mr. W. A. S. Calder, Mr. W. H. Coleman, Dr. William Cullen, and Mr. J. Arthur Reavell, *Ordinary Members*.

Mr. Francis H. Carr, C.B.E., has been nominated for re-election to the office of President under By-Law 19. Mr. E. V. Evans, Mr. C. S. Garland, Dr. H. Levinstein, and the Right Hon. Sir Alfred Mond, Bart., M.P., have been nominated Vice-Presidents under By-Law 20. Dr. E. W. Smith has been elected Honorary Treasurer, and Dr. E. Frankland Armstrong, F.R.S., has been elected Honorary Foreign Secretary.

Mr. A. J. Chapman, Dr. H. E. Cox, Dr. W. M. Cumming, Mr. George Gray, Mr. C. Norman Kemp, Prof. G. T. Morgan, F.R.S., Dr. F. L. Pyman, F.R.S., Mr. L. Guy Radcliffe, Prof. Joseph Reilly, and Mr. Harold Talbot have been nominated under By-Law 24 to fill four vacancies among the Ordinary Members of Council.

A Ballot List is being posted to every Member entitled to vote.

J. P. LONGSTAFF,
General Secretary

CALENDAR OF FORTHCOMING EVENTS

- May 28. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, *Associates' and Students' Section*. The Mining Institute, Neville Hall, Newcastle-upon-Tyne, at 3 p.m. "Variable speed gears and their application for colliery purposes," by W. S. Armstrong. (Illustrated by lantern slides.)
- May 31. ROYAL PHOTOGRAPHIC SOCIETY, 35, Russell Square, W.C.1. "The development of chloro-bromide papers" and "The exposure of colour-screen plates," by E. A. Bierman.
- June 2. CHEMICAL SOCIETY, Burlington House, London, W.1, at 8 p.m. *Ordinary Scientific Meeting*.
(1) "The passivity of metals. Part I.—The isolation of the protective film," by U. R. Evans.
(2) "Studies of valency. Part VIII.—The molecular structure of Vernon's dimethyltellurium salts," by Prof. T. M. Lowry and R. R. Goldstein.
(3) "The factors controlling the formation of some derivatives of quinoline, and a new aspect on the problem of substitution in the quinoline series," by E. Roberts and E. E. Turner.

THE INSTITUTION OF CHEMICAL ENGINEERS

Recent Elections

Full Members

- Airey, F. T., B.Sc., Superintendent of the Chemical Section of the Salt Union, Ltd., Weston Point.
Whitelock, E. D., Chief Engineer, Brotherton & Co., Ltd., Leeds.
Powell, D. H. G., Chemical Engineer, Oil Mills, Punjab.

Transferred from Associate-Membership to Full Membership

- Barber, C., Chemical Engineer and Manager, Coke Oven By-Product Department, Norton's (Tivdale), Ltd., Tipton.
Bingham, J. H., A.M.I.Mech.E., Chevalier de l'ordre de la Couronne, Works Manager of Geo. Glover & Co., Ltd., Chelsea.
Webb, H. W., M.Sc., F.I.C., Head of Department of Chemistry and Industrial Chemistry, and Lecturer in Chemical Engineering, Cardiff Technical College.

Associate-Members

- Ambrose, A. J., Engineer to Manly Gas Company, near Sydney, N.S.W.
Dallas, W., A.I.C., A.I.M.M., Chemist and Assistant Manager to Brand's Pure Spelter Co., Ltd., Irvine, Ayrshire.
Green, A. T., F.Inst.P., Technical Adviser to Derbyshire Silica Firebrick Co., Ltd., Friden, near Buxton.
Johnson, W., Carbonising Superintendent on Vertical Retort Installations; c/o Wests Gas Improvement Co., Ltd., Miles Platting, Manchester.

Transferred from Graduate-ship to Associate-Membership

- Heggie, R. G., B.Sc.(Eng.) in Chemical Engineering; Chemist, South African Railway and Harbour Administration Laboratory, Workshops, Pretoria.

Graduates

- Colton, W. J., Assistant with Ruston & Hornsby, Ltd., Lincoln.
Emler, K. L., B.Sc., A.R.C.Sc.
Hickson, H. E., B.Sc. (Tech.).
Manchester
Rogers, R. C., B.Sc., A.R.C.Sc.
Franklin, H. B., B.Sc., A.R.C.Sc.,
D.I.C.
Swallow, J. C., B.Sc., Ph.D., on Research Staff of Brunner, Mond & Co., Ltd., Northwich.

Student

- Hayman, R. F., Assistant with Messrs. A. Boake Roberts & Co., Ltd., London.

CHEMICAL SOCIETY

The Faraday lecture was delivered on May 18, at the Royal Institution, by Prof. Dr. Richard Willstätter, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., presiding over a large gathering of Fellows and distinguished guests, among whom was the Right Hon. the Earl of Balfour, K.G., F.R.S. The President, introducing the lecturer, said that the occasion was not a memorial lecture, but a triennial discourse whereby they rendered homage to the name of Faraday, a name which would be honoured as long as science was studied. Those who had been invited to deliver the Faraday lectures had been among the most celebrated scientists from all parts of the world. Faraday and the lecturer had both chosen the frontiers of chemistry as their

campaigning ground, and had largely extended our knowledge of its borderland.

Prof. Willstätter, taking as his subject "Problems and methods in enzyme research," first referred to Faraday's experiments "on the power of metals and other solids to induce combination of gaseous bodies," and proceeded from a consideration of inorganic catalysis to deal with the organic catalysts, developing the parallelism which had been recognised even in the earliest observations of the phenomenon. The modern progress of industrial catalysis had emphasised the problem of improving inorganic catalysts on the pattern of the enzymes, so as to make them more selective as well as more active. In investigations on the behaviour of hydrogen and oxygen with platinum the lecturer had found reason to believe that a new contact substance was produced: that platinum charged with oxygen must be considered as a mixed catalyst. Similarly, the behaviour of activated enzymes suggested that mixtures may be of the nature of new chemical compounds. The gulf between the inorganic catalysts and the enzymes, which are still of obscure chemical constitution, had now been bridged by accurately defined organic compounds which behave like the latter.

The conception of the enzymes as specific organic compounds led Prof. Willstätter to discuss the problem of isolating them in a state of purity. The processes are accompanied by determinations of the relative activity of the preparations, whereas in the production of inorganic catalysts it is customary to be satisfied with the conversion of an unknown small fraction of the atoms of the crystal structure into an active condition. The processes of separation were based on adsorption, which could be made so selective that enzymes could be largely freed not only from foreign admixtures, but also from their activators, the enzymes being subsequently removed from the adsorbates by gentle chemical treatment. In this way it could be shown that phosphorus and iron are not essential constituents of invertase and peroxidase respectively, but there is no certain method of freeing the enzymes from the protein derivatives. For separating enzymes from those substances which they most closely resemble in colloidal and chemical properties, a process of adsorption on a very finely divided precipitate, e.g., of lead phosphate, produced in the enzyme solution itself, is employed. It had thus become possible to separate an enzyme even from the products of its inactivation (by keeping or warming), which differ only in the absence of the active specific group. By adsorption, also, complete resolution of the proteolytic system of the pancreas and the intestine had been attained: in many cases the atomic groups responsible for the union of the enzyme to the adsorbent were indicated, and delicate gradations of adsorptive power are determined by the peculiar chemical differentiation of the gels used. So far as is known, the only property of enzymes which is independent of their varying degree of purity is their qualitative specificity, and in this connexion it is even possible to ascertain the particular atomic group of the substrate molecule towards which their enzymic activity is directed.

At the conclusion of the lecture the President, in presenting the Faraday medal to Prof. Willstätter, expressed the hope that it would be a happy souvenir of this great occasion. A vote of thanks to the lecturer was proposed by Prof. W. H. Perkin, F.R.S., who referred appreciatively to Prof. Willstätter's splendid work in pure organic chemistry as well as in biochemistry. Prof. J. F. Thorpe, C.B.E., F.R.S., seconding, said that the lecturer's researches entitled him to be placed on a pinnacle with his great countrymen Baeyer and Fischer. The motion for the vote of thanks having been put by the President and carried with enthusiasm, Prof. Willstätter, in acknowledgment, expressed his sincere thanks for the opportunity both of sharing in the tribute to Faraday and of reciprocating a desire to unite the scientists of every country. A vote of thanks to the Managers of the Royal Institution for permitting the use of Faraday's lecture theatre was carried with acclamation.

At an ordinary scientific meeting, held on May 19, Professor Dr. Richard Willstätter was admitted an Honorary Fellow. The President, Professor H. Brereton Baker, C.B.E., F.R.S., reminded Fellows that applications for grants from the Research Fund must be received by June 1.

Prof. H. M. Dawson then gave a general account of his investigations on acid catalysis and the catalytic catenary in the following paper:—

New Developments in the Study of Acid Catalysis The Catalytic Catenary

THE long continued acceptance of the view which ascribes the catalytic activity of acids entirely to the hydrogen ion is largely due to the circumstance that this theory is in approximate agreement with a considerable body of facts. Outstanding anomalies, such as are presented by the salt effects observed in the catalytic action of strong acids, have been accommodated by the introduction of ad hoc hypotheses.

More detailed and accurate investigations of acid catalysis led subsequently to the idea that the undissociated acid also plays the part of a catalyst. Notwithstanding the very strong evidence of the dual theory of catalytic activity, it has received comparatively little attention. On the other hand, the suggestion that the facts may be explained in terms of variations in the activity of the hydrogen ion seems to have had undue weight attached to it. It is possible that such variations cannot be ignored, but there can be little doubt that the deviations from the simple hydrogen ion theory are mainly due to the circumstance that the observed catalytic effects are not entirely due to the hydrogen ion, but represent the joint action of hydrogen ions, acid anions, and undissociated acid molecules.

If a comparison is made of the catalytic activities of mixtures of a weak acid and its corresponding salts, represented by the formula $cHA + xMA$ (where c is constant and x is variable), it will be found very generally that as x increases the reaction velocity falls, reaches a minimum, and then increases. If the velocity is plotted against p_H , a curve of catenary type is obtained.

The experimental facts are expressed by the equation $v = k_h[H^+] + k_a[A^-] + k_{OH}[OH^-] + k_m[HA] + k_w[H_2O]$ and this, in combination with

$$K = \frac{[H^+][A^-]}{[HA]} \text{ and } K_w = [H^+][OH^-]$$

may be shown to give a catenary curve when v is plotted against pH .

The dimensions of the catenary curve and the position of its minimum (iso-catalytic) point vary with the concentration of the acid. The complete series of catenaries yields a catalytic space model in the form of a catenary surface, by means of which it is possible to represent the catalytic behaviour of all possible mixtures of an acid and its salts.

The catalytic catenary may be given a generalised form, for if the hydrogen ion concentration and the ionic reaction velocity for any acid-salt mixture are expressed in terms of the corresponding quantities which are characteristic of the iso-catalytic mixture with the same acid concentration, the connexion between the reduced ionic velocity (r) and the logarithm of the reduced hydrogen ion concentration (h) is given by

$$r = \cosh h.$$

This equation contains no specific constants, and is therefore independent of the nature and concentration of the catalysing acid, of the temperature of the solvent, and of the nature of the catalysed reaction. It is the equation of the general catenary, and is found to be consistent with known facts.

For a given reaction the catalytic activities of the pure acids are represented by points on the general catenary, the position of these points being determined by the relative magnitudes of the velocity coefficients of the hydrogen ion and the undissociated acid anion.

The considerations underlying the general theory have been applied successfully to the phenomena associated with reaction velocity in isohydric solutions and in buffer solutions, and also to the phenomena of auto-catalysis. Kinetic methods have been described for the determination of ionisation constants, of velocity coefficients which cannot be obtained by direct measurement, and of the degree of dissociation of water. The general results are such as to offer a very comprehensive picture of the catalytic relations involved in acid catalysed reactions, and throw new light on the nature of acids and their relation to the so-called bases.

Dr. E. K. Rideal said that the author had interpreted the velocity curve in terms of four different velocity constants, permitting a certain latitude in adjustment, yet he had so devised his experiments as to justify this course. He asked how far Prof. Dawson had considered the mechanism of the reaction, *e.g.*, in terms of Wieland's conception of hydrogen ion donation and acceptance, H^+ and HA providing hydrogen ions and OH^- and A^- accepting them. This two-stage process would lead to the catenary if the product $[H^+][OH^-]$ was constant. He also asked how far neutral salts such as sodium chloride affected the velocity, *i.e.*, how far hydration is an important factor in these changes.

Prof. H. Bassett remarked that curves correlating the time necessary for the first appearance of sulphur in acidified thiosulphate solutions with the acid concentra-

tion are closely of catenary form. The time-minima were attributed to the opposition of two opposing reactions, the formation of sulphurous acid and sulphur (producing free sulphur) and the formation of polythionates (consuming free sulphur).

Prof. J. C. Philip asked whether the author had considered the relation of his results to modern views on ionic environment.

Prof. H. M. Dawson, replying, said that no attempt had yet been made to apply the results in the direction of elucidating the mechanism of the catalytic process so far as the catalysed reaction itself was concerned. The main object had been to identify the active entities and to correlate their effects. Whilst the effects produced by the addition of chlorides to hydrochloric acid would seem to differ from those produced by the addition of salts to the corresponding weak acids, there was reason to believe that no fundamental difference is involved. The phenomena discussed by the author referred to a specific reaction, and the speaker emphasised that the catenary relation between v and pH is *exact* within the limits of experimental error. The $v - pH$ curve would be catenary in type if the conditions were such that the product of the concentrations of the active ions remains constant. Attempts to interpret the observations in terms of changes in the "activity" of the hydrogen ion had not met with success. The selective nature of the catalytic effect suggested that ionic environment is not a factor of primary importance.

MINING AND METALLURGY IN CANADA

The Rouyn area in Quebec, north of Ottawa, which has been attracting attention, is fast developing into a large mining district. It is anticipated that the Noranda Mines, Ltd. (Horne Mining Company operating subsidiary), will be operating its large smelter in November next. The railway into Rouyn has been completed, and machinery and materials are being transported in large quantity. The report, just issued, shows the ore reserves of the Horne Mine have a gross value of \$25,100,000, on the basis of copper at 13 cents per lb. At the close of 1926 the indicated tonnage is shown at 1,022,425 tons of ore, having a grade of 5.03 gold and 7.51% copper, all above the 300 foot level. These estimates are considered to be conservative. In shaft No. 2 sufficient work has been done to show 53,000 tons, averaging 10.4% zinc, but more diamond drilling remains to be done before the limits of this ore body are determined. Electrical power having been introduced, further development will be pushed forward. The construction of the smelter, buildings and houses is proceeding rapidly. The Hollinger Company is a large holder of the Noranda bonds. The general manager of the Horne Mining Company is Mr. Ernest Hibbert.

The earnings of the Premier Gold Mining Company of British Columbia for 1926 amounted to \$2,211,490, a gain of \$198,000 over the return of last year. The estimate of broken and unbroken ore reserves, down to the fifth level of the present mine workings, is 798,269 tons averaging 0.48 oz. gold and 9.6 oz. silver, having a gross value of \$14.40 a ton, with silver at 50 cents per oz.

OBITUARY

WILLIAM BEAMONT HART, F.I.C.

With the death, on December 29, 1926, of William Beamont Hart, the chemical world of Manchester lost a highly respected member. Born on March 1, 1865, Mr. Hart was educated at Manchester Commercial Schools and at Owens College, where he became Roscoe Scholar in 1885. He gained several successes in the City and Guilds examinations, and was awarded the Silver Medal twice, in 1885 for the examination on alkali manufacture, and in 1886 for that on coal-tar products, for which subject he was awarded the Bronze Medal in 1888. After leaving Owens College he was engaged for some time with the Clayton Aniline Company, but in 1892 established himself in practice as an analytical and consulting chemist. From 1895 to 1900 he visited Constantinople on behalf of the Turkish Government in connexion with the manufacture of sulphuric acid and smokeless powder. For these services he was presented with the Order of the Osmanieh in 1902.

Mr Hart was held in high repute in Manchester as a chemist, and was retained by several firms in an advisory capacity. He took a great interest in the work of the Institute of Chemistry and of the Society of Chemical Industry. He served on the local Committees for several years, and contributed papers to the meetings of the Manchester Section of the Society.

GEORGE SISSON

By the death of George Sisson through a motor accident at the beginning of April the technical chemical world, and especially that of Tyneside, has suffered a severe loss.

Born in Gateshead in 1856, he received his scientific education at the University of Durham College of Physical Science (now Armstrong College) in Newcastle-upon-Tyne, and as a Royal Exhibitioner at the Royal College of Science, Dublin. He went as chemist to the works of the Washington Chemical Co., in the county of Durham, taking part later in the management; here he remained (with an interval of about three years from 1890, when he worked with Messrs. Peter Spence & Sons, Manchester) till 1905. In the early years of this period the Chance-Claus process for the recovery of sulphur from alkali waste was introduced into the works, and later a process for the manufacture of magnesia from sea water was developed, and one for the recovery and liquefaction of the carbon dioxide gas, which was till then a waste product of the magnesia process.

On leaving the Washington Chemical Co., he practised for a few years as consulting technical chemist, and then accepted a position as technical adviser to, and later as managing director of, the Blaydon Manure and Alkali Works, which he occupied till his death, and in which position he entirely reorganised the works.

He was always fond of natural history, and did much work in research with Professor Meek at the Marine Biological Laboratory of Armstrong College at Cullercoats. He was for many years a member of the Society of Chemical Industry, and read before the Newcastle Section, with his brother, Mr. Harry Sisson, an important paper on liquefied carbon dioxide.

He was an accomplished chemist, independent in his thought, and sound in his judgments; and he had an almost instinctive sense of the industrial possibilities (or lack of possibilities) of a laboratory reaction. In his technical advice he was always "safe," yet he had an open and unprejudiced attitude of mind towards new ideas and suggested processes. He was a man of strong common sense and always helpful.

His personal qualities endeared him to all with whom he came into contact. His demeanour, natural and unassuming, his equable disposition, a certain serenity, that was suggested in his leisurely speech, his sense of humour and enjoyment of paradox, and his unfailing kindness, made him the most approachable of men, and drew esteem and regard from even slight acquaintances; and those who were privileged to enjoy his intimate friendship, and had revealed to them his simple, just, and upright character, of which those qualities were the natural outcome, can only mourn the loss of his sunny personality, "Whose coming was as light and music are, 'mid dissonance and gloom," and cherish the memory of it among their most precious possessions.

J. T. DUNN

PERSONAL AND OTHER ITEMS

On the occasion of the visit of Monsieur Doumergue, the President of the French Republic, to the Institut Français du Royaume Uni, he presented the decoration of Officier de la Légion d'Honneur to Mr. Emile Mond, who is a member of council of the Institut.

Emeritus Professor A. G. Perkin will receive the honorary degree of D.Sc. from the University of Leeds in July.

Mr. C. A. Klein has been elected President and Prof. T. M. Lowry, Dr. H. H. Morgan, and Messrs. W. S. Morris and T. M. Tyson have been elected Vice-Presidents of the Oil and Colour Chemists' Association for the session 1927-28.

Mr. Sidney S. Napper, who has been a director of British Visada, Ltd., since the beginning of the year, and consultant chemist to the firm, has been appointed managing director. Mr. Napper was works and chief research chemist to Courtaulds, Ltd., for 18 years.

Mr. Christopher Dalley and Mr. Richard R. Tweed, the technical directors of the British Controlled Oilfields Company, have been appointed joint general managers for a term of years. Mr. G. W. Halse has joined the geological staff.

Prof. C. A. Edwards, professor of metallurgy and acting principal of the University College of Swansea, has been appointed Principal of the College in succession to Dr. Sibly. Prof. Edwards will continue to act as professor of metallurgy, and will supervise the work of honours students and direct research in the department.

Dr. W. E. Garner has resigned from the University Readership in Physical Chemistry tenable at University College, London.

Amongst the 20 Fellowships tenable in American Universities awarded by the Commonwealth Fund Fellowships, Mr. R. Robinson, of Birmingham University,

has been appointed to a Fellowship in physical chemistry at the University of Pennsylvania.

A national research fellowship (U.S.A.) has been awarded to Dr. J. Allen Harris, Assistant Professor of Chemistry, University of British Columbia, and co-discoverer of illium with Dr. E. S. Hopkins. He will take up post-graduate studies at the Sorbonne, Paris, and University of Upsala.

The Plummer gold medal for 1926 has been awarded by the Engineering Institute of Canada to Deau C. J. Mackenzie (engineering) and Prof. T. Thorvaldson (chemistry), of Saskatchewan University, for researches upon the prevention of the deterioration of concrete arising from the presence of alkaline-earth salts in certain soils of the Canadian Western provinces.

We regret to announce the death, at the age of 72, of Mr. Frank Lloyd, head of the important paper-making firm of Edward Lloyd, Ltd.

Imperial Chemical Industries, Ltd., and Cassel Cyanide Co., Ltd.

It is announced that an offer has been made by Imperial Chemical Industries, Ltd., to acquire the shares of Cassel Cyanide Co., Ltd., and that the directors of the latter company recommend acceptance by their shareholders. Particulars are given in Company News on page 496.

Low-Temperature Carbonisation

It is understood that International Combustion, Ltd., and Imperial Chemical Industries, Ltd., have come to a working arrangement, mainly designed for the development of low-temperature carbonisation in Great Britain. Two large plants are to be erected, one utilising the McEwen Runge process and the other the Kohlen-scheidung process, which has been worked for some years in Germany.

Research on the Treatment of Coal

Speaking recently at the House of Commons, Dr. G. C. Clayton, M.P., a director of Imperial Chemical Industries, Ltd., and a member of the Advisory Council of the Department of Scientific and Industrial Research and of the Fuel Research Board, said that the Bergius plant at the Fuel Research Station was dealing with a ton of coal a day, and was giving very good results. There was a danger some time ago that the British Empire rights of the Bergius process might be lost to this country, but the Department advised the Government to get some control over this patent, and an option on a considerable amount of the interest in the British rights of the Bergius process had now been acquired by Imperial Chemical Industries, Ltd. The Bergius process had been developed up to a large experimental scale only, but a modification of the Bergius process had been worked out by the Interessens Gemeinschaft, who had got at work now a full large-scale plant, with an output of, roughly, 100,000 tons per annum of coal oil. The plant was now working, and he understood from members of Imperial Chemical Industries, Ltd., who paid a visit there a short time ago, that it was working extraordinarily well, and was going to be a commercial success.

Dealing with the present position of low-temperature carbonisation at the station, Dr. Clayton said that a

short time ago Sir David Milne-Watson, Governor of the Gas Light and Coke Company, was asked to investigate the low-temperature carbonisation processes that were in existence. Sir David was asked to see whether there was any process his company could take up as a commercial proposition, with or without Government assistance. After full investigation, he decided that the most suitable plant for adoption by his company to work, in conjunction with the ordinary gas process, was the plant designed by the members of the Fuel Research Board staff. That showed that the Fuel Research Board staff were deserving of very great praise for the work they had done. The Gas Light & Coke Company stated that, while they thought that that was the best process, they did not consider that they were justified as a company in bearing the entire cost of long experiment on this process, but offered a site for a plant to deal with 100 tons daily, to erect the plant, run it for three years and carry out investigations, if the Government would pay the cost of providing and erecting the plant. It has now been agreed by the Government and Sir D. Milne-Watson that the Gas Light & Coke Company shall form a subsidiary, the Fuel Production Co., Ltd., with capital guaranteed under the Trade Facilities Act, to carry out the proposal. The Gas Light & Coke Company will manage the new company and bear all costs, and will have the option of taking over the plant at the end of 1930. The scheme will, it is expected, be in operation next winter.

The Patent Office in 1926

The 44th report of the Comptroller-General of Patents, Designs, and Trade Marks for the year 1926 (H.M. Stationery Office, 4d.) states that the total number of applications for the year was 33,080, an increase of 77 on the number received in 1925. The complete specifications filed numbered 19,948, or 514 more than in 1925. Excluding the year 1920, when there was a post-war rush of applications, the number of complete specifications filed last year was the highest on record. The applications received from women inventors numbered 537, as compared with 608 in 1925. The applications made from abroad numbered 1390, as compared with 1547 in 1925. The receipts from patents fees were £398,391, from designs fees £10,834, and from trade marks fees £51,117, as compared with £391,677, £11,213, and £46,960 respectively for 1925. The total receipts were £488,152, as compared with £476,044 in 1925, an increase of £12,108. On the expenditure side, salaries amounted to £254,691, as against £254,952 in 1925. The surplus of receipts over expenditure was £98,813.

The Bulletin of the Imperial Institute

It has been decided to discontinue the publication of the Mineral Resources Section of the Bulletin of the Imperial Institute in the form in which it appeared during 1926. This course was adopted in consideration of the time required in preparing it and the pressing need for continuing the separate publication of monographs on specific subjects. In future, articles on minerals will appear only when there is some subject of outstanding importance to be dealt with. The publication of monthly statistics relating to minerals and metals will be discontinued, but can still be obtained by enquirers.

Applications for information on the mineral and metal industries will be attended to as heretofore.

An International Competition

The Fondazione per l'Incremento Culturale ed Economico della Sicilia announces that the following prizes are open for international competition: (1) The Stanislao Cannizzaro prize of 20,000 lire for an unpublished thesis on "The production of cellulose from Sicilian raw materials." (2) The Emanuele Paternò prize of 20,000 lire for an unpublished thesis on "The complete utilisation of the lemon." (3) Three prizes of 5000 l., 3000 l., and 2000 l., respectively, for theses on a subject related closely to the progress of chemical industries in Sicily. The competing theses must be sent in duplicate by registered post before the last day of February, 1929, to the "Fondazione per l'Incremento Culturale ed Economico della Sicilia," presso la Direzione Generale del Banco di Sicilia, Palermo. Further information can be obtained on applying to this address or to the

Associazione Italiana di Chimica Generale ed Applicata," Rome (101), via IV Novembre, 154, Italy.

Helium in Canada

Helium possesses many remarkable properties which may make it a very valuable industrial gas. It is an ideal gas for filling balloons and airships, for although it has 10% less buoyancy than hydrogen, it has the great advantage of being non-inflammable. An application of helium that promises to become of great value is its use in making up artificial atmospheres to supply to divers and caisson workers. An investigation, still in progress, by the U.S. Bureau of Mines has shown that there are great possibilities along these lines, and that such artificial oxygen-helium "airs" may permit of greater depths being attained and longer periods being spent under water by divers, and the prevention of caisson disease among tunnel and caisson workers. Suggestions for other industrial uses have been put forward, but outside of the United States no commercial supplies have yet been available, and there have been no opportunities for investigation and experiment.

From 1922 to 1926 the Mines Branch of the Dominion Department of Mines, as part of a survey of the natural gas resources of Canada, made a special study of the helium content of the gases, and a thorough examination was made of all possible sources of this element. It was found that the gas from three small wells at Inglewood, Ontario, contained as high a percentage of helium as that treated in the United States Government plant at Fort Worth, Texas. The Ontario Government has since taken up many of the leases in this neighbourhood, and it is anticipated that the National Research Council may establish an experimental helium extraction plant, if it be proved that sufficient gas is available. A few wells in other fields in Ontario, particularly in Norfolk county, yield gas carrying 0.5% helium. Natural gas in Alberta, where much larger quantities are available than in Ontario, was found to contain little or no helium, with the exception of that from the Bow Island and Foremost fields. If natural gas, containing as little as 0.2% helium, could be economically processed to extract helium, it is calculated that about 5 million

cub. ft. could be obtained in Canada annually (up to the end of 1926 over 25 million cub. ft. had been extracted by the U.S. Government). Canada is the only present known source of helium in the British Empire. The results of this investigation are described in a report, "Helium in Canada," by Dr. R. T. Elworthy, recently issued by the Mines Branch. It contains a brief account of the particulars and occurrences of helium, the methods employed in the work, particulars of the gas fields, including analyses of many gases, the methods and apparatus for recovering helium, and notes on its uses. Copies may be obtained on application to the Director, Mines Branch, Department of Mines, Ottawa, Canada.

Production of Asbestos in Quebec

Quebec is still the world's greatest producer of asbestos. Of the world's production of 340,000 tons in 1926, about 266,000 tons were produced in Quebec.

International Foundry Exhibition

An International Foundry Exhibition, organised by the Syndicat Général des Fondateurs de France, will be held in Paris in September. There will be three main groups of exhibits: raw materials, manufactured products, foundry materials and tools; and there will be sections for technical education and organisation within the foundry trade.

Output of Coal-Tar Dyes in the U.S.A.

The U.S. Tariff Commission Census shows further progress in the United States in the production of coal-tar dyes and chemicals, although the output of dyes in 1926 was still 5,000,000 lb. below the record reached in 1923. Sales of home-produced dyes in 1926 totalled 98% of the production volume. Exports remained the same as for 1925, and imports amounted to 5% of domestic production. In spite of increased production values fell, and there was a decline of 3% in total values of sales, the unit fall being from 46.6 cents a pound in 1925 to 42 cents in 1926. There was a still larger drop in the export trade, owing to competition with European manufacturers. In the last five years the total fall has been something like 50%, and in China and other countries of the East, American manufacturers make little or no profit. Of the total domestic output of finished coal-tar products, synthetic dyes constituted about 72%, and colour lakes, synthetic tanning materials, and phenol-formaldehyde resins made up about 20% of the total of 123,000,000 lb. In 1926 sales were 120,000,000 lb., worth about \$60,000,000. Outputs included 44,000 t. of synthetic dyes; 6000 t. of colour-lakes; 7000 t. of synthetic tanstuffs and resins; 900 t. of acetylsalicylic acid (aspirin); and 1200 t. of methyl salicylate (oil of wintergreen). The output of synthetic chemicals not of coal-tar origin was 105,000,000 lb., including 21,830 t. of ethyl acetate 15,975 t. of formaldehyde, 9500 t. of carbon tetrachloride, and 4600 t. of butyl acetate.

Synthetic Methanol in the United States

Lazote, Inc., a subsidiary of the du Pont Co., is now manufacturing synthetic methanol on a commercial scale at Belle, W. Va., in conjunction with the firm's synthetic ammonia plant.

REVIEWS

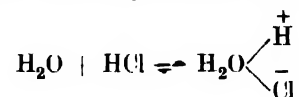
ESSAYS ON THE ART AND PRINCIPLES OF CHEMISTRY, INCLUDING THE FIRST MESSEL MEMORIAL LECTURE. By Prof. H. E. ARMSTRONG, F.R.S. Pp. xxxi + 276. London: Ernest Benn, Ltd. 1927. Price 15s.

Professor Armstrong's collection of "Essays on the Art and Principles of Chemistry" is in the main a reprint in book form of an article contributed to the 13th edition of the "Encyclopædia Britannica," and published in September, 1926. This, with an introduction describing the main features of the articles contributed to the ninth edition in 1876, to the tenth edition in 1902, and to the twelfth edition in 1922, occupies almost exactly one-half of the present volume. The other half contains two essays entitled "A Dream of Fair Hydron" and "The Thirst of Salted Water," published in 1909, an essay on "The Corrosion of Iron and other Metals" (1911), the first "Messel Memorial Lecture—Rhapsodies culled from the Thionic Epos" (1922), and two short papers on "The Origin of Osmotic Effects" and on "Electrolytic Conduction," reprinted from the Proceedings of the Royal Society (1923).

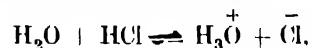
Since these reprinted essays are already familiar to readers of this JOURNAL, to which the Messel Memorial Lecture was first contributed, attention may be directed principally to the article in which the author, after a lapse of 50 years, again gives a review of the "Art and Principles of Chemistry," as it should be presented to the "man in the street," when he decides that it is time to spend an evening in discovering what chemistry is all about, and for this purpose takes down from its shelf the appropriate volume of the Encyclopædia. The task of condensing, for such a purpose, the theory and practice of chemistry into the narrow span of 120 pages is so formidable that we must all be curious to know how it has been tackled by the *doyen* of our science. The early steps are taken most ingeniously—fire, limestone, lime, "calcite gas" and oxygen, lead in a simple and direct way to quantitative data, based upon the standard $\text{CaCO}_3 = 100$, which needs no revision in order to convert it into the more familiar 0—16 scale, since the elements in question all obey the "whole number" rule within very narrow limits. The densities of the relevant gases are then used to lead up to Avogadro's hypothesis, and to the familiar atomic and molecular symbols, so that the classification of the elements on the basis of their atomic numbers and atomic weights is already reached within the first 25 pages. The next 35 pages are occupied with the physico-chemical problems of electrolysis, chemical change, catalysis, osmotic pressure and acidity, leaving almost exactly one-half of the available space for the problems of organic chemistry. The author has, however, been able in these remaining pages to discuss such diverse problems as the correlation of function and structure, stereochemistry old and new, oxidation and reduction, unsaturation, phenoid carbon, and colour, and then passes on to deal with plant activities, such as the fixation of carbon with the help of chlorophyll, the formation of carbohydrates, enzyme action, optical activity and

geometric structure of the sugars, constructive metabolism, proteins, the colloid nature of natural products and the problems presented by their dissolution. Whilst, therefore, the earlier part of the essay is remarkable for the ingenuity of its logical sequence, the latter part has the pleasing generality which made Schorlemmer's "Rise and Development of Organic Chemistry" such a delightful and valuable book to read.

In such a general review of the science of chemistry there is ample opportunity, but very little space, for controversy. Of special interest are the paragraphs which deal with Arrhenius' theory of electrolytic dissociation. The author's final conclusion, that hydrogen chloride is divisible under the influence of hydron, and is "distributed" according to some such scheme as



resembles so closely the current view, which represents the product as an ionised oxonium salt



that controversy can only arise as to the degree of freedom of the negative chloride radical in the product: but the further supposition, that the converse product $\text{HCl} \begin{array}{c} \text{H} \\ \diagup \\ \text{OH} \end{array}$ must also be present before electrolysis can occur, has no parallel in current theory.

The views summarised in the principal essay are set out in fuller detail in the essays which occupy the remainder of the volume. The last short essay, however, touches new ground in a discussion of Tubandt's observations on the electrolysis of solid crystalline silver iodide and lead chloride. In the former case there is a quantitative transference of *silver* between a silver anode and a platinum kathode, but no migration of the halogen; in the latter case, when a cylinder of silver iodide was interposed between the lead chloride and the silver anode, there was a quantitative transference of *chlorine* to the anode, but no migration of the metal. The validity of the explanations given of this opposite behaviour of the two solid salts may be open to dispute, but it is very fitting that so stimulating a book should conclude with an appeal to such arresting and unfamiliar facts.

STANISLAO CANNIZZARO: SCRITTI VARI E LETTERE INEDITE NEL CENTENARIO DELLA NASCITA. Pp. vii + 486. Published by the Associazione Italiana di Chimica Generale ed Applicata, Rome, 1926. Price 150 lire.

Last year the "Associazione Italiana di Chimica Generale ed Applicata" celebrated the centenary of the birth of Cannizzaro at Palermo. In addition to the ceremonies in which Italian chemists paid homage to their great compatriot, it was decided to publish a volume, not one containing the scientific papers of Cannizzaro—which are available in the "Nuovo Cimento" and the "Gazzetta"—but one in which his varied

activities as citizen, politician, scientist and teacher could be set forth by authoritative writers.

This has been done and the "Associazione" has published a handsome illustrated volume, which presents a detailed and fascinating picture of this many-sided man of science. Professor Paternò describes his qualities as a man; Prof. Giacosa discusses his contribution to physiological chemistry; his work in organic chemistry is dealt with by Prof. Bargellini; Prof. Parravano summarises the evolution of the atomic theory in relation to Cannizzaro's work, which is also discussed in a letter from Marcelin Berthelot, with comments by Prof. Nasini, who writes, in addition, on Cannizzaro and the theory of valency; Prof. Villavecchia shows his influence on the development of the Customs Laboratories; and Prof. Provenzani writes on the Italian school of chemistry. Then follows a series of unpublished letters from Baeuer, Beilstein, Berthelot, Frankland, Friedel, Kopp, Landolt, Leblanc, Liebig, Ludwig Mond, Ostwald, Ramsay, Kelvin, T. E. Thorpe, Wurtz, and various other well-known men of science. These varied contributions not only give a most attractive picture of the man, but enable the reader to recreate the atmosphere of the times in which he moved. The volume is a worthy tribute to the memory of Cannizzaro, and would grace the shelves of any chemist who cares for the history of his science.

PRACTICAL PHOTOMICROGRAPHY. By J. E. BARNARD, F.R.S., and F. V. WELCH. Second edition. Pp. xii + 316. London: E. Arnold & Co., 1925. Price 18s.

"Barnard" has long proved a strong arm to help the beginner in photomicrography and this new edition will be sure of a welcome. The authors observe that radical revision has not been necessary, as, though 14 years have elapsed since the book was first published, "microscopy has no outstanding advance to its credit, either on the optical or mechanical side." Attention is, therefore, mainly concentrated on method. Apparatus, of course, is fully described, and enough detail about optical equipment, sources of illumination, cameras, plates, etc. is given to guide the veriest beginner to success. Indeed, the whole book is remarkable for its attention to those practical details which make for successful photomicrography, and, if any criticism were to be made, it might be that there is too much detail. Thus, in such a book one does not require a description of the manufacture of calcium carbide; the wiring-up of arc lamps is best left to persons accustomed to the work; whilst the utility of including instructions for photographic development and after treatments may be doubted. No mention could be found of desensitisation, though the use of panchromatic plates is discussed. These are but minor points, however, for the book is not only a thoroughly safe guide for the beginner, but can be read with profit by the experienced worker. Photomicrography by ultra-violet light is treated shortly in a chapter on special processes (including the photomicrography of metallic and other opaque objects), as the authors intend to publish a book on that subject. The book is well produced and provided with excellent illustrations.

PARLIAMENTARY NEWS

Iraq (Oil)

In reply to various questions, Mr. Amery said that the only part of Iraq in which oil was at present being worked was in the area near the Persian frontier known as the Transferred Territories. The production was not at present large, though there were no actual figures. The Turkish Petroleum Company was the only concern searching for oil in Mesopotamia as far as he was aware. He could not say off-hand what amount of the capital of this company was British, but a certain proportion was held by the Anglo-Persian Oil Company, which was a British firm, and another portion, he thought 20%, was held by the Shell Company, which was 40% British. May 16.

Fuel Research

In reply to Mr. Tinker, the Duchess of Atholl said that the amount of coal treated at the Fuel Research Station, East Greenwich, during 1925 was 3314 tons. A considerable portion of the products from the coal carbonised was used at the Fuel Research Station. The value of the untreated gas and tar surplus to the requirements of the station and sold to the South Metropolitan Gas Company amounted to: gas £1249, and tar £318. In addition, £250 was received from sale of coke, the balance of gas and coke being used for other experimental work and for power production. The coal-washing plant, as with other large-scale plant at the station, was intended for investigations of general interest, and the coal required was usually purchased. Special investigations might be carried out for interested parties when the plant was available. In such cases the coal would be provided free, and a fee might be charged in addition, depending on whether the results were of general interest, and available for publication, or of restricted interest only.

The crude oil and spirit obtained from one ton of a suitable coal treated by the Bergius method amounted to from 110 to 135 gals. In addition, a further unknown amount of coal was necessary for power and hydrogen production. The highest yields of dry tar and spirit observed by the Fuel Research Board, as obtained from low-temperature carbonisation of ordinary coal in a large-scale plant, was about 21 gals., but average bituminous coal would probably not yield more than about 15 gals. Good quality cannel coal, of which there was a limited supply only, might yield 50 to 60 gals.—May 17.

Carbonisation (Statistics)

Colonel Lane-Fox informed Mr. Lunn that in 1925 approximately 30,200,000 tons of coal were used for high-temperature carbonisation and 20,000 tons for low-temperature carbonisation. May 17.

Zinc Concentrates Contract

In a written answer to Sir J. Power, Sir P. Cunliffe-Lister stated that the financial results of the zinc concentrates contract for the year ended March 31, 1927, could not, at present, be stated. A loss was anticipated of between £500,000 and £600,000 in the accounts for both the past and the current financial year.—May 17.

Ethyl Alcohol (Excise Duty)

Mr. McNeill informed Lieut.-Colonel Heneage that an investigation into the subject of substitutes for ethyl

alcohol had been made by the departments concerned, and as a result the following conclusions had been reached:—(1) Purified methyl alcohol will remain within the scope of the spirit duty. But no duty will be payable so far as it is used for industrial purposes, and the official supervision of manufacture and duty-free use will be reduced to the minimum consistent with the safety of the Revenue. Moreover, provision has been made in Clause 14 (1) of the Finance Bill for the extension to methyl alcohol of an appropriate Excise allowance on the lines of that now payable on ethyl alcohol manufactured in this country and used duty-free for industrial purposes, in order to compensate for the expense involved in conforming to Excise restrictions on manufacture; (2) as at present advised, it is not proposed to bring any other substance which may be used as a substitute for ethyl alcohol within the scope of the spirit duty. It is, however, proposed in Clause 15 of the Finance Bill to take power to collect information as to the importation, manufacture, distribution and use of the higher alcohols, and to require manufacturers of these substances to register with the Customs and Excise Department. May 19.

COMPANY NEWS

IMPERIAL CHEMICAL INDUSTRIES, LTD., AND CASSEL CYANIDE CO., LTD.

An offer has been made by Imperial Chemical Industries, Ltd., to acquire the shares of the Cassel Cyanide Co., the offer being conditional upon its acceptance by the holders of not less than 75% of the shares. The directors of Cassel Cyanide recommend shareholders to accept. Cassel Cyanide Co. is an old-established and prosperous Glasgow company, which was registered in 1883 as the Cassel Gold Extracting Company to acquire certain patent rights of Mr. H. R. Cassel for an improved method of extracting gold from ores. The company changed its title in 1906, and confined its business to the manufacture of cyanide. The directors are Col. Sir Ed. A. Brotherton, Bart., LL.D. (chairman), A. Moore, C.A., J. A. Spens, LL.D., Wm. Neill (managing), H. N. Beilby, T. Ewan, M.Sc., Ph.D., F.I.C., J. L. Deuchar, B.A., LL.D.

W. J. BUSH AND CO., LTD.

The thirtieth annual general meeting was held on May 23. Mr. J. M. Bush (chairman and managing director) presiding. In view of the unsettled industrial conditions which prevailed during the past year, the results shown by the accounts were regarded as satisfactory. The high price of fuel enhanced materially the cost of the fine chemicals manufactured by the company, at a time when foreign competition was becoming increasingly severe. But against this the company had the benefit of more economic production through the use of its remodelled plant. The outlook indicated that foreign competition in fine chemicals would continue, and that profits in this field of work were not likely to be commensurate with the knowledge and skill required. But the manufacture of fine chemicals was only one section of the company's business. Its main foundation was based on the manufacture of flavouring essences and the distillation of and trading in essential oils, and in this direction an upward tendency in sales was shown, notwithstanding the decline in

turnover in some foreign markets. The subsidiary companies in New York and Montreal showed substantial profits. The net profit of the company for 1926 was £57,880, which with £53,544 brought forward, makes an available balance of £111,424. A final dividend of 7% was declared on the ordinary shares, making 10% for the year, absorbing £25,000; general reserve received £20,000, and £60,174 was carried forward.

CHLORIDE ELECTRICAL STORAGE CO.

A dividend has been declared of 5%, making 10% for 1926, together with a bonus of 2s. per share, both tax-free.

DUNLOP RUBBER CO., LTD.

The twenty-eighth ordinary general meeting, held on April 12, was presided over by the chairman, the Right Hon. Sir Eric Geddes, G.C.B., G.B.E. The fact that the company was able to show such highly satisfactory results, and was able to increase its dividend from 15% to 20%, in spite of the difficulties of the year, served as proof that its prospects were brighter than they had even been. The company had to be both progressive and highly efficient to meet competition with a product in which raw material representing 60% of its total cost was subject to violent fluctuations in value. In addition to sharing with other industries the havoc caused by the disturbances of 1926, the company had had to face a 29% drop in the average value of the main raw material, necessitating drastic writing down of its stocks. In addition, 1926 had been the worst tyre-buying year in the recent history of the automobile industry, but during the first three months of the current year sales have beaten all previous records. The Tire and Rubber Corporation of America, in which the company had a large investment, made a small profit on its operations after providing for full depreciation, and was considered to be making satisfactory progress. During 1926 the estates had supplied 80% rubber in excess of their output of the previous year, and very far in excess of the output of any group of estates in the British Empire. Referring to the Anode patents, these involved the electric deposition of rubber upon moulds by electrolysis, and were due to Dr. P. Klein. The licences to manufacture under these patents were offered to the company some time ago, and a small experimental plant had been installed, and the company was fully confirmed in its views as to their probable value and further development. It decided to acquire, in addition to the licence, an interest in the patents themselves, and a substantial interest had also been obtained in the Hungarian Rubber Company, which controls the patents outside the U.S.A.

AMERICAN CELLULOSE AND CHEMICAL MANUFACTURING CO.

A large increase in earnings is shown by the report for 1926, the net working profit being \$1,458,517, compared with \$305,360 for 1925. The directors have authorised the issue of 55,000 shares 7% cumulative first participating preferred and 13,750 shares of common stock in 13,750 blocks (each consisting of four shares of preferred and one share of common stock). These are to be offered to the common shareholders for subscription at \$450 for each block. This issue is to provide funds for the doubling of the company's factory, in order to supply the increasing demand for its products.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d. 2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate. 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic, Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Cerium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithophone, 30%.—£22 10s. per ton.
 Mmral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey. £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d. 4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals.—8½d.—9d. per lb. Crude 60's, 2s. 4d. 2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. Steady. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%. 2s.—2s. 2d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d. 3d. per unit, 40%—3d. per unit: Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons, Pure, 1s. 8d.—2s. 3d. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 9d.—2s. 0½d. per gal. Pure, 1s. 10d.—2s. 3½d. per gal.
 Xylol. 1s. 11d.—2s. 4d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24°.—10½d. per gal. Standard specification, 6½d. 9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naptha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/160, 1s. 10d. 1s. 11d. per gal. Solvent 95/160, 1s. 6d.—1s. 7d. per gal. Solvent 90/190, 1s. 1½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Quiet. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—70s.—80s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol (disulpho (1.8.2.4.))—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7d. per lb., naked at works.
 Aniline Salts.—7d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline. 2s. 3d. per lb.
 Dimethylaniline. 1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene. 48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine. 3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 3d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d.—8d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xyldine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4½d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 3d. per oz.; 500 oz. lots.—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%. Advancing.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic. B.P. 1s. 3½d.—1s. 5d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%. Firm market.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d. 3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium.—1s. 10d.—2s. per lb. Sodium.—2s. 1d.—2s. 2d. per lb. All spot.
 Calcium Lactate.—1s. 4d.—1s. 5d. per lb.
 Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 11½d., per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacum Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green. 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—22s. per cwt., 112 lb. lots.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%, in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 3d. per lb. net. Synthetic, 11s.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb.; Detached cryst., 14s. 6d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonate.—11s. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin. 3s. per lb.
 Phenazone.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferriyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s. per lb. spot.
 Saccharin.—55s. per lb. Very limited inquiry.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C. 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—7s. 6d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—11s.—12s. per lb., according to quantity.
 Natural.—13s. 6d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
 Aubepine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 3d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. 6d. per lb.
 Citronellol.—14s. 6d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—10s. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol.—9s. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol. 6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb. (*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb. (*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. 6d. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—9s. 9d. per lb.
 Rhodinol.—30s. per lb. Saffrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanilin.—17s.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—14s. 9d. per lb.
 Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%. 8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 1d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—8s. 9d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 15s. 6d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The Complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than July 18th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on June 2nd. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

Applications

Arnold (Standard Development Co.). Lubricants. 12,473. May 9.
 Bacher. Heat-exchange apparatus. 12,438. May 9. Austria, 7.5.26.)

Buttner-Werke, and Kleinmann. Decolorising agents. 13,023. May 14.

Crowe. Grinding and separating apparatus. 12,702. May 11.

Neill. Crushing etc. machines. 12,779. May 12.

I.—Complete Specifications

7794 (1926). Alliot, Hatfield, and Achille Serre, Ltd. Filtration. (270,461.)

8201 (1926). Torrance. Grinding mills. (270,465.)

14,035 (1926). Marston. Rotary drying apparatus. (270,503.)

16,903 (1926). Carborundum Co., Ltd. (Johnson). Kilns. (270,520.)

29,997 (1926). Ultra-Filtre. Purification, decoloration, and deodorisation of liquids and solutions. (262,131.)

30,978 (1926). Grimason, and Keesbey-Mattison, Ltd. Heat-retaining coverings or lagging. (270,589.)

5146 (1927). Haddan (Oliver Continuous Filter Co.). Pulp thickeners or filters. (270,616.)

*11,871 (1927). Power Specialty Co. Fractionating tower. (270,720.)

*12,438 (1927). Bacher. Heat-exchange apparatus. (270,759.)

II.—Applications

Akt. Separator, and Steward. 12,789. See III.

Bunge and Pistorius. Splitting coal into its constituents. 12,919. May 13. (Ger., 8.9.26.)

Cross. Making motor fuel. 12,773. May 12. (U.S., 28.6.26.)

I.-G. Farbenind. Transforming hydrocarbons. 12,402. May 9. (Ger., 20.5.26.) Production of hydrocarbons.

12,403. May 9. (Ger., 22.5.26.) Extraction of carbon dioxide from gaseous mixtures. 12,404. May 9. (Ger., 28.5.26.)

Production of valuable liquid etc. from coal etc. 12,680—5. May 11. Production of hydrocarbons from natural oils etc. 12,777—8. May 12.

Mathys (Tar and Petroleum Process Co.). Coke ovens. 12,642. May 11.

N.V. Silica en Ovenbouw Mij. Coke ovens. 12,461. May 9. (Ger., 8.5.26.)

Rhenania-Kunheim Ver. Chem. Fabr. Apparatus for roasting gas-purifying substances. 12,771. May 12. (Ger., 25.5.26.)

Simon Extracting Machine Syndicate, Ltd., and Simon. Apparatus for refining oils. 12,653. May 11.

Still. Coke ovens. 12,795. May 12.

Whitfield. Production of gas from solid fuel. 12,354. May 8.

II.—Complete Specifications

4122 (1926). Patent Retorts, Ltd., and Davidson. Gas generators. (270,429.)

4323 (1926). Katz. Apparatus for quantitative determination of gases. (249,088.)

14,181 (1926). Threlfall. Manufacture of activated carbon. (270,505.)

23,416 (1926). Geipert. Distilling small samples of coal. (267,082.)

*21,749 (1926). Standard Development Co. Treating sulphur-containing oils. (270,626.)

*9282 (1927). American Hydrocarbon Co., Inc. Apparatus for extracting vaporisable matter from fragmentary solid materials and the like. (270,662.)

*11,569 (1927). I.-G. Farbenind. Conversion of coal materials into valuable liquid products. (270,698.)

*11,656—7 (1927). I.-G. Farbenind. Pulverulent fuel for internal-combustion engines. (270,702—3.)

*11,658 (1927). I.-G. Farbenind. Conversion of hydrocarbons of high boiling-point into others of lower boiling-point. (270,704.)

*11,650 (1927). I.-G. Farbenind. Manufacture of hydrocarbons. (270,705.)

*12,401 (1927). N.V. Silica en Ovenbouw Mij. Coke ovens. (270,765.)

III.—Application

Akt. Separator, and Steward. Dehydration of water-gas tar emulsions. 12,789. May 12.

IV.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of derivatives etc. of anthraquinone. 12,808. May 12. Manufacture of vat dyestuffs. 12,809 and 13,024. May 12 and 14.

I.-G. Farbenind. Production of azo dyestuffs. 12,668. May 11. (Ger., 11.5.26.)

IV.—Complete Specifications

4096 (1926). British Dyestuffs Corp., Baddiley, and Hill. Azo-dyestuffs and process of dyeing acetyl cellulose. (270,428.)

5288 (1926). British Dyestuffs Corp., Baddiley, Chorley, and Brightman. Manufacture of new azo dyes and process of dyeing. (270,446.)

32,840 (1926). I.-G. Farbenind. Manufacture of alkyl-naphthalenes chlorinated in the nucleus. (263,844.)

*12,294 (1927). I.-G. Farbenind. See XIII.

V.—Applications

Bleachers Association, Ltd., Barrett, Kershaw, Sutton, and Whitelegg. Treatment of cellulosic materials. 12,345—8. May 9.

Dreaper. Artificial silk etc. 12,591. May 11. Manufacture of cellulose esters. 12,713. May 12.

Inray (I.-G. Farbenind.). Manufacture of mixed acid esters of cellulose. 12,794. May 12.

Nobel's Explosives Co., Ltd., and Traill. Manufacture of cellulose compounds. 12,664. May 11.

Nobel's Explosives Co., Ltd., Traill, and Wilson. Cellulose compounds. 13,022. May 11.

V.—Complete Specifications

27,721 (1925). Clavel. Treatment of cellulose ester materials. (252,661.)

2439 (1926). Heberlein. Treatment of cellulosic material (270,375.)

7061 (1926). Scholz. Manufacturing cuprammonium silk threads. (249,845.)

8917 (1926). I.-G. Farbenind. Preparing hair for felting. (250,575.)

*8170 (1927). Soc. Chim. Usines du Rhône. Continuous manufacture of cellulose acetate. (270,656.)

VI.—Applications

Böhm. Dyeing-apparatus. 12,437. May 9. (Austria, 7.5.26.)

Chem. Fabr. vorm. Sandoz. Preparation of effect threads. 12,822. May 12. (Ger., 13.10.26.)

Sindl. Apparatus for wet treatment of textile fibres etc. 12,646. May 11. (Ger., 7.2.27.)

VI.—Complete Specifications

3558 (1926). I.-G. Farbenind. Dyeing mixed textile goods. (247,224.)

4096 (1926). British Dyestuffs Corp., Baddiley, and Hill. See IV.

5091 (1926). I.-G. Farbenind. Reserving animal fibres. (248,007.)

5288 (1926). British Dyestuffs Corp., Baddiley, Chorley, and Brightman. See IV.

*32,851 (1926). Kritchewsky and Prutsman. Chemicals for colouring fabrics. (270,637.)

*8270 (1927). Soc. Anon. Etabl. Petitdidier. Colour-printing on fabrics having a foundation of silk or wool. (270,657.)

*12,437 (1927). Böhm. Dyeing apparatus. (270,758.)

VII.—Applications

Fairlie, and Fairlie & Co., Ltd. Manufacture of chromates of potash etc. 12,783. May 12.

I.-G. Farbenind. 12,404. See II. Production of chromates. 12,772. May 12. (Ger., 1.7.26.)

Titan Co. Akt. Manufacture of titanium compounds. 12,656. May 11. (Norway, 12.5.26.)

VII.—Complete Specifications

3565 (1926). Uhde. Synthetically producing ammonia. (247,225.)

10,451 (1926). Harnist. Manufacture of ammonium sulphate and bisulphate and of sulphur. (250,990.)

24,214 (1926). Uhde. Synthetic production of ammonia. (259,230.)

24,609 (1926). Falco. Manufacture of baryum salts free from sulphur. (270,559.)

30,568 (1926). I.-G. Farbenind. Manufacture of phosphorous acids and hydrogen. (262,447.)

*8894 (1927). Colombo. Chambers for the manufacture of sulphuric acid. (270,661.)

*11,805 (1927). Permutit A.-G. Production of chromyl chloride. (270,711.)

IX.—Applications

Bates. Artificial marble. 12,895. May 13.

Consortium f. Elektrochem. Ind. Cementing, impregnating, etc. 12,669. May 11. (Ger., 11.5.26.)

Harnisch. Artificial stone. 12,949. May 13. (Ger., 14.5.26.)

Rigby. Manufacture of cement. 12,470. May 9.

Thompson. Manufacture of bricks etc. 12,614. May 11.

IX.—Complete Specifications

27,558 and 28,569 (1925). Rigby. Treatment of slurries in rotary kilns. (270,356.)

12,826 (1926). Voisin. Manufacture of aluminous cements (270,496.)

*6375 (1927). Alexander. Manufacturing bituminous products. (270,649.)

X.—Applications

Buhrmann. Superheating blast furnace etc. slag. 12,662. May 11. (Ger., 15.5.26.)

Copper Deoxidation Corp. Refining etc. copper. 12,435. May 9. (U.S., 26.5.26.)

Dechesne. Apparatus for purifying etc. molten metals. 12,876. May 13. (Ger., 14.5.26.)

Garnett, Holden, and Smith. Magnetic alloys. 12,934. May 13.

Harris. Production of metals. 12,471. May 9.

I.-G. Farbenind. Manufacture of highly-porous coherent lead aggregates. 12,459. May 9. (Ger., 7.5.26.)

Michel. Metallurgy of magnesium etc. 12,665. May 11. (Fr., 11.5.26.)

Siemens & Halske A.-G. Copper-beryllium alloys. 12,454. May 9. (Ger., 21.5.26.)

X.—Complete Specifications

6662 (1926). Smith. Soldering aluminium. (270,453.)

22,249 (1926). Dwight & Lloyd Metallurgical Co. Sintering machines. (264,450.)

23,385 (1926). Kelly. Alloys. (270,553.)

31,283 (1926). Meyer and Meyer. Recovering antimony from alloys. (264,139.)

*1282 (1927). Kropf. Alloys of high melting-point. (270,640.)

*11,035—6 (1927). Parker Rust Proof Co. Rust-proofing (270,679—80.)

*12,132 (1927). Schwarz. Working-up mixed shavings of white metal and red metal. (270,740.)

*12,459 (1927). I.-G. Farbenind. Manufacture of highly porous coherent lead aggregates. (270,763.)

XI.—Applications

Anglo Galvanising Co., Ltd., and Charlier. Manufacture of zinc electrolytes. 12,770. May 12.

Wilderman. Electric batteries. 12,564. May 10.

XI.—Complete Specifications

27,419 (1925). Ajax Electrothermic Corp. Induction furnaces. (243,694.)

27,420 (1925). Ajax Electrothermic Corp. Induction electric furnaces. (247,519.)

15,687 (1926). Mond (Warlimont). Preventing evaporation and oxidation of heated electrolytes. (270,514.)

23,063 (1926). Langbein-Pfanhauser-Werke A.-G. Galvanic mass production. (266,285.)

28,048 (1926). Comp. Franc. pour L'Exploit. des Proc. Thomson-Houston. Primary voltaic cells. (261,371.)

217 (1927). Brown, Boveri, et Cie. Electrode carriers for electric furnaces. (264,157.)

*12,078 (1927). British Thomson-Houston Co., Ltd. Treating filaments. (270,733.)

XII. Applications

Arentz. Boilers for whale oil. 13,006. May 14. (Norway, 15.5.26.)

Simon Extracting Machine Syndicate, Ltd., and Simon. 12,653. See II.

XII.—Complete Specifications

3875 (1926). Cabot. Polymerisation of oils. (250,538.)

*11,964 (1927). British Thomson-Houston Co., Ltd. Oleaginous compositions. (270,724.)

XIII. Applications

Consortium f. Elektrochem. Ind. 12,669. See IX.

Marks (Bakelite Corp.). Condensation products. 12,914. May 13

XIII.—Complete Specifications

4466 (1926). Bakelite Ges. Production of compositions containing phenolaldehyde condensation products. (247,957.)

8888 (1926). Commercial Solvents Corp. Synthetic resins and their manufacture. (250,265.)

*7217 (1927). Sichel Kommandit Ges. Manufacture of a colour-binding means. (270,652.)

*8480 (1927). Comp. Lorraine de Charbons, Lampes, et App. Electriques. Treatment of pulverulent fillers and pigments. (270,658.)

*10,210 (1927). Chem. Fabr. (vorm. Schering). Printers' ink. (270,671.)

*11,035--6 (1927). Parker Rust Proof Co. See X.

*12,294 (1927). I.-G. Farbenind. Manufacture of colour lakes. (270,750.)

XIV. Application

Rubber Latex Research Corp. Rubber compositions. 13,038. May 14. (U.S., 1.6.26.)

XIV.—Complete Specifications

18,533 (1926). Simplex Wire & Cable Co. Rubber compounds. (269,124.)

23,346 (1926). Danier. Regeneration of rubber. (269,127.)

*4642 (1927). Silesia, Ver. Chem. Fabr. Accelerating vulcanisation. (270,644.)

*10,659 (1927). Scheithauer. Regenerating rubber. (270,675.)

XV. Application

I. G. Farbenind. 12,457. See XXI.

XVI.—Application

Patton. Insecticide for red spider. 12,513. May 10.

XVII.—Application

Dorr Co. Carbonation of sugar juices. 12,436. May 9. (U.S., 8.5.26.)

XVII.—Complete Specification

12,436 (1927). Dorr Co. Continuous carbonation of sugar juices. (270,757.)

XIX.—Application

Landé. Flour improver etc. 12,812. May 12.

XIX.—Complete Specifications

14,746 (1926). To Aroha Dairy Co., Ltd., and Murray. Deodorising fluids. (270,509.)

25,420 (1926). Beaufour. Extraction of albuminaceousness of vegetable origin. (260,242.)

*11,660 (1927). Treuhand-Ges. Bartmann & Co. Treatment of cereals. (270,706.)

XX.—Applications

Consortium f. Elektrochem. Ind. Manufacture of butyric aldehyde. 12,907. May 13. (Ger., 15.5.26.)

Dicker (Verein f. Chem. Ind.). Production of santalol derivatives. 12.8.11. May 12.

Elektrizitätswerk Lonza. Manufacture of crotonaldehyde. 12,460. May 9. (Switz., 8.5.26.)

XX. Complete Specifications

2300 (1926). U.S. Industrial Alcohol Co. Esterification. (246,526.)

4302 (1926). Carpmuel (I.-G. Farbenind.). Manufacture of condensation products of crotonaldehyde. (270,433.)

25,400 (1926). Consort. f. Elektrochem. Ind. Manufacture of acetals. (264,791.)

26,754 (1926). Consort. f. Elektrochem. Ind. Manufacture of acetaldehyde. (260,305.)

31,612 (1926). Binz and Rath. Production of 2-oxy-3-bromopyridine-5-arsinic acid. (263,142.)

3721 (1927). Merck, Merck, Merck, Merck, and Merck. Dehydrating ethyl alcohol. (270,612.)

*6540 (1927). Canadian Electro Products Co. Manufacture of benzoic acid esters. (270,651.)

*11,998 (1927). Chem. Fabr. (vorm. Schering). Manufacture of derivatives of aminometal-mercaptosulphonic acids and salts thereof. (270,729.)

*12,460 (1927). Elektrizitätswerk Lonza. Manufacture of crotonaldehyde. (270,764.)

XXI. Applications

Chem. Fabr. vorm. Schering. Photographic gelatin papers. 12,935. May 13. (Ger., 14.5.26.)

I.-G. Farbenind. Gelatin for light-sensitive silver salts emulsions. 12,457. May 9. (Ger., 16.6.26.)

XXI.—Complete Specifications

3263 (1926). Wade (Wadsworth Watch Case Co.). Photographic processes. (270,386.)

3264 (1926). Wade (Wadsworth Watch Case Co.). Manufacture of photographic media. (270,387.)

XXIII.—Application

Bourgognion and Philips. Treatment of water. 12,542. May 10. (Holland, 11.5.26.)

XXIII. Complete Specifications

4920 (1926). Walker, Ltd., and Freestone. Manufacture of disinfecting, deodorising, or sanitising substances. (270,440.)

9561 (1926). Walker, Ltd., and Freestone. Insecticide. (270,470.)

14,746 (1926). To Aroha Dairy Co., Ltd., and Murray. See XIX.

29,997 (1926). Ultra-Filtre. See I.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Chinaware, glassware, cutlery (445). *British India*: Paint, varnish, soap (497);

Galvanised-iron wire (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1); Cast iron, rolled steel (Directors, South Indian Railway Company, Ltd., 91, Petty France, London, S.W.1). *Canada*: Malt extract (498); Metal sheets, steel, brass, copper, tinplate (501); Aluminium hollow-ware (504). *Egypt*: Stone-crushing machinery, manganese steel, special steel, forgings, iron and steel castings (513). *Germany*: Artificial silk yarns (505); Ores, metals, chemical and pharmaceutical products (506). *Spain*: Galvanized-iron sheets, galvanized hoop iron (511). *Sweden*: Rubber goods, linoleum, oilcloth (512). *Turkey*: Galvanized iron wire, solder, lead, tin (A.X. 1689).

New Coke-oven Plant

The Nunnery Colliery Company, of Sheffield, has placed an order with the Woodall Duckham Vertical Retort & Oven Construction Company (1920), Ltd., for a complete coke-oven works, comprising a battery of 25 Becker ovens capable of carbonising 3600-tons of slack per week. The contract includes the erection of semi-direct by-product recovery plant, railway sidings, coal store, coal- and coke-handling plant, and coke-screening plant.

New Dyestuffs

The latest addition to the British Dyestuffs Corporation range of vat colours is Durindone Scarlet Y Paste, which, on account of its brilliant shade, is of considerable interest to the calico printing trade, either for direct printing, tannin discharge style, or discharging by the Rongalite-Leucotrope process. It is applicable to all forms of cotton materials where brilliancy of shade, cross-dyeing and chlorine fastness is required. In particular, it is very suitable for the dyeing of cotton yarns fast to washing. It is also very suitable for wool dyeing where particular fastness to milling is required, and possesses the additional advantage of vatting in the presence of ammonia without the addition of caustic soda. It is of interest for the dyeing of viscose artificial silk, giving even shades on material of irregular quality.

News from Advertisements

Copies of the JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY are offered for sale (p. viii).

Research Assistant required for Government Laboratory (p. viii).

Applications are invited from ex-service men between the ages of 23 and 30 for certain posts of Class II chemists in the Establishment of the War Department Chemist at Woolwich (p. viii).

Safeguarding of Key Industries

The Board of Trade give notice that representations have been made to them under Section 10 (5) of the Finance Act, 1926, for the exemption from a Safeguarding duty of the following articles: Didial (ethyl morphine diallyl barbiturate); ethylene glycol, and glycol ethers.

Communications regarding the application should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, within two months from the date of this notice (May 18, 1927).

PUBLICATIONS RECEIVED

CO-OPERATIVE INDUSTRIAL RESEARCH. An account of the Work of Research Associations under the Government Scheme, with a Preface by the Rt. Hon. The Earl of Balfour, K.G., O.M., F.R.S. Department of Scientific and Industrial Research. Pp. vii + 46. H.M. Stationery Office, 1927. Price 9d.

THE METALLURGIST'S MANUAL. By T. G. Bamford, M.Sc., and H. Harris, M.Sc., F.C.S., with a foreword by T. Turner, M.Sc., A.R.S.M. Pp. x + 246. London: Chapman & Hall, Ltd., 1927. Price 15s.

INTRODUCTION TO PHYSIOLOGICAL CHEMISTRY. By Meyer Bodansky, Ph.D. Pp. vii + 440. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. Price 20s.

CHEMICALS AND ALLIED PRODUCTS IN CANADA, 1925. Canada. Department of Trade and Commerce, Dominion Bureau of Statistics, Mining, Metallurgical and Chemical Branch. Pp. 128. Ottawa: F. A. Acland, 1927. Price 25 c.

THE PRIMARY DECOMPOSITION OF COAL. I. The Temperature of Initial Decomposition. By J. G. King, Ph.D., A.R.T.C., and R. E. Willgress, B.Sc., A.R.C.S., A.I.C. Fuel Research Technical Paper No. 16. Department of Scientific and Industrial Research. Pp. vi + 19. H.M. Stationery Office, 1927. Price 9d. net.

RESEARCH DEPARTMENT, WOOLWICH, R.D. REPORT, No. 64. The Behaviour under Compression of Service Copper Crushers. Pp. 45. H.M. Stationery Office, 1927. Price 4s. 6d.

METHODS OF ANALYSIS OF COAL. FUEL RESEARCH BOARD PHYSICAL AND CHEMICAL SURVEY OF THE NATIONAL COAL RESOURCES No. 7. Department of Scientific and Industrial Research. Pp. iv + 35. H.M. Stationery Office, 1927. Price 9d. net.

THE CHEMISTS' YEAR BOOK, 1927. Edited by F. W. Atack, M.Sc.Tech., D.Sc., B.Sc. Pp. 1179. Manchester: Sherratt & Hughes; New York: The Chemical Catalog Co., Inc.; Toronto, Canada: The Westman Press, Ltd., 1927. Price 21s.

THE JOURNAL OF THE ROYAL TECHNICAL COLLEGE, GLASGOW No. 3, December, 1926. Pp. 180. Glasgow: Robert Anderson, 1926. Price 10s. 6d.

ACHEMA-JAHREBUCH, JAHRGANG 1926-27. Berichte über Stand und Entwicklung des Chemischen Apparatewesens. Edited by Dr. Max Buchner, and Collaborators. Pp. 319. Berlin: Verlag Chemie G.m.b.H. 1927. Price 10 r.m.

INSULATING OIL. A List of References (1900-1925) in the New York Public Library. Compiled by A. W. Fyfe, jun., with an introduction by J. L. R. Hayden. Pp. 71. New York: The New York Public Library, 1927. Price (selling) 50 c.

PRELIMINARY REPORT ON THE MINERAL PRODUCTION OF CANADA DURING THE CALENDAR YEAR 1926. Department of Trade and Commerce, Dominion Bureau of Statistics, Mining, Metallurgical and Chemical Branch. Pp. 51. Ottawa: F. A. Acland, 1927.

PRELIMINARY REPORT ON THE MINERAL PRODUCTION OF CANADA DURING THE CALENDAR YEAR 1926. Dominion Bureau of Statistics, Canada. Department of Trade and Commerce, Mining, Metallurgical and Chemical Branch. Pp. 51. Ottawa: F. A. Acland, 1927.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

VOL. 46 **NEW
SERIES**

LONDON, JUNE 3, 1927

No. 22

EDITORIAL

The Geneva Conference

THE Final Report of the World Economic Conference is an interesting document of fifty pages; its conclusions are mainly very general statements of the best methods of persuading the nations of Europe to become more peaceful, more economical, and more prosperous. So far as international commerce is concerned, it advocates free trade and deprecates dumping. The Report adopts that cautious and general tone in dealing with the great European problems which is characteristic of the editorials which have often appeared in these columns. The Report does, however, speak with greater authority, though hardly with greater precision. The President's address to the Conference and the subsequent pages of the Report would be even more impressive if we knew who the President was and who were the individuals who have published these words of wisdom; this omission from the document should be remedied when it is republished. So far as Great Britain is concerned, we know that Sir Arthur Balfour, Mr. Walter Runciman, Mr. W. T. Layton, Sir Norman Hill, Sir Max Muspratt, Mr. Arthur Pugh, Sir Hubert Llewellyn Smith, and Mr. W. J. U. Woolcock were included in the delegation; if other countries were as strongly represented as Great Britain the Report of the Conference should carry very great weight. We had the opportunity a few years ago of attending two international conferences, one at Washington and one at Geneva. In those days two hundred and fifty people from fifty different countries met, usually for the first time; nine-tenths of them did not trust each other, three-quarters of them did not understand each other. After the lapse of a fortnight or three weeks they came to the conclusion that most of them were sensible and able men, sincerely anxious to be useful and helpful. A few general principles were stated and hotly debated, many impracticable suggestions and inexpedient phrases were at the last moment unanimously excluded, and just as we had got to know something of each other and the many subjects we were discussing we had to go home to attend to our business. We hope that things have now altered for the better in these international conferences. The Final Report is well worth reading, and costs one shilling. Special memoranda have been prepared on the chemical industry, the potash industry, and the artificial silk industry.

The Annual Meeting in Edinburgh

It is difficult to think of any city so well suited to an annual meeting of a learned society as Edinburgh. We have seen many northern cities which

are now, or once were, capitals of small or large kingdoms; few of them can compare with Edinburgh in beauty and historic interest. Its history goes back some thirteen hundred years, and it has many monuments remaining of the Middle Ages. Its streets constantly remind us of John Knox, of Sir Walter Scott, of the great family of the Sturmts, and of those many famous men who flourished in Edinburgh in the nineteenth century. To the historian and to the geologist the whole district is fascinating; we see no reason why it should not be fascinating to the chemist. Certainly the Edinburgh Section has provided a programme which is remarkably attractive. One kindred society, the Biochemical, has arranged interesting matter for our consideration, and the Society is duly grateful; two branches of the Society, the Engineering Group and the Fuel Section, have also contributed valuable papers for serious chemists. The presidential address on Tuesday, July 5, is sure to be good, and we feel equally confident about the address of the Messel Medallist, Col. Pollitt, fixed for the Thursday. Let no one say the Society does not pay due attention to the eternal verities: those who hear all the papers will for ever after be wiser and better-informed than their fellow creatures; moreover, they will have, in addition to their immediate pleasure and subsequent justifiable self-satisfaction, a gratification of another sort. Those who listen to the President's address will be panoramically photographed; those who pay due attention to Col. Pollitt's remarks on synthetic ammonia will be received in the evening by the Lord Provost and magistrates. The social side of these annual meetings is, as has often been remarked, of considerable educational value: if you wish to know about a man, dance with his wife, or play bridge with his aunt, neglect not these simple hints; if you find your daughter taking your chief chemist out in your Rolls-Royce, the two-seater, your opinion of him cannot remain as it was. You may learn how to raise the cardiac temperature at Dryburgh Abbey on a sunny afternoon or at Melrose in the pale moonlight, a sort of fuel economy amounting almost to a science; if you wish to learn the most recent facts of biochemistry, you must lure Prof. Drummond or Dr. Dudley to see an inspection of the Black Watch at the Castle or to view the Raeburns in the National Gallery. In an unguarded moment either of these may reveal the very fact you are waiting for. As for the lunch and the dinner, we advise our English friends to reflect on the changes which time has brought about; it is no longer safe to assume that if after dinner you find the table is some two feet vertically above you, necessarily there will

be found a wee laddie detailed to loosen your cravat—it was so in the old days, no doubt. The view from the top of Scott's Monument is wonderful: we advise the young and incredulous to verify this statement; others may take our word for this, and everything else we say, in perfect confidence. As for Abbotsford, those who have once been there have never forgotten it. Peebles we cannot discuss; we never visited it. On the other hand, the great law case of *Peebles v Plainstones* is familiar to us, and whilst in Edinburgh we shall, no doubt, revisit some of the scenes with which it is connected. We think we have sufficiently indicated our belief that in scientific importance, in social activity, in the enjoyment of Scots hospitality, and in the provision of gaseous, spiritual, liquid and solid matter, this forthcoming gathering at Edinburgh will be unsurpassed. We intended to conclude this notice with an account of the geology of Arthur's Seat and North Berwick law, but this has belahps been already better done by Geikie.

The Livesey Professor at Leeds

Prof. J. W. Cobb has prepared a report of the work of his Gas and Fuel Department at Leeds during the sessions 1924—5 and 1925—6. We recollect very well the Leeds University long before a Gas and Fuel Department was dreamed of, and we well knew Prof. Cobb long before he dreamed of becoming a Fuel Professor there, or anywhere else. We recollect also that when the department was created it seemed to us to be a subject entirely unfitted for any University curriculum. Without any sense of shame, we now admit that the study of fuel is so vast and so important as to deserve great attention, and we can think of no better way of training up research workers in connexion with fuel than the way of the department at Leeds and under the direction of Prof. Cobb. You must train up your men before they can undertake research; without proper research, no progress in fuel will be worth bothering about. The West Yorkshire Coal Owners' Association has again come to the assistance of the Fuel Department at Leeds by the handsome donation of £25,000 towards an extension of the premises, and no doubt this will enable a greater quantity of research to be carried out. Prof. Cobb's department is a wide one, for it includes not only coal gas and fuel, but also refractory materials and metallurgy; consequently, the recent researches cover a wide area, the influence of ash constituents on carbonisation, the gasification of coke in steam, the scaling of metals, the removal of sulphur compounds from coal gas by catalysis, the properties of sillimanite and the recrystallisation of metals. The technology of fuel has made remarkable advances in recent years; many of us remember the introduction of the internal-combustion engine, of oil as a fuel, of low-temperature carbonisation, of the direct contact of water with flame or explosion as in the Brunler boiler and the Humphrey pump, of powdered coal as a fuel, of the incandescent mantle and the change of gas from a lighter to a heater, of superheaters and steam accumulators, of the hydrogenation of coal. Who will say that we have not made great progress, and that we shall not make much more if we study fuel as they do at Leeds?

TESTING OF SEPARATORS FOR ACCUMULATORS

By M. WILDERMAN, Ph.D., B.Sc.

THE ELECTRICAL RESISTANCE

This is important for the determination of the variation of the volts with temperature, and of the difference in the volts obtained with different separators having different resistances, when different ampere discharges are made (see CHEM. AND IND., January 21, 1927, p. 55).

This is determined by the method of Kohlrausch. The electrical resistance of the solution between two platinised platinum electrodes is measured first without any separator, then with the separator. This gives the increased resistance due to the separator, which can be expressed in millimetres of solution at a given temperature. The temperature coefficient is then determined. The resistance is measured after 5 min., 10 min., some hours, and then days till the minimum resistance is reached.

This gives the initial resistance of the separator and how soon its best working conditions are attained. The separator ought to be tested dry and when moist, as upon this depends its usefulness.

Perforated ebonite sheets do not even give their minimum resistance at once, evidently on account of the air which gets entrapped in the holes between the solution. For example, with a section of a perforated ebonite separator 11.7 cm.² by 0.5 mm. thick, with holes 1.5 mm. diameter the resistance introduced was:

1st day	2nd day	3rd day	4th day	5th day	8th day
Ohms.	Ohms.	Ohms.	Ohms.	Ohms.	Ohms.
0.300	0.248	0.187	0.134	0.061	0.056

The minimum value should be 0.014 ohm.

SPEED OF ABSORPTION OF THE SOLUTION BY THE SEPARATOR

This is determined by dipping the separator perpendicularly into a flat dish of water to a depth of 1 cm. of the diaphragm and measuring the time taken for the solution to reach different heights of the diaphragm by absorption. This property in the separator is important for hot countries, where batteries are liable to get dry.

The property of absorption also explains the enormous differences in the time taken for a separator to reach its minimum resistance.

THE SPEED OF PERCOLATION

This is important for the determination of the speed of circulation of the electrolyte between the electrodes. This is done by taking a given disc of the diaphragm of a given uniform thickness (say 1 mm.), fixing it in a small cylinder by means of rubber rings (see Fig. 1) so that the solution from the cylinder can only pass through the diaphragm. The cylinder is connected with a glass tube of a given height, which is connected at the top to a vessel or small tank where water is run in and kept at a constant level by a suitable overflow pipe, thus ensuring a constant height of water (say 1 metre) on the diaphragm under test.

The speed of percolation of water through a porous diaphragm is :—

$$V = \frac{KSP}{L}$$

V = amount of water passing through a diaphragm per 1 cm.² per minute.

S is the surface of diaphragm expressed in cm.²

P is the height of the column of water pressing on the diaphragm expressed in cm.

L is the thickness of the diaphragm in mm.

K is the characteristic constant for the given diaphragm depending upon its nature, the radius of the capillaries and the viscosity of the solution which changes with temperature.

K = V when S = 1, P = 1, L = 1.

Then K gives the amount of water passing through a given diaphragm of 1 cm. square surface, 1 mm. thick

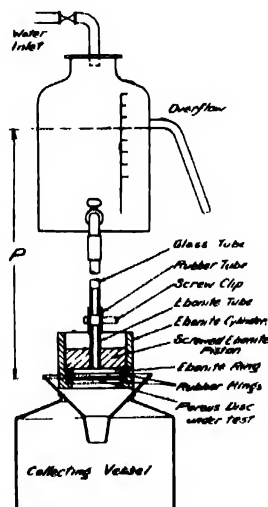


FIG. 1.

under a pressure of water of 1 cm. height per minute. If the same liquid, say water, of the same temperature be used for the diaphragms which are to be compared, the relative values of the characteristic constants K for the two diaphragms remain the same.

A rough and quick qualitative test of the speed of percolation can be made by letting a drop of water fall on the diaphragm and noting the speed of percolation to the other side. With the Wilderman porous ebonite separator it is instantaneous, whereas wood and other diaphragms remain practically unaffected.

Upon the speed of percolation depends the circulation of the solution between the electrodes, and upon this all the functions of the battery depend, during the discharge, such as the volta, ampere and watt hours capacity, speed of recuperation, etc. Upon the speed of percolation depends whether the separator can be used dry, or must be used wet, and whether a dry battery can be made and transported.

ESTIMATION OF THE RELATIVE AMOUNT OF SOLUTION CIRCULATING BETWEEN THE ELECTRODES DURING CHARGE AND DISCHARGE, USING DIFFERENT SEPARATORS

The equation given above enables us to approximately calculate the amount of solution passing per minute between the electrodes through 1 cm.² of the separator when different separators of varying construction are used. This is done by using the characteristic constant K for the given diaphragm as given above, and by inserting the actual values of P into the above equation.

In the battery only very small over-pressures (maximum 0.3 to 3 cm. of water) come into consideration (see article before mentioned) if the concentration of the solution is arranged to be different at each side of the diaphragm during charge and discharge. Having thus found the amount of solution passing through 1 cm.² of the diaphragm per minute, and knowing the total surface of the porous parts of all the separators used in the battery, we then get the total amount of the solution passing through all the diaphragms per minute. This is then compared with the total amount of the solution between the electrodes, as well as with the total amount of the solution in the battery. This shows whether the amount of solution passing through the diaphragm is sufficient to cause a circulation.

It should be noted :—

(a) If separators of perforated sheets be used, no electro-osmotic or hydrostatic pressures are present. In this case, P in the above equation equals zero, V equals zero; i.e., no circulation takes place.

(b) When a diaphragm is used with the solution between the electrodes equally divided, the number of molecules of the acid which are taken from the solution or pass into it during discharge and charge in unit of time being on both sides of the diaphragm equal, the concentration of the acids on both sides of the diaphragm is also equal; no hydrostatic pressure exists here, whilst the small electro-osmotic pressure still remains.

(c) When a diaphragm is used with the solutions between the electrodes unequally divided (more solution being on the positive than on the negative side), the concentration of the solution on the positive side is greater during discharge than on the negative side. An increased electro-osmotic and a hydrostatic pressure is then created from the positive side to the negative side of the diaphragms through it, and can only be approximately estimated by taking into account the value of the specific gravity of the solution on each side of the diaphragm during discharge and the height of the electrodes.

TESTING ACCUMULATORS

In making comparative tests with different kinds of separators such as wooden separators having no frames or vertical supports, and threaded rubber separators having vertical ebonite strips or Wilderman separators, having a frame and vertical ribs etc., it is essential that equal active surfaces of the electrodes should work in all cases. If the cell is to work to the best advantage it is necessary that the electrode should be adapted to the separator, or the separator to the electrode, both giving

the same active surface. It is just as important that the electrodes should have a longer life as it is to prolong the life of the separator. The principle involved in the new ebonite separator consists in the provision of a non-compressible frame with vertical ribs (see patent No. 245,552, 1926) in order efficiently to support the outer frame and the corresponding vertical ribs of the grid of the electrode in a vertical and horizontal direction, thus forming one solid block preventing the electrode from buckling and bending in any direction.

With threaded rubber separators the electrodes should be constructed with corresponding strengthening ribs in the grid. The electrodes are then much stronger and can be made thinner, *i.e.*, a battery of greater active surface capacity can be made for the same weight.

If the electrode be not adapted to the Wilderman separator, the separator is then made with a non-compressible frame with porous vertical ribs instead of non-porous, to suit the given electrode. If the separators and electrodes are not adapted to one another, and different separators be compared, the same active surfaces of the electrodes should be taken for test in both cases, by inserting an insulating ebonite sheet of the requisite surface between the outer negative and positive electrodes.

Before any two batteries with the same or different kinds of electrodes can be used for the testing of the comparative merits of two different kinds of separators, it is necessary that, with the same active surfaces of the electrodes, their volts, ampere and watt-hours capacity when discharged without separators between the same equipotential lines, the concentration of the acid, its temperature and the distance between the electrodes, be the same in both batteries, thus eliminating all factors other than the physical factors of the different separators. For this a number of new cells, which are supposed to be of the same capacity, with glass rods of the desired diameter (say, 2½ mm.) between the electrodes, are taken and first charged in series with the same current until they all reach the same total potential of 2.6 volts, the same single potentials (Cd. neg. and Cd. pos. readings), while the concentration of the acid and its temperature are kept the same. Readings are noted from time to time of the volts, single potentials, concentration, etc. As soon as one cell reaches 2.6 volts it is removed from the series and the other cells are further charged until they reach the same 2.6 volts at the same or at different times. The cells having all reached 2.6 volts are then all connected again in series and further charged for a couple of hours and all data noted. The cells are allowed to stand for about 12 to 24 hrs. in open circuit and the total volts, single potentials, etc. are again noted. It will be found that the volts have dropped very considerably. The cells are then discharged in series down to 1.8 or 1.7 volts with, say, 20 amperes for a 60-ampere-hour battery, a current which is not too great to bend or buckle the electrodes unsupported by separators. The volts, single potentials, amperes and time, etc. are noted from time to time during discharge. We thus get the discharge curves for the different cells. It will be found that the volts of the different cells and the discharge curves between equipotential lines are not the same. This will be due to the different capacities of

the electrodes, if the concentration of the acid, its temperature, and the distance between the electrodes are the same. It may, however, be found that between a number of such cells two or more show exactly the same drop of the volts, the same ampere and watt-hour capacity between the same equipotential lines. These are separated from the rest to be used for further tests. The chosen cells are charged again in series as before until they reach the same total volts, single potentials, etc. If the cells are of equal capacity they ought to reach the same volts in the same time, *i.e.*, the charge curves should practically coincide. A second discharge with 20, 30 or 40 amperes is made and the discharge curves noted. The cells which give the same charge and discharge curves are separated from the rest and used for testing the separators. The cells mentioned above are now again charged to about 2.3 volts, the glass rods removed, the two different kinds of separators placed in the batteries, and the cells further charged until they reach 2.6 or 2.65 volts.

The cells are then allowed to stand as before in open circuit, readings being taken and noted. A discharge is then made either in series or separately with the same amperes (10, 20 or 40 for a battery of 60 ampere hours, which gives the limit of the currents used for continuous work). If the circulation has an effect upon the volts, ampere hours, etc. of the battery, it will be found that the cells do not behave equally. If the cells are discharged in series it will be found that before one of the cells reaches, say, 1.8 volts, the volts of the other drop very considerably, although the discharge was made with the same amperes and the same time. If both cells are discharged separately down to the same 1.8 volts, it will be found that they reach these values at different times. In this case we get the drop in the volts, the ampere and watt-hours taken out between the same equipotential lines with the different separators. The cells are then allowed to stand in open circuit and the *recuperation* curves for both cells investigated, *i.e.* the speed of the rise of the volts in dependence of time is noted in both cases (Fig. 2). This is continued until they both reach their constant values. After this a second discharge in series (or separately) is made down to the same 1.8 volts as before. The second recuperation is then investigated, after which a third discharge is made down to the same volts.

The cells are now charged again. It is essential for correct work that if the cells were discharged separately the extra ampere hours which were taken out from one cell in comparison with the other should be returned to the cell, account being also taken of the efficiency of the cell during discharge, the object being to return to the cell the extra energy which was previously taken out from it, and to bring them both back as far as practicable to the same condition. The two cells are then charged in series again until both reach 2.6 (or 2.65) volts, and if one cell reaches 2.6 volts before the other it should not be disconnected, but should continue to be charged until the second cell in series also reaches 2.6 volts (as volt measurement alone does not give the capacity created by the charge).

After this, discharges with 100, 200 and 300 amperes are made, but only for comparatively short periods,

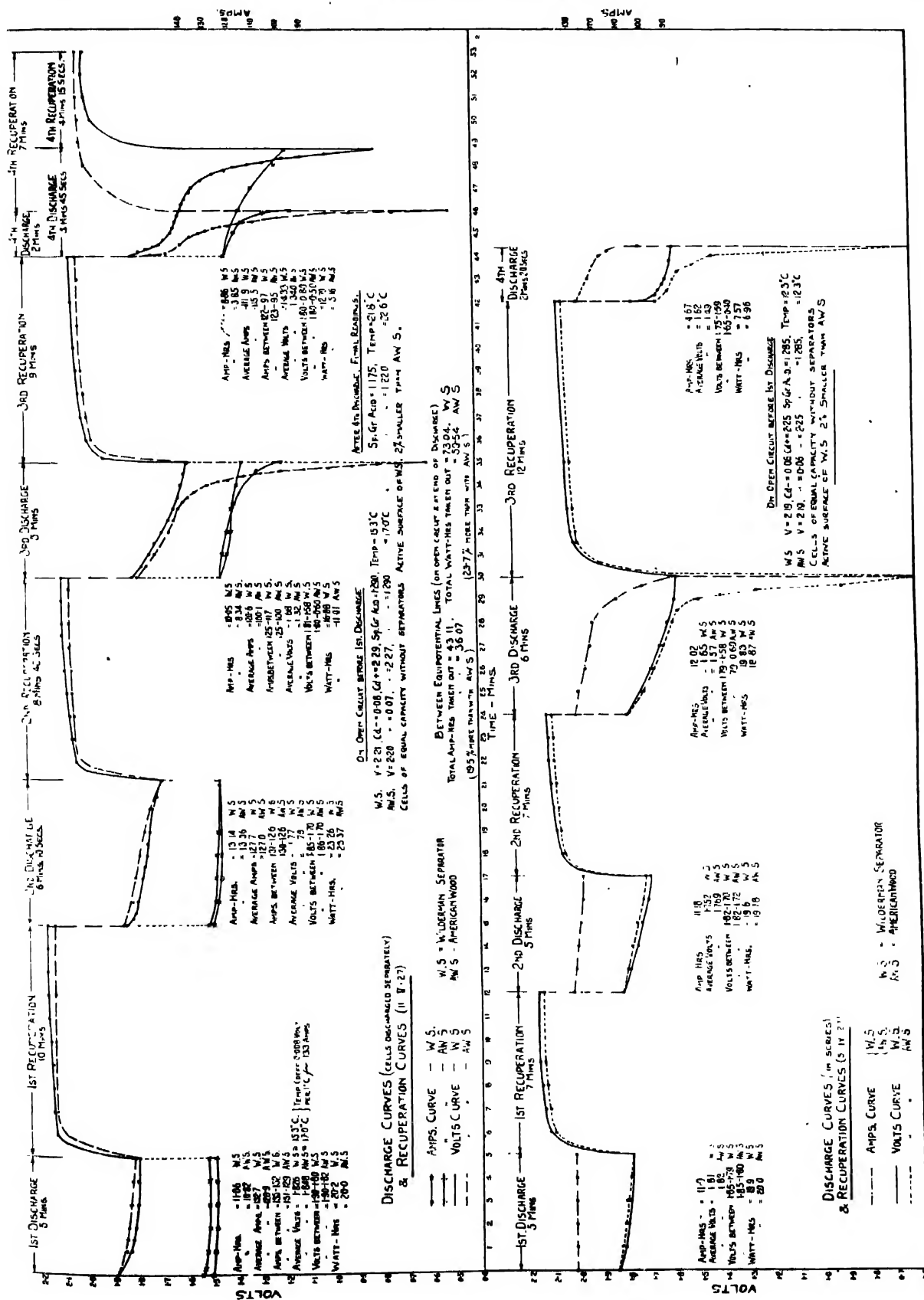


Fig. 2.

such discharges being used for starting a motor-car, in practice, usually for only a few seconds or a fraction of a minute. These discharges are made down to lower volts than 1.8, the initial volts of the same cells being, for physical reasons, given, in the above-mentioned article, lower when higher currents of discharge are used (see Fig. 2).

In making discharges of 100 amperes, either in series or separately, conduct the first discharge for five minutes, then allow it to recuperate for ten or fifteen minutes, and make a second discharge for five minutes, after which a second recuperation and a third discharge follows etc., until the volts reach a low value of about 1.3 volts. If the discharge of both cells is in series, it is stopped, if the volts in one of the cells reached about 1.3, even if the volts in the other cell is considerably higher.

The object of this procedure is to prevent damaging the batteries by an uninterrupted prolonged discharge, which, in view of the actual working of the batteries, does not come into consideration, and also in order to study the recuperation curves which are of great importance in the practical work of the battery. If the two cells are separately discharged with the same amperes down to the same volts, we have to proceed as before, returning the extra ampere hours taken out from one of the batteries, then charging again, until both reach in series the same 2.6 volts, when another discharge with, say, 150 to 200 amperes, is made with correspondingly shorter periods than five minutes, so as not to damage the batteries etc. Very short discharges with still higher amperes for a few seconds may be made.

CANADIAN MINERAL OUTPUT IN 1926

The total production of gypsum in Canada in 1926 amounted to 878,283 tons, compared with 740,323 tons in 1925. Imports of gypsum amounted to 6298 tons in 1926, as against 8921 tons in 1925, and Canadian crude gypsum exported, principally to the United States, totalled 668,064 tons in 1926. Ground gypsum and prepared wall plaster exported during the year totalled 10,062 tons, the United States, Newfoundland, Australia, and New Zealand being the chief importers of these materials. In 1926 the tonnage of magnesite produced in Canada decreased, but there was a considerable increase in value. The 1926 shipments were recorded as 4571 tons, compared with 5576 tons in 1925, and imports for the two years were 150 tons against 111 tons respectively, exports totalling 653 tons in 1926 and 834 tons in 1925. The International Magnesite Company and the Scottish Canadian Magnesite Company were the only producers of this material in Canada. Production of quartz in 1926 totalled 218,121 tons (197,224 tons in 1925), and imports of siliceous and crystallised quartz to a total of 2554 tons and of flint to the amount of 4731 tons were recorded during the same year. During 1926 Canada's salt output continued to increase, the high record of 233,746 tons in 1925 being surpassed by a production of 262,547 tons in 1926. Natural sodium sulphate shipped from Canadian deposits during 1926 amounted to 6775 tons, as compared with 3876 tons in the previous year.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

ANNUAL GENERAL MEETING, 1927

July 4 to 9

In accordance with the provisions of By-Law 68, notice is hereby given that the Annual General Meeting of the Society of Chemical Industry will be held in the Debating Hall, University Union, Edinburgh, on Tuesday, July 5, 1927, at 10 a.m.

A detailed programme with form of application for tickets for the various functions has been issued to members.

In accordance with the provisions of By-Law 23, notice is hereby given that the following Members of Council retire from their respective offices at the forthcoming Annual General Meeting: -

Mr. Francis H. Carr, C.B.E., *President*; Dr. E. Frankland Armstrong, F.R.S., Prof. J. W. Hinchley, Prof. J. C. Philip, F.R.S., and Sir Richard Threlfall, K.B.E., F.R.S., *Vice-Presidents*; Mr. W. A. S. Calder, Mr. W. H. Coleman, Dr. William Cullen, and Mr. J. Arthur Reavell, *Ordinary Members*.

Mr. Francis H. Carr, C.B.E., has been nominated for re-election to the office of President under By-Law 19; Mr. E. V. Evans, Mr. C. S. Garland, Dr. H. Levinstein, and the Right Hon. Sir Alfred Mond, Bart., M.P., have been nominated Vice-Presidents under By-Law 20. Dr. E. W. Smith has been elected Honorary Treasurer, and Dr. E. Frankland Armstrong, F.R.S., has been elected Honorary Foreign Secretary.

Mr. A. J. Chapman, Dr. H. E. Cox, Dr. W. M. Cumming, Mr. George Gray, Mr. C. Norman Kemp, Prof. G. T. Morgan, F.R.S., Dr. F. L. Pyman, F.R.S., Mr. L. Guy Radcliffe, Prof. Joseph Reilly, and Mr. Harold Talbot have been nominated under By-Law 24 to fill four vacancies among the Ordinary Members of Council.

A Ballot List has been posted to every Member entitled to vote.

J. P. LONGSTAFF,
General Secretary

EXTENSION OF PERIOD FOR REDUCED RAILWAY FARES

Since the programme for the Annual Meeting was printed, the Railway Companies of Great Britain which agreed to issue tickets at the ordinary single fare and one third for the double journey to persons travelling to Edinburgh to attend the meeting have extended the validity of these tickets, and they will be **available from Saturday, July 2, to Monday, July 11**. These tickets will be obtainable at the time of booking on production of vouchers which will be supplied on application to Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

PROPOSED EXCURSION TO ST. ANDREWS ON SATURDAY, JULY 9

The train will leave the Waverley Station, Edinburgh, at 9.30 a.m., arriving at St. Andrews at 11.22 a.m.

A visit to the University, including the Chemical Laboratories, will be arranged for the afternoon, and the St. Andrews University Court has kindly offered to entertain the members to tea in the University Buildings.

The return train will leave St. Andrews at 5.35 p.m., arriving in Edinburgh at 7.26 p.m.

Members will also have an opportunity of visiting other places of historic interest in St. Andrews or of playing golf.

AMERICAN SECTION

At the meeting held on May 6, the American Section passed the following resolution:—

Whereas Ira Remsen, a Past President of the Society and a leader in the development of chemical research in America, has been removed from us in the fullness of years by death, and *Whereas* the American Section of the Society desires to place on record its appreciation of his services to the science of chemistry, as a gifted teacher and as a director of research, *Therefore, be it resolved*, that the Section hereby recognises with sincere sorrow the loss which it has sustained in his demise, but at the same time rejoices in the fact that his genius and enthusiasm, which inspired so many of his students and fellow-workers during his life, will continue to bear fruit in the years to come, and will hold for him an honoured place in the history of chemistry throughout the centuries.

(Signed) JAMES KENDALL
CHARLES HERTY
HARLAN S. MINER

CALENDAR OF FORTHCOMING EVENTS

- June 9. OPTICAL SOCIETY. *Ordinary Meeting.* Imperial College of Science and Technology, Imperial Institute Road, South Kensington, S.W., at 7.30 p.m.
- June 14. RÖNTGEN SOCIETY. Tenth Sylvanus Thompson Memorial Lecture will be given in the Royal Society of Medicine, 1, Wimpole Street, W., at 8.30 p.m., on "The structure of the atom and radiation," by Sir J. J. Thomson.
- June 14 to 17. INSTITUTION OF ELECTRICAL ENGINEERS. Summer Meeting at North-Eastern Centre. Numerous visits to Works. Registration Office, The Central Station Hotel, Newcastle-upon-Tyne.
- June 15. ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY, Northampton Polytechnic Institute, St. John Street, Clerkenwell, London, E.C.1., at 8.15 p.m. "Electrorefining of silver," by E. Downs.
- June 15. SOCIETY OF GLASS TECHNOLOGY. Meeting at Sheffield.
- June 18. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS. General Meeting, at 2.30 p.m.
- June 29. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2., at 4 p.m. Annual General Meeting.
- July 4 to 9. SOCIETY OF CHEMICAL INDUSTRY. Forty-sixth Annual Meeting in Edinburgh. (See CHEM. AND IND., May 20, 1927, p. 464.)
- July 4 to 8. SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group.* Annual Meeting in Edinburgh. "Some aspects of the manufacture of fibrous cellulose," by Dr. J. L. A. Macdonald. A discussion will follow.

BRITISH ASSOCIATION OF CHEMISTS

The annual meeting of the London Section took place at the offices of the Association on May 20. In the absence of Mr. S. R. Price, M.B.E., Mr. E. R. Redgrove took the chair.

After the disposal of the formal business, Mr. Hy. T. F. Rhodes, General Secretary of the Association, opened the discussion upon registration. It was of great importance that interest should be aroused, and a strong opinion formed within the profession. No society, however great in numbers, or however perfect in organisation, could effect anything unless professional opinion as a whole demanded it. The Association had done a great deal in this connexion. Continuous propaganda had been carried out, not only in the chemical but in the public press. There was abundant evidence that public interest in this question was being aroused. Professional opinion was not yet united, and much friendly difference of opinion existed as to the ways and means of carrying the policy through. This, however, should encourage to greater effort, since there was little doubt that the whole profession was agreed upon all the fundamental issues.

Prof. G. T. Morgan, F.R.S., President of the Association, said it would be unwise to minimise the difficulties of the policy. At the same time, until the profession became in some sense closed the chemist could not hope for improved status. Chemistry has so enormously increased in scope that inadequate training was a much more serious question than it had been even a few years ago. Obviously registration would be a safeguard in this connexion. Again, a form of registration which was not able to adjust the supply of chemists to the demand would not be complete. He considered that an analogy between the profession of chemistry and those of medicine and law must not be pressed too far, since the functions of these professions and their relation to the community were different from that of chemistry. This, however, was not to say that registration for the profession of chemistry was impracticable. In order to succeed the chemist must develop his policy in a form which took into consideration the particular problems the profession had to face. But it was evident that a great deal had been done by the Association. The fact that the Association was as yet a young society, far from discouraging them, ought to encourage that energy, the complement of experience, which was the virtue of youth.

An interesting discussion followed, in which Mr. Macdonald, Mr. Gatehouse, Mr. Clark, and Dr. Atkinson joined. The question of the time limit allowed to those without academic qualifications was raised, the general secretary stating that the standing committee on registration was considering this question. In reply to questions by Mr. Macdonald and Mr. Clark, the General Secretary stated that at first registration would effect little more than giving the profession form and shape, but that that was a great deal. Educated men did not combine for the purpose of aggression, but in order the better to serve the community, and to win recognition by education of the public rather than by useless attempts at intimidation. The council had strictly kept this fact in mind in considering the Association's policy.

A resolution proposed by Mr. Dunford and seconded by Mr. Long, "That this meeting is in favour of the principle of registration, and prays the council to do all that is possible to give effect to the policy as soon as may be practicable," was carried unanimously.

A discussion followed upon the granting of certificates of membership. The meeting was of opinion that this was not desirable at present, and a resolution to that effect, proposed by Mr. Cosbie and seconded by Mr. Barrett, was passed.

Mr. C. B. Woodley, Secretary of the Association, gave an account of the position of the unemployment benefit fund and of the appointments bureau. An increasing number of employers approached the bureau direct. In connexion with salaries a large amount of work had been done. Many members had been advised as to the salary a particular position should carry, and in two cases through the Association's advice a member had obtained almost double the original salary offered.

CERAMIC SOCIETY

The Continental tour of the Ceramic Society was made the occasion of a joint meeting with the Czechoslovak Ceramic Society at Prague on May 6, when five papers were presented.

Dr. R. Barta, Secretary of the Czechoslovak Ceramic Society, reported on "The ceramic industry in Czechoslovakia." Czechoslovakia, next to England, is the richest country in Europe as regards ceramic raw materials, especially kaolin. There are also abundant supplies of clays, felspar, quartz, and refractory shales. The burnt clayware includes bricks, refractory products, pottery, stoneware, tiles, and porcelain. Other products include Portland and other cements, lime, magnesite, and glass. In Czechoslovakia are five Institutions where advanced instruction is given on ceramic subjects, in addition to a number of local centres where the instruction has a more limited range.

"Results of work carried out in the Silicate Research Department of the State Institute of Technology, Brno." Under this title is comprised four short papers contributed by Dr. O. Kallauner and colleagues. One relates to the determination of small amounts of magnesium in the presence of excess of ammonium salts, with special reference to the determination of magnesium in Portland cements. The second is concerned with the determination of soluble salts in clays and ceramic wares. The third paper discusses the injurious effect of nodules in brick products, and the fourth has for its subject a study of lead glycerine cements.

"The testing and behaviour of refractory material under stress at high temperatures," by Mr. A. J. Dale, B.Sc. In the ordinary refractory test an elongated tetrahedron or "cone" of the clay or brick to be tested is surrounded by standard "cones" which bend over or squat after definite heat treatments. The high temperature load test, as devised by Mellor and Moore, consisted in heating (in an electric furnace) small test pieces, subjected to definite pressure, until rapid collapse set in, the result being reported as the standard cone which collapsed in like manner. Evidence was found indicating that in certain cases failure in the test was due less to viscous squatting than to reduction in mechanical strength and

failure by shear. It also became clear that the temperature of complete collapse under load was often very indefinite. Hence further work was deemed necessary before rigid standardisation of the load test and the formulation of specifications based on the load test results. The author has been carrying out this work, which is still proceeding, and he describes the method of testing proposed as the result of these investigations, and gives the more important indications of the data collected during the past three years.

In the modified load test, the furnace adopted is essentially that designed and used by Mellor and Moore. The test piece rests on a column of specially made carborundum blocks, and pressure is applied by means of a thrust rod built up of similar carborundum blocks and cylinders. The fittings include an arrangement by which vertical movement of the test piece, thrust rod and supports, heated under any desired load, can be followed with a magnification of 10 to 40. A load test result can in this way be presented as a continuous curve, showing the progress of the subsidence and other characteristics of the test piece over a wide range of temperature. If desired, recording can be made autographic.

In order that expansion and subsidence data recorded may be comparable, standardisation of the size and shape of test pieces, as well as of the rate of heating, is necessary. The test pieces used are $3\frac{1}{2}$ in. \times 2 in. \times 2 in., with ends ground smooth and parallel. A rise of temperature of 50° C. per 5 min. is maintained throughout the test. The time factor being thus eliminated, the result can be recorded in actual temperatures.

Temperature readings are obtained by the use of a thermo-couple and an optical pyrometer. For the scale readings, a magnification of 16 is most generally suitable. Scale readings are taken every $2\frac{1}{2}$ or 5 mm., until very rapid or complete collapse of the test piece occurs. These readings are plotted against corresponding temperatures, and the resulting graph represents the behaviour of the tested material. The expansion readings include both test piece and carborundum expansions, but, as determinations on the thermal movements of carborundum material have produced only smooth and approximately linear expansion curves under high and low loadings and up to 1600 – 1700° C., any marked deviations from a smooth course in the modified load test result on a refractory product is characteristic of the test piece and not of the thrust rod or support material.

Silica products, with more than 92% silica, may contain a silicate glass, quartz, cristobalite, and tridymite in various proportions, and give different results accordingly with the modified Mellor and Moore test. Silica bricks containing unconverted quartz, when tested under a load of 4 lb. per sq. in., stood up until softening of the matrix caused squatting. Under a load of 75 lb. per sq. in., the same bricks began to fail at about 1500° C., and collapsed completely at 1570° C., owing to actual fracture. It is inferred that bricks containing unconverted quartz are liable to disruption under high external loadings at temperatures above 1250° or 1300° C., unless a specially elastic matrix is present. Silica bricks containing much cristobalite, under a load of 4 lb. per sq. in., stood up to the highest temperature attainable in the load test furnace without showing any abnormal

expansion at high temperatures. Under 50 lb. per sq. in. the brick failed at 1700–1730° C., and did not begin to deform appreciably until 1700° C. was reached. Such bricks should behave very well under industrial conditions of stress and high temperatures. Silica bricks with much tridymite showed under the 4 lb. per sq. in. load a subsidence range of 150° to 180° C., whereas with many silica products this range seldom exceeds 50° to 80° C. The temperature of collapse is very high, being over 1675° C., even under a load of 75 lb. per sq. in., and there is no rapid expansion at high temperatures nor marked rapid expansion at low temperatures. Such bricks seem specially suited for high temperature arch work.

The author suggests that the proper application of the modified Mellor and Moore load test will enable a scientific choice to be made of silica bricks for any specific type of industrial service.

With regard to fireclay products of ascertained composition, the results of ordinary refractory tests and porosity tests show that a brick with high ferric oxide content is not necessarily inferior in refractoriness at moderate temperatures, that a brick of low refractoriness may prove efficient enough below 1250° C., that high alumina content and moderate porosity favour refractoriness at temperatures up to about 1400° C., and that the temperature of complete squatting of a brick under load is not a safe guide as to behaviour of the material at lower temperatures.

Grog effects are briefly discussed, with special reference to the influence of the amount, the nature, and the grading of the grog.

Mr. W. J. Rees, B.Sc., contributed a paper entitled "Some notes on the use of Indian sillimanite." Bricks made from sillimanite with 10% ball clay bond were placed in a pot of molten lime-soda glass after a slight preliminary heating on the sill of the pot, and they did not crack or spall. These bricks were used to keep the pot-rim from floating too far to the left, and the founding temperature of the glass was 1350–1400° C. When removed from the pot after six weeks, the bricks were only slightly corroded—much less than fireclay bricks under similar circumstances. To get the best results from sillimanite bricks (or blocks) they must be burned at higher temperatures than those generally used for fireclay, the minimum being 1300° C. for sillimanite articles intended for contact with molten glass. It is advantageous to let the wet mixture of sillimanite and clay mature for 4 weeks or more before using. Much improved "bond" is obtained by maturing for 8 to 12 weeks—in the case of a mixture of 75 sillimanite with 25 ball clay. The pot dried much faster than an ordinary clay pot, and the total contraction from wet to dry was about 1 in 100. Though the pot costs about three times as much as one made from pot-clay, the longer life of such pots and the better quality of the glass much more than compensates for extra cost.

Sillimanite has been successfully used in the construction and repair of the sieges of pot furnaces, the mixture used being 75 sillimanite to 25 plastic fireclay. One such siege showed very little wear after three years in use. A sillimanite brick roof to a 3-ton Heroult electric furnace used for steel-melting at Sheffield lasted 132 heats, and the volume change of the bricks during use

was negligible. The normal life of a silica brick roof on this furnace is 60 heats.

Sillimanite bricks are giving very promising results in the arches and walls of high-pressure boiler furnaces with normal coal-firing and also with oil and pulverised-coal firing. Sillimanite shelves on the trucks of tunnel ovens are also giving good results. The mechanical strength at high temperatures of well burned sillimanite bricks with 15 to 25% of fireclay bond is much superior to that of fireclay bricks.

The results are given of tests for refractoriness (ordinary and under load), and of burning shrinkage, of sillimanite made up with various bonds.

The last paper, by Mr. A. T. Green, F.Inst.P., was on "The firing properties of refractory fireclay products." This paper was at once a general and a particular survey of the whole subject of fireclays and fireclay products in relation to the effects produced by heat. After a brief consideration of the constitution of fireclays, the nature of the firing operation was discussed, with particular references to the three outstanding periods, termed the water-smoking period (ranging normally up to about 250° C.), the oxidising period (500° C. to about 850° C.), and the vitrification range (from 800° C. to the finishing temperature). The water-smoking period is concerned with the expulsion (in a kiln or oven) of mechanical and hygroscopic water contained in the dried but unfired product, together with the colloidal water associated with halloysitic clays. The oxidation period is mainly concerned with the elimination of carbonaceous matter, the oxidation of iron compounds, and the decomposition of carbonates, sulphides, etc. During the vitrification range the fluxing action arising from the incipient fusion of the felspathic, micaceous, ferruginous, and other constituents of the original clay greatly affects the texture and strength of the product. The time-factors required to complete these operations vary with the nature of the clay, and with the design and manipulation of the kiln.

In the water-smoking period, too rapid expulsion of water may set up strains in the material, but experimental data relating to such strains are scanty. Reference is made to certain bricks, the water contents of which represent about 150,000, 108,500, and 66,800 c.c. of steam respectively, the largest of these volumes being practically 100 times the volume of the brick. Data obtained by Theobald and Green suggest that the time required for successful water-smoking is nearly proportional to the water-contents of the dried goods, i.e., in grogged fireclay bricks the water-content is the most important factor, outweighing all the others (texture, nature of clay, etc.). The controlling factors of water-smoking in industrial operations seem to be the moisture content of the original dried products, the rate of removal of water-vapour in the kiln, and the rate of rise of temperature.

In the oxidation period, many of the phenomena begin at about 500° C., as the burning out of carbonaceous matter from some fireclays, and the decomposition of ferrous carbonate. Iron sulphide in the presence of air begins to oxidise below 400° C., and at 1000° C. is fully converted into a mixture of magnetite and ferric oxide.

The formation of "black cores" is briefly alluded to, and the burning away of carbonaceous matter and the changes taking place in iron compounds are considered.

During the oxidation period the mechanical strength of the clayware is at a minimum, so that a general weakening of the finished product may result from additional thermal strains.

In the vitrification range, the heat-work produces vitrified or glassy material, which will surround the remaining particles and fill the interstices to an extent dependent on the properties desired in the finished product. The finer the grain, the greater the vitrification.

At about 800° C. fireclays begin to vitrify, the most fusible silicates beginning to melt or melting silicates being formed. Solution of other constituents gives rise to complications. The rate of vitrification of most fireclays is slow up to about 1200° C. With calcareous and very micaceous clays the range of temperature marked by involved chemical and physical actions is very small (perhaps not more than 50° C.), but with very good fireclays it may extend from 850° to 1450° C., with marked effects from 1250° C. upwards. As vitrification and its effects depend on the time-factor as well as on temperature, it is often beneficial in practice, after carefully heating up to the "maturing" temperature to "soak" for some hours to remove inadequate effects obtained in earlier stages.

It is inferred that crushing strength, apparent porosity, and sealed-pore value data when taken together give valuable indications of the vitrification of a fireclay product.

Loss of porosity is accompanied by a contraction of the clay mass as a whole. This volume-change, or, better, its rate of change, forms another criterion of vitrification.

The author proceeds to discuss the constitutional changes taking place during the vitrification range, and afterwards makes a brief reference to the colour changes in fireclays, due mainly to iron and calcium compounds.

Finally, in connexion with time-factors, some results are quoted concerning work done in an experimental kiln which indicate possibilities of some economy in the firing time of certain industrial kilns.

ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY

The 17th meeting was held at the Northampton Polytechnic Institute on May 18, when Mr. S. Wernick, B.Sc., read a paper on "The protective effect of metal deposits on iron." The Chair was occupied by Dr. W. H. Vernon. Mr. Wernick, opening his paper, said that the three important factors concerning electrodeposition for rust protection were the nature of the protective metal, the thickness and condition of the deposit and the conditions under which it had been deposited. So far as the first two points went, a useful guide was found in applying Nernst's solution pressure theory and the normal potentials of the metals commonly deposited. The same theory gave us a good picture of the mechanism of the rusting of iron, and this he outlined. It was thus seen theoretically that of the metals which had been deposited, only zinc, chromium and possibly cadmium could be expected, by acting anodically to the iron, to act as rust preventives. The conditions of deposition were, however, extremely important: such factors as the preliminary treatment, porosity of the base metal, structure of the deposit, type of solution used, throwing

power of the solution, mode of handling, and the final finish all entered into the production of an efficient deposit. The throwing power of a solution was particularly important in the case of articles with sharp bends or deep recesses. This fact, together with the fine structure obtainable from cyanide solutions, accounted for the marked superiority of these baths over acid sulphate solutions in the case for example of zinc.

Electrolytic zinc was superior to zinc deposited in any other way on account of its great purity. Nickel can act as an efficient protective provided its thickness is at least 0.001 in. Cobalt has given very good results with a copper underlay, and has stood up better than a copper-nickel deposit. Chromium was certainly comparable with zinc as a rust preventive. Chromium gave varying results mainly of a disappointing character—probably due to its proneness to passivity; a copper-nickel underlay gave improved results. In conclusion, he stressed the need for a standard corrosion test which should be laid down to render the results of different investigators comparable.

A communication was read from Mr. T. H. Turner, M.Sc., drawing attention to the unsatisfactory condition of modern commercial electroplate and the consequent increase in the specifications for "all-black" finishes. He heartily supported the suggestion for a standard corrosion test, which he proposed should be taken up in collaboration with the National Physical Laboratory and the British Engineering Standards Association.

Mr. E. A. Ollard said failure of electroplate was rather different from that of ordinary metal. He outlined three types of failure: (1) the plate itself gradually disappears; (2) pits form which open out, causing the rust to spread; (3) the plating breaks clear away. It would, therefore, be difficult to obtain corrosion data by weighing. With chromium, porosity resulted from strains in the deposit. An underlay of copper to nickel was not such good practice as a coat of nickel treated anodically then coppered and again nickeled. The adhesion of this combination was extremely good. Mr. W. James gave several practical instances of corrosion which had resulted from porosity, and said platers were frequently blamed for bad results which arose from the very poor material supplied. Mr. L. Wright, referring to the porosity of chromium plate, said he had found the chromic acid entered the deposit and was retained after the polishing process had "flowed" the surface—on removing this layer, the acid could be detected. In addition to the protection derived from the deposited metal, there was often an additional protection arising from the corrosion product formed.

Mr. S. Field said that heavy lacquers certainly increased the life of a deposit, but their object should be to get a plate which would not require a lacquer. A standardised salt spray is, perhaps, not the ideal corrosion test. Tests which were more in accord with atmospheric conditions, covering a longer period, will probably be used later. Mr. H. Perring suggested that a cyanide zinc coat followed by sulphate zinc to cover bends still rendered the latter the "weakest link in the chain." Mr. P. J. Craddock gave details of the "close plating" process, which was considerably thicker than electroplate and effectively closed up pores. It has been known to act as a protection for upwards of 20 years.

CORRESPONDENCE

IRISH CHEMISTS

SIR,—To add to a growing list of portraits of prominent Irish chemists, since the time of Sir Robert Boyle, and of chemists of other extraction who have worked in Ireland, the undersigned will be grateful for copies of pictures of Edmund Rolands (1819—1899), Robert Galloway (1822—1896), and William Plunkett (died 1884). The former two chemists were among Hofmann's first pupils in the Royal College of Chemistry, London. From 1849 to 1856 Rolands was Professor of Chemistry in Queen's College, Galway, and for part of this period he was Secretary of the Chemical Society, London, and edited the first two volumes of the Journal of that Society. Galloway was Professor of Applied Chemistry at the Museum of Irish Industry at Dublin (1857). When this institution became the Royal College of Science he held the Chairs of Chemistry and Metallurgy until he retired on pension in 1880. Plunkett was Assistant Professor with Galloway for many years, and published several papers on chemical subjects in the Proceedings of the Royal Irish Academy.

It may be of interest to mention that the portraits or pictures I have already collected under the above classification (excluding living chemists) are R. Boyle, F.R.S., P. Kirwan, F.R.S., W. Maple, J. Black, F.R.S., H. Davy, F.R.S., T. Hincks, R. Kane, F.R.S., J. Blyth, J. and E. K. Muspratt, J. Sheridan Muspratt, W. K. O'Sullivan, C. O'Sullivan, F.R.S., T. Andrews, F.R.S., E. Divers, F.R.S., J. Heron, J. Apjohn, F.R.S., J. Mallet, F.R.S., E. Reynolds, F.R.S., J. Bell, F.R.S., T. Rowney, Maxwell-Simpson, F.R.S., C. Cameron, W. N. Hartley, F.R.S., E. Letts, A. Senior, and Benjamin Moore, F.R.S.

There are at least two other Irish chemists of importance, namely, Brian Higgins and his nephew, William Higgins, F.R.S. In an early number of the *Dublin Quarterly Journal of Medicine*, W. K. Sullivan refers to a pencil sketch of these men by Cummerford, but so far I have not succeeded in tracing this or any portrait of the men.

Yours faithfully,
JOSEPH REILLY

Chemical Department,
University College, Cork

PERSONAL AND OTHER ITEMS

Sir Harry McGowan, President and Deputy-Chairman of Imperial Chemical Industries, Ltd., has been elected to a seat on the board of the Midland Bank, Ltd.

Prof. W. L. Bragg has been elected president of the Manchester Literary and Philosophical Society; Dr. H. Levinstein and Dr. R. S. Willows are elected as vice-presidents; and Mr. John Allan and Prof. E. A. Milne have been elected as secretaries.

Mr. H. J. Page, M.B.E., B.Sc., F.I.C., has resigned his position as Chief Chemist and Head of the Chemical Department at the Rothamsted Experimental Station on his appointment as Head of the Research Laboratories of Nitram, Ltd.

Major A. Rhydderch, B.Sc., has arrived in Australia, where he will join the staff of Hadfields (Australia), Ltd.

For some time Major Rhydderch was manager to Lake & Elliott, Ltd., of Braintree.

Mr. E. McKenzie Taylor has been appointed University Lecturer in agricultural chemistry, and Mr. W. A. Woodster has been appointed University Demonstrator in agricultural physiology and in mineralogy at Cambridge.

Dr. L. B. Mendel, professor of physiological chemistry at Yale University, has been awarded the annual medal of the American Institute of Chemists in recognition of his researches on food and nutrition. Dr. Mendel is the editor of the *Journal of Biological Chemistry* and a member of the editorial board of the publications of the American Chemical Society.

The late Mr. A. R. Musgrave, soap manufacturer, left £18,053.

The late Mr. Joseph Dixon, J.P., head of Peter Dixon & Sons, Ltd., paper manufacturers, left £377,366.

From Germany the deaths are announced of: Dr. M. Kempner, a well-known member of the Potash Syndicate; Dr. V. Rothmund, professor of physical chemistry in the German University of Prague; Prof. H. Noll, aged 70 years, well known for his work on the development of the chemistry of water supply; Prof. G. Tschermak, the well-known Viennese mineralogist.

Safety in Mines

The Safety in Mines Research Station at Harpur Hill, Buxton, is nearing completion, and will be formally opened in a week or so. The station has cost about £35,000 to complete, and will supersede the station at Eskmeals, Cumberland, which was too remote from mining centres. Equipment is provided for research on the explosibility of coal dust, on coal-mining explosives, on gob-fires, and other subjects, whilst laboratory work on these and related problems is carried out at Sheffield. Researches that require heavy and expensive plant are carried out in London at the Imperial College of Science and Technology.

Colonial Research Council

The Committee appointed by the Colonial Office Conference to make recommendations in regard to the establishment of a Colonial Scientific and Research Service, has been issued. It is proposed to set up a representative council to administer an Empire chain of agricultural research stations, to create a clearing house for information, and organise a "pool" of scientific workers. The annual cost of such a service is estimated at £175,000.

Smokeless Fuel

The directors of Low Temperature Carbonisation, Ltd., announce the successful completion and lighting up of the first of five batteries of retorts for the large-scale commercial production of "Coalite" smokeless fuel. When the remaining batteries are completed, there will be a plant of four batteries in day and night operation and one in reserve, with a throughput of 200 tons of coal per day. The estimated weekly output, based on the report of the Government Fuel Research Board issued in 1924 (since when the plant has been greatly improved and modernised) is:—"Coalite" smokeless fuel, 1020 tons; motor spirit, 1820 gals.; oils for lighting, burning,

lubricating, etc., 26,500 gals.; sulphate of ammonia, 20,000 lb.; and rich gas, 7,000,000 cb. ft.

Iron in Newfoundland

The iron mine at Snow's Pond, Conception Bay, Newfoundland, which has not been operated for several years, has been recently examined by experts, and it is understood that diamond drilling will be undertaken at once with a view to a further and more extensive development and operating at an early date. It is reported that the mine has been sold to Henry Ford, the motor-car manufacturer, Detroit, who will export the ore to the United States.

Steel Subsidy in S. Africa

A Bill has been introduced in the House of Assembly to promote the development of S. African iron and steel industries, under which a South African Iron and Steel Industrial Corporation will be formed with a capital of £3,500,000, and with a directorate of nine, five of whom would be Government nominees, for the acquisition of rights relating to the production or treatment of iron and steel, prospecting for deposits, and similar purposes. The Corporation's capital will consist of 2,000,000 ordinary £1 shares, of which the Government will take 500,000, the remainder being offered for public subscription. In addition, 1,500,000 £1 preference shares will also be offered for public subscription. An interesting provision of the Bill is that the requirements of the South African railways, in iron and steel, shall be bought from the Corporation at a price not more than 10% above the cost of the imported article. At present the Union Steel Corporation is the only company in the Union which is producing profitably, not only from scrap, but also from native ore.

German Exhibition of Chemical Apparatus and Plant

The fifth German exhibition of chemical apparatus and appliances will take place from June 7 to 19, at Essen, simultaneously with the conference of the "Verein Deutscher Chemiker" (Association of German Chemists). This is not the first occasion upon which the "Verein" has made public exhibits, as exhibitions have been held previously at Hanover, Stuttgart, Hamburg and Nuremberg under the name of "Achema." The name "Achema" is a combination of the initial letters of the "Ausstellung für chemisches Apparate-Wesen" (Exhibition of chemical apparatus, appliances, etc.). The important character of this trade exhibition, which is above all an exhibition for serious students of chemistry, is shown by the connexion which it has with the conference of the "Verein," which consists of four-fifths of the chemists in Germany, representing 10,000 members. Apart from the problems of chemical apparatus in general which arise from science and practice, apparatus for the chemical treatment of carbon will have special attention. The offices of the "Achema" are at Seelze (Hannover), to which all communications should be addressed.

Benzole Recovery in France

Recent decrees order the installation at the Grenoble, Mulhouse, and Bourbonnais gas-works of the Cie Genevoise de l'Industrie du Gaz and the Société les Compagnies réunies de Gaz et d'Electricité of plant to strip town gas completely of benzole. The work must be carried out within a period of two years.

REVIEWS

THE MICROBIOLOGY OF CELLULOSE, HEMICELLULOSES, PECTIN AND GUMS. By A. C. THAYSEN and H. J. BUNKER. Pp. viii + 363. London: Humphrey Milford, Oxford University Press, 1927. Price 25s. net.

The subject of the present volume has assumed considerable importance in recent years, both from the purely scientific and the industrial view-points. The authors have endeavoured to present, in a convenient form, an ordered survey of our present knowledge of the microbiology of polysaccharides, drawing freely on the mass of literature which has grown round their subject.

The book is divided into four sections, of which the first deals chiefly with the occurrence and properties of the various polysaccharides etc. under consideration. Whilst admitting the difficulties involved in an attempt to give a brief summary of the chemistry of these substances, the biochemist cannot but feel some slight disappointment on reading this section. Cellulose is summarily, but efficiently dealt with in some three or four pages, but in the case of pectin, hemicelluloses, etc., the more recent work has not been included, and some of the earlier work is misquoted (see especially pp. 11-12).

The second section deals with the classification and description of the various types of micro-organism associated with the decomposition of cellulose etc. This section gives a complete account of the occurrence and morphology of these organisms, contains a wealth of practical detail, and should be of considerable use to the worker in this field.

In the third section, the actual processes of decomposition effected by the organisms are described. The more recent work on the retting of flax is ably discussed; succeeding chapters are devoted to the microbiological decomposition of hemicelluloses and cellulose. The damage effected by micro-organisms to cellulose fibres and fabrics is a matter of grave economic concern; the chapter on this subject, and the ensuing one concerned with wood and wood pulp, is of great interest, and describes a field of research in which the authors have had much personal experience, as is evinced by considerable practical detail.

The book concludes with a short, perhaps too short, section on the industrial applications of microbiological reactions, including a very brief reference to the problem of the production of power alcohol.

Abundant references are given at the conclusion of each chapter. The format of the book is good; it is free from typographical errors, and the illustrations, mostly photomicrographs, are excellent. It should prove a very useful addition to the library of the biologist, bacteriologist and the biological chemist.

F. W. NORRIS

CHEMICAL ENGINEERING AND CHEMICAL CATALOGUE. Edited by Dr. D. M. NEWITT, A.I.Chem.E. Third edition. Pp. 404. London: Leonard Hill, 1927. Annual subscription, 10s. 6d.

Further improvement is to be remarked in the new, third edition of this useful catalogue, which appears to gain in scope every year, whilst losing nothing of its

lucidity. A foreword is contributed by Sir Robert Hadfield, then follow the separate catalogues of chemical products, and of plant and equipment. These sections consist of illustrated descriptions of the products of various firms in alphabetical order. Next come the classified index of chemicals and plant, a valuable list of trade marks and trade names, an index to industrial applications, a useful selection of technical and scientific tables and data, and a section giving a list of scientific and technical books.

The new matter consists of the list of trade names and the bibliography of technical books, whilst new tables and technical data have been added, the main index has been recast and enlarged, and the list of industrial applications has also been enlarged.

One regrets to note that the classified index has been moved from its former place at the beginning to a less convenient position. To demand absolute completeness in such a work would be unreasonable, but the classified index, already comprehensive in previous editions, has been considerably augmented, and has further gained in utility. Special commendation should be given to the list of industrial applications of various chemical products, and to the bibliography of technical books. The Catalogue can be safely recommended to all who are concerned with the sources and uses of chemical products and plant.

GMELIN'S HANDBUCH DER ANORGANISCHEN CHEMIE. Eighth completely new and revised edition. Edited by R. J. Meyer and Collaborators. System No. 5. Fluor. Pp. xvi+86. System No. 13. Bor. Pp. xix+142. Leipzig and Berlin: Verlag Chemie, G.m.b.H., 1926. Published by the Deutsche Chemische Gesellschaft. Price: (1) subscription, 11 m.; published, 18.50 m., post free. (2) Subscription, 17 m.; published, 22 m., post free.

Gmelin's Handbuch is so well known as a work of reference that it is needless to commend to chemists the parts now issued. They constitute a very complete and well-arranged account of the known chemistry of fluorine and boron, and will be of great service to all chemists whose work or interest lies in this field. It is, of course, impossible to test such works completely, but examining them by sampling, the writer has found that, with reference to those matters with the literature of which he is thoroughly familiar, the new Gmelin gives a complete and just account of the known facts. Hence, clearly, it may be inferred that, as a whole, these books are exhaustive and trustworthy.

One of the most striking impressions left by a perusal of these volumes is how scanty is our knowledge of the chemistry of fluorine. Of the 86 pages devoted thereto, about 25 are occupied by an exhaustive list of formulæ of complex fluorides, oxyfluorides, etc., with references; so that, apart from such compounds, a very full account of fluorine (18 pages, for example, being devoted to the preparation and properties of the element) occupies a surprisingly small space.

Chemists generally will welcome these volumes, and will feel themselves indebted to the authors for an extremely useful contribution to chemical literature.

H. V. A. BRISCOE

PARLIAMENTARY NEWS

British Industries Fair, 1928

Sir Burton Chadwick informed Mr. Hannon that the British Industries Fair would be held as usual next year in London and Birmingham, from February 20 to March 2. Forms of application for space in the respective sections will shortly be issued by the Department of Overseas Trade and the Birmingham Fair authorities, and preliminary arrangements had been made for publicity overseas. In view of the great success of the last Fair, a considerable increase in the number of exhibitors was expected, and arrangements were being made for the provision of a larger exhibiting area at both London and Birmingham.—May 23.

Chemistry and Physics (Courses for Lecturers)

In reply to Mr. Rennie Smith, Lord E. Percy said that from information in his possession he did not think that there was a demand among lecturers in technical institutions for short refresher courses of an advanced character in chemistry and physics. Lecturers in such institutions had ample opportunities, e.g., through membership of learned societies, of keeping in touch with scientific progress.—May 23.

Reparation Dyestuffs

Mr. McNeill informed Sir F. Wise that there have been no deliveries of reparation dyestuffs to this country during the year to March 31, 1927. The value of the deliveries of reparation dyestuffs to other Powers was 15,774,127 gold marks, or £773,243. — May 25.

COMPANY NEWS

BELL'S UNITED ASBESTOS CO., LTD.

At an extraordinary general meeting held on May 30, resolutions were passed to increase the capital of the company from £100,000 to £750,000 by the creation of 190,000 new preference shares of £1 each and 160,000 new ordinary shares of £1 each, and to alter the articles of association relating to the borrowing powers of the company. The funds thus raised will be used in connexion with the business of one of the associated companies—Bell's Poilite and Everite Co., Ltd., which, owing to an increasing turnover, requires additional working capital. Further funds are also required by the Poilite Co. to replace expenditure on buildings and plant—now practically completed—at the Harefield factory for the manufacture of poilite and rubber tiles. It is also expected that it will shortly be in a position to manufacture another new product, namely, asbestos-cement pipes for water mains etc., which possess advantages over cast iron and other pipes for similar purposes, the asbestos-cement pipes being free from the corrosive and vegetable growths so common in water mains. Arrangements have been made for Bell's United Asbestos Co. to acquire 100,000 preferred ordinary shares of £1 each in the Poilite Co., thus bringing its holding in this company up to £390,007, or over 76% of its total issued share capital, in addition to holding £125,500, or over 83% of the outstanding debentures.

BOOTS PURE DRUG CO., LTD.

Trading profits for the year to March, 1927, amounted to £789,570, compared with £850,228 for 1926, the net

profits amounting to £641,733, against £688,473. Preference dividends absorbed £96,750 (same), and £150,000 was again placed to reserve. After allocating £100,000 to a works development fund, and maintaining the dividend on the ordinary shares at 24%, the sum of £169,334 was carried forward, compared with £234,351 brought in.

BAKER PERKINS, LTD.

The net profit for 1926 was £63,722, compared with £61,965 for 1925. A final dividend has been recommended of 5%, making 9%, tax free.

BRITISH COTTON AND WOOL DYERS' ASSOCIATION, LTD.

The twenty-eighth ordinary general meeting was held on May 26, Mr. Adolph Hoegger (chairman) presiding. He expressed regret at the retirement, through ill-health, of Mr. C. R. Hindley from his position as a managing director since the inception of the Association and vice-chairman since 1909. Mr. C. R. Hindley will still retain his position as a director and vice-chairman. He also deeply regretted the deaths of Mr. T. B. Stewart the late manager of the Turnbulls, Ltd., branch, and of Dr. Adolph Liebmann, their consulting chemist. The net profits for the year to March 31, 1927, amounted to £81,805, compared with £142,349 in 1926. The sum of £25,000 was transferred to depreciation fund (now standing at £290,000); reserve received £20,000, and employees' benefit fund £5000. A dividend was declared of 5% on the ordinary shares, and £27,275 was carried forward. These results, though disappointing, were undeniable proof of the company's continued efforts in perfecting plant, processing methods, machinery, and the organisation generally. As a result of the coal-strike, an extra amount of £65,116 had been paid for fuel. The continual drop in processing prices had also to be taken into consideration. Referring to the company's interest in the Nuera Art-Silk Co., Ltd., the chairman said that Mr. F. J. Smith had been elected vice-chairman to the Nuera Co., and it was hoped that by such a close co-operation between the makers and the users of artificial silk, both companies would ultimately benefit materially. The dyestuffs industry in this country was now in a better position than it had been at any other time. During the past year many dyestuffs not hitherto made here had been produced by various British firms, most of these being "fast colours," including vat dyes, chrome mordant colours, and acid alizarine colours. There existed much uncertainty as to the term "fastness." A colour might be very fast to light, but not to washing or bleaching, or *vice versa*, and in order to deal with this question, a special Fastness Committee had been formed by the Society of Dyers and Colourists, in conjunction with British Textile Research Associations. The outstanding feature of the colour industry during the year was the formation of Imperial Chemical Industries, Ltd., of which the British Dyestuffs Corporation, Ltd., forms a part. Although British colour-users were still paying higher prices for dyestuffs than their foreign competitors, reductions in price were gradually and continually being made. With the recent consolidation of interests there seems every prospect of still further reductions, and of the British dyestuffs industry being placed on a solid foundation and becoming a real success.

PINCHIN, JOHNSON AND CO., LTD.

The usual dividend has been announced on the preference shares at 6½% per annum, less tax, for the six months to June 30, payable on July 1.

NATIONAL DRUG AND CHEMICAL CO., LTD.

The net profit for the year ending January 31, 1927 was £13,208, which, with income from investments in other companies, makes £23,030, which compares with a profit of £9069 for the previous year, and a loss of £6858 for the year 1924—25.

TURNER AND NEWALL, LTD.

This Rochdale firm of manufacturers of asbestos goods etc. has declared an interim dividend of 2½%, being the same as for the previous year.

ENGLISH CHINA CLAYS, LTD.

The eighth annual general meeting, held on April 26, was presided over by the chairman and managing director, Mr. R. Martin. The net profit for 1926 was £57,621, compared with £83,019 for 1925, and with £11,175 brought in, there was an available balance of £68,797. After payment of the preference dividends and an interim dividend of 2% on the ordinary shares, the sum of £22,084 remained, from which it is proposed to pay a final dividend of 1%, making 3%, on the ordinary shares, leaving £9395 to be carried forward. The general strike and the coal strike were the main causes of the decline in profits, the effect of which would still be felt in the early part of this year. Another cause was the failure of the negotiations for the formation of an association of china clay producers, followed by a further drop in the prices of the lower-grade clays. Satisfactory expansion had taken place in exports to America, India, Germany, the Netherlands, Belgium, Finland and Sweden, and the home market had absorbed more than could have been reasonably expected. Consumption in France, Italy and Spain showed a slight reduction. Improvements and extensions had been made at the various works of the company during the year, and soon practically the whole of the uneconomical plant would have been eliminated and the works equipped with up-to-date machinery. Since December, 1926, the company had acquired the whole of the shares of the North Goonbarrow China Clay Co., Ltd., and the directors were satisfied it would prove a great asset to the company. Mr. Hart Nicholls, sole managing director of the North Goonbarrow Co., had joined the board of the company. The chairman thought that 1927 would prove a more prosperous year than 1926. The import duty on translucent pottery should give a much-needed fillip to the home pottery trade.

NUERA ART-SILK CO., LTD.

The first ordinary general meeting was held on March 17, Sir James W. Paton, J.P., presiding. Reference was made to the loss to the company, through illness, of the services of Mr. H. O. Brandt, who was the first chairman. The company had purchased a site at Sutton Oak, near St. Helens, Lancashire, comprising about 20 acres, and including valuable water rights and reservoirs, for less than £20,000. Rapid progress was now being made in the erection of the factory, and temporary use had been made of some of the existing

buildings, in which the company had installed an experimental plant of considerable magnitude, which had been producing a very satisfactory silk and staple fibre on a semi-commercial scale during the last three months. A separate research department had been established, equipped with machinery and apparatus specially designed for the purpose of investigating and working out new processes. In this connexion, about a year ago, the company acquired an exclusive option on certain patents for the manufacture of new artificial silks and similar products, and these processes were now being investigated in co-operation with Messrs. Courtaulds, in this country, and the Vereinigte Glanzstoff Fabriken on the Continent. These processes were still in the experimental stage, but if they ultimately proved a commercial success, the company's share in the production of the new products would be very considerable. Dr. Herbert Levinstein and Mr. J. B. Walker were re-elected directors.

VISCOSE DEVELOPMENT CO., LTD.

The net profit for 1926 was £3478, making available, with £375 brought forward, £3852. A dividend has been declared of 3% (against 7½% for 1925). £1309 has been placed to reserve, and £144 carried forward.

CELANESE CORPORATION OF AMERICA

A dividend has been declared of 7% on the 7% cumulative first participating preferred stock, 3½% being on account of six months' arrears to June 30, 1925.

VEREINIGTE GLANZSTOFF GES.

The report for the past business year shows a net profit of 6,980,000 marks, as against 5,960,000 marks for the previous year. The total receipts amounted to 14,340,000 marks, or 1,680,000 marks more than in 1925, of which receipts from the manufacturers accounted for 12,190,000 marks. Expenses and taxation increased by 1,160,000 marks to 4,460,000 marks, 2,890,000 marks were applied to various settlements, and 147,238 marks were carried forward. A dividend has been paid of 15%. The report states that the situation improved during the second half of the year owing to the German price convention and international agreements, especially with the Italian firms. The Glanzstoff-Courtauld undertaking will begin production in the autumn, whilst the American Bemberg Corporation has already been working for several months, and the Aceta Company has already begun work. The patent for the "Airsilk" process, which was acquired last June by the Glanzstoff Company, has been handed over to the German Celta Company. Last year the company mainly developed the German and international participations, the total value of which now exceeds the value of the company's own plants. The participation account now amounts to 20,740,000 marks, having increased from 15,000,000 in 1925, the increase being mainly due to the purchase of shares of the Snia Viscosa, as well as the taking over of the Enka Company by the Glanzstoff Company. The report states that the works at present are fully occupied, and that the company anticipates good results in future, especially with regard to the co-operation with the foreign companies.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep. —6s. —6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor. 9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 8½d.—9d. per lb. Crude 60's, 2s. 6d. 2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d. 1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 8d.—2s. 3d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 9d.—2s. 0½d. per gal. Pure, 1s. 10d.—2s. 3½d. per gal.
 Xylol.—1s. 11d.—2s. 4d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24%—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/100, 1s. 2d.—1s. 11d. per gal. Solvent 95/100, 1s. 6d.—1s. 7d. per gal. Solvent 90/190, 1s. 3d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—70s.—80s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 3d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d.—8d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4½d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum 1s. 3d. per oz.; 500 oz. lots.—1s. per oz.
 Acid, Boric B.P.—Cryst. £41 per ton. Powder £45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. p r lb.
 Acid, Citric.—1s. 6d.—1s. 7½d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 3½d.—1s. 5½d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzophenanthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal £24 per ton, Powder £25 per ton, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 5d. per lb. Potassium.—1s. 1d.—2s. per lb. Sodium.—2s. 1d.—2s. 3d. per lb. All spot.

Calcium Lactate.—1s. 2½d.—1s. 4½d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ether moth.—1s. 1d.—1s. 1½d., per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiaac Carbonate.—6s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—22s. per cwt., 112 lb. lots.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 3d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb.; Detached cryst., 14s. 6d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonol.—11s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. per lb.

Phenazone.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar. 100s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 5d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C.; 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 2d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonol.—7s. 6d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.

Thymol, Puriss.—10s. 3d.—12s. per lb., according to quantity.

Natural.—12s. 6d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (*ex Anethole*).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.

Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.

Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. 6d. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—8s. 9d. per lb.

Ethyl Cinnamate.—10s. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—9s. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 6d. per lb. Vanilin.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—14s. 9d. per lb.

Camphor.—67s. 6d. per cwt. Cananga, Java, 20s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 1d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure.—6s. per lb.

Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—8s. 3d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 17s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than July 23rd. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on June 9th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Baillie and Todd. Heat insulation. 13,412. May 18.

Chem. Fabr. vorm. Schering. Manufacture of colourless melted products. 13,638. May 20. (Ger., 18.6.26.)

Dörstling. Roller mills. 13,363. May 18.

Filtrators, Ltd., and Saks. 13,385. See XXIII.

Fowler, and Fowler & Co. (Leeds), Ltd. Mixing-machines. 13,192. May 17.
 (Gordon. 13,269—70. See XXIII.)
 Harris. Filtration media. 13,288. May 17.
 Huhn. Drying or cooling material. 13,279. May 17.
 I.-G. Farbenind. Manufacture of emulsifying etc. agents. 13,273. May 17. (Ger., 19.5.26.)
 Menager. Manufacture of porous material. 13,585. May 20.
 Rein. Filtering systems. 13,168. May 17.

I.—Complete Specifications

5283 (1926). Ges. f. Linde's Eismaschinen. Separation of gases. (248,377.)
 12,303 (1926). Siemens Bros. & Co., Ltd., and Salmon. Optical pyrometers. (270,901.)
 3556 (1927). Goldman. Mixing and agitating machines. (267,480.)
 *28,069 (1926). Mase. Continuously determining a constituent of a mixture of gases. (271,027.)

II.—Applications

Battig. Production of hydrogen. 13,389. May 18. (Ger., 20.5.26.) Producing hydrogen in fractionation of furnace gases. 13,528. May 19. (Ger., 20.5.26.)
 Feige. Production and conversion of oils. 13,267. May 17. (Ger., 19.5.26.)
 I.-G. Farbenind. Production of liquid hydrocarbons etc. from natural ores etc. 13,508. May 19. Manufacture of valuable products from coal etc. 13,601. May 20. (Ger., 1.6.26.)
 Johnson (I.-G. Farbenind.). Splitting hydrocarbons. 13,101. May 10.
 Laing and Nielsen. Distillation of carbonaceous materials. 13,410. May 18.
 Sandiford. Composition fuel. 13,225. May 17.
 Sunderland. Artificial fuel. 13,305. May 18.

II.—Complete Specifications

28,548 (1925). Meyer. Fuels for internal-combustion engines. (270,772.)
 6231 (1926). Holmes & Co., Ltd., Parker, and Henshaw. Separation of tar and ammonia from fuel gases. (270,852.)
 6417 (1926). Litharge Recovery Corp. Separating metallic base reaction products from other derivatives in treatment of hydrocarbon oils. (263,730.)
 18,159 (1926). Debauche. Apparatus for drying and distilling lignite, peat, etc. (270,921.)
 20,942 (1926). La Riboisiere. Motor fuels. (257,613.)
 23,930 (1926). Bowater. Manufacture of water-gas. (270,948.)
 30,214 (1926). Debauche. Transforming lignite etc. into fuel of high calorific value. (270,976.)
 444 (1927). International Combustion Engineering Corp. Treatment of coal. (264,160.)
 6419 (1927). Deutsche Erdöl-A.-G., and Bomecke. Gas-purifying apparatus. (271,018.)
 *6878 (1927). A.-G. f. Chem. Ind. Converting high-boiling hydrocarbons into low-boiling hydrocarbons. (271,042.)

III.—Application

Still. Recovering sulphuric acid from acid-tar of benzol purification. 13,122. May 16. (Ger., 20.9.26.)

III.—Complete Specification

6231 (1926). Holmes & Co., Ltd., Parker, and Henshaw. See II.

IV.—Applications

British Dyestuffs Corp., and Wellacott. Dyestuffs for dyeing cellulose ethers etc. 13,401. May 18.
 I.-G. Farbenind. Production of anthraquinone derivatives. 13,509. May 19. (Ger., 8.6.26.)
 Johnson (I.-G. Farbenind.). Manufacture of complex metallic compounds of α -hydroxyazo dyestuffs. 13,602. May 20.

IV.—Complete Specifications

30,908 (1925). Badische Anilin & Soda Fabr. Manufacture of anthraquinone derivatives. (244,462.)
 789 (1926). British Dyestuffs Corp., Shepherdson, Tatum, and Bunbury. Manufacture of anthraquinone intermediates. (270,778.)
 790 (1926). British Dyestuffs Corp., and Tatum. Manufacture of anthraquinone intermediates. (270,779.)
 5421 (1926). Imray (I.-G. Farbenind.). Manufacture of anthraquinone derivatives. (270,840.)
 10,781 (1926). I.-G. Farbenind. Manufacture of water-soluble condensation products. (251,294.)
 20,688 (1926). British Dyestuffs Corp., Rodd, and Everatt. See XX.
 22,146 (1926). Soc. Chem. Ind. in Basle. Manufacture and application of dyestuffs. (258,854.)
 9388 (1927). British Dyestuffs Corp., Shepherdson, Tatum, and Bunbury. Manufacture of anthraquinone intermediates. (271,023.)
 *12,068 (1927). I.-G. Farbenind. See VI.

V.—Applications

Carpmael (I.-G. Farbenind.). Protecting wool etc. against insects. 13,374. May 18.
 Craven, and Yorks Dyeware & Chem. Co. Treatment of wool. 13,402. May 18.
 Kantawala. Manufacture of wool substitutes. 13,084. May 16.

V.—Complete Specification

*26,772 (1926). Böhm. Preparation of animal hair for felting. (271,026.)

VI.—Applications

British Dyestuffs Corp., and Wellacott. 13,401. See IV.
 Heberlein & Co. Producing pattern effects on textiles. 13,123. May 16. (Ger., 25.5.26.)

VI.—Complete Specifications

10,095 (1926). British Dyestuffs Corp., Baddiley, Chorley, and Brightman. Dyeing artificial silk. (270,883.)
 22,146 (1926). Soc. Chem. Ind. in Basle. See IV.
 *12,668 (1927). I.-G. Farbenind. Production of azo-dyestuffs on weighted silk. (271,089.)

VII.—Applications

Battig. 13,389 and 13,528. See II.
 Carpmael (I.-G. Farbenind.). Absorbing ammonia etc. from gases. 13,272. May 17.
 Castner-Kellner Alkali Co., Ltd., Moore, and Polack. Manufacture of ammonium chloride. 13,318—9. May 18.
 Haddan (Stackable). Manufacture of dicalcium phosphate etc. 13,488. May 19.
 Müller. Production of synthetic ammonia. 13,388. May 18. (Ger., 19.5.26.)
 Still. 13,122. See III.
 Synthetic Ammonia & Nitrates, Ltd., and Ewan. Production of hydrocyanic acid from formamide. 13,650. May 21.
 Weitz. Separation of alkali salts. 13,626. May 20. (Ger., 26.5.26.)

VII.—Complete Specifications

31,321 (1925). Petersen. Manufacturing sulphuric acid. (244,764.)
 4448 (1926). Marks (Parker Rust Proof Co.). Production of high-acid phosphates. (270,820.)
 4600 (1926). Packards & J. Fison (Thetford), Ltd., and Maudsley. Sulphuric acid chambers. (270,826.)
 6231 (1926). Holmes & Co., Ltd., Parker, and Henshaw. See II.
 31,880—1 (1926). Petersen. Manufacture of sulphuric acid. (270,988—9.)
 5019 (1926). Johnson (I.-G. Farbenind.). Manufacture of hydrated chromic chloride. (271,016.)

*12,656 (1927). Titan Co. Akt. Manufacture of titanium compounds. (271,085.)

VIII.—Applications

British Thomson-Houston Co., Ltd. Tinting glass. 13,372. May 18. (U.S., 18.5.26.) Heat-resistant compounds. 13,596. May 20. (U.S., 20.5.26.)

Menager. 13,585. See I.

Migeot Frères et Arnould. Enamels. 13,492. May 19. (Fr., 26.6.26.)

Pittsburgh Plate Glass Co. Leers. 13,380. May 18. (U.S., 29.7.26.)

Vitreux Co. Clay products etc. 13,149. May 16. (U.S., 22.6.26.)

IX. Application

Verein. Stahlwerke A.-G. Building material. 13,237. May 17. (Ger., 22.5.26.)

IX. Complete Specifications

30,882 (1926). I.-G. Farbenind. Production of cements. (263,124.)

3906 (1927). Chassevent. Tempering plaster. (266,335.)

*12,949 (1927). Harnisch. Manufacture of artificial stone. (271,108.)

X. Applications

Carlisle and Silva. Production of steel etc. from titaniferous ores etc. 13,411. May 18.

Farrbrother (Remfry & Son). Granulating etc. aluminium. 13,130. May 16.

Jackson (Siemens & Halske A.-G.). Treatment of metals. 13,710. May 21.

Morris Motors (1926). Ltd., and Smart. Case-hardening etc. iron etc. 13,713. May 21.

Smith. Treatment of ores containing platinum. 13,719. May 21.

Soc. Ital. di Elettrochimica, and Verney. Production of aluminium in electric furnaces. 13,500. May 19.

X. Complete Specifications

28,593 (1925). Lacour and Lindh. Tough annealing of metal alloys. (243,006.)

3867 (1926). Michel. Protection of molten baths of easily oxidisable metals. (257,221.)

4525 (1926). Fairweather (Etabl. Métallurgiques de la Gironde). Light aluminium alloys. (270,824.)

8264 (1926). Cornelius. Producing dense iron and iron alloys directly from oxide ores. (252,077.)

30,976 (1926). Limbourg. Substitute for platinum. (270,974.)

*12,662 (1927). Bührmann. Superheating blast-furnace and cupola-furnace slag. (271,087.)

*12,665 (1927). Michel. Metallurgy of readily oxidisable metals such as magnesium. (271,088.)

XI.—Applications

Bedford. Electric accumulators. 13,570. May 20.

Codd. Galvanic batteries. 13,375. May 18.

Comp. Franç. pour l'Exploit. des Proc. Thomson Houston. Electric dry cells etc. 13,544. May 19. (Fr., 19.5.26.)

Electric Furnace Co. (Northrup). Electric furnaces. 13,708. May 21.

Soc. Ital. di Elettrochimica, and Verney. 13,500. See X.

XI.—Complete Specifications

11,081 (1926). Lahousse. Electric insulating material. (251,970.)

27,829 (1926). I.-G. Farbenind. Mounting electrodes of closed electric furnaces. (263,756.)

*7311 (1927). Pechkranz. Electrolyser diaphragms of the filter-press type. (271,043.)

*12,932 (1927). Siemens & Halske A.-G. Electromagnetic bodies. (271,106.)

XII.—Application

I.-G. Farbenind. Soap preparations etc. 13,099. May 16.

XII.—Complete Specification

*12,295 (1927). I.-G. Farbenind. Manufacture of soap-like preparations. (271,071.)

XIII.—Complete Specifications

4553 (1926). Bakelite Ges. Purification of condensation products from phenols and aldehydes. (248,726.)

21,872 (1926). Marconi's Wireless Telegraph Co. Writing-fluids. (257,954.)

*2594 (1927). Kunstharzfabr. Pollak. Manufacture of artificial compositions. (271,037.)

XIV.—Application

I.-G. Farbenind. Preserving rubber latex. 13,366. May 18. (Ger., 28.5.26.)

XIV.—Complete Specification

5196 (1926). Anode Rubber Co., Ltd. Production of homogeneous rubber deposits from rubber latex. (257,885.)

XV.—Application

Herold A.-G., and Jaeger. Manufacture of white artificial horn. 13,260. May 17.

XVI.—Applications

I.-G. Farbenind. Fungicide. 13,370. May 18. (Ger., 18.5.26.) Production of fertilisers. 13,700. May 21.

Read. Production of fertilisers. 13,649. May 21.

XVI.—Complete Specification

25,871 (1926). Cerasoli. Fertilisers. (270,957.)

XVII.—Complete Specifications

4474 (1926). Ackers. Manufacture of icing sugar. (270,822.)

*12,183 (1927). Treuhand-Ges. Bartmann & Co. Treatment of materials containing starch. (271,068.)

XVIII.—Complete Specifications

28,318 (1925). Jansen. Fermentation of sugar and production of yeast. (270,770.)

5393 (1926). Commercial Solvents Corp. Fermentation processes for the production of butyl alcohol and acetone. (249,833.)

XIX.—Applications

Brighthouse. Concentrating fish. 13,051. May 16.

Miles and Reilly. Preparation of vegetable food. 13,141. May 16.

Stejskal. Preparation of a nutrient medium. 13,264. May 17. (Austria, 17.5.26.)

Zierer. Preparation of a mild aromatic yoghurt-curdled milk. 13,504. May 19. (Austria, 9.6.26.)

XIX.—Complete Specifications

804 (1926). Loon. Treating meal, flour, etc. with per-compounds. (245,801.)

*13,264 (1927). Stejskal. Preparation of a nutrient medium. (271,120.)

XX.—Applications

Arnold (Standard Development Co.). Manufacture of metallo-organic compounds. 13,723. May 21.

Chem. Fabr. vorm. Schering. Obtaining germ gland hormones. 13,531. May 19. (Ger., 20.5.26.)

Erslev. Preparing aqueous solutions of benzoic acid. 13,423. May 19.

I.-G. Farbenind. Manufacture of acid derivatives of the $\alpha\alpha'$ -dimethyl- γ -hydroxypiperidine- β -carboxylic acid esters. 13,124. May 16. (Ger., 17.5.26.)

XX.—Complete Specifications

917 (1926). Buchner. Cyclic process of producing soluble salts of organic compounds of an acid character. (246,142.)

4194 (1926). British Celanese, Ltd., and Skertchly. Purification of acetic anhydride. (270,809.)

5393 (1926). Commercial Solvents Corp. See XVIII.

16,840 (1926). Carbide & Carbon Chemicals Cor
Manufacture of glycols. (264,124.)

20,688 (1926). British Dyestuffs Corp., Rodd, and Everatt.
Separation of tertiary from secondary and primary amines.
(270,930.)

29,842 (1926). I.-G. Farbenind. Catalytic dehydrogena-
tions. (262,120.)

*7541 (1927). Holzverkohlungs-Industrie A.-G. (Concen-
trating volatile aliphatic acids. (271,044.)

*12,907 (1927). Consort. f. Elektrochem. Ind. Manu-
facture of butyric aldehyde. (271,103.)

XXI.—Applications.

Bernet. Producing light-sensitive films. 13,631. May
20. (Switz., 21.5.26.)

Berthon. Reproducing photographic prints. 13,632. May
20. (Fr., 1.6.26.)

I.-G. Farbenind. Photographic emulsions. 13,274. May
17. (Ger., 20.5.26.)

XXI.—Complete Specifications

5372 (1927). I.-G. Farbenind. Photographic silver halide
emulsions. (271,039.)

*12,935 (1927). Chem. Fabr. (vorm. Schering.). Photo-
graphic gelatin papers. (271,107.)

XXIII.—Applications

Filtrators, Ltd., and Saks. Treatment of feed water.
13,385. May 18.

Gordon. Process for conditioning etc. water. 13,269 - 70.
May 17.

XXIII.—Complete Specification

*12,542 (1927). Bourgognion and Philips. Treatment of
water. (271,079.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and
Intelligence), 35, Old Queen Street, London, S.W., has
received the following inquiries for British goods. British
firms may obtain further information by applying to
the Department and stating the specific reference
number: *Argentina*: Glassware, articles for domestic
cleaning and polishing (551). *Australia*: Perfumes, soaps
(517); Hollowware, glassware (520); Instrument
equipment for boiler house and turbine room (B.X. 3531).
Austria: Iron ore, smelted aluminium and nickel
(528). *British India*: Pig-iron, creosote, paper (Director-
General, India Store Department, Branch No. 10,
Belvedere Road, Lambeth, S.E.1). *Czechoslovakia*: Tin,
lead, antimony, phosphor copper (A.X. 4734). *Dominican
Republic*: Galvanised iron sheets, chinaware, lard, soya
bean oil (552). *Egypt*: Iron and steel, metals (A.X. 4723).
Germany: Dyes, paint, varnish, chemical products
(530). *Holland*: Chemicals (acids, dyes, sulphate of
ammonia, etc.) (532). *Italy*: Non-ferrous metals and
ferro alloys (536). *New Zealand*: Aluminium hollow-
ware (526); electric insulators (B.X. 3533). *Norway*:
Gum arabic, sole crepe rubber (541). *Rumania*: Palm
oil, tallow (542). *Uruguay*: High-tension cables
(B.X. 3539).

British Industries Fair

Larger exhibition areas in both London and Birming-
ham are to be provided for next year's British Industries
Fair, according to an answer given recently in the
House of Commons (on Monday, May 23) by the Parlia-
mentary Secretary to the Board of Trade (Sir Burton
Chadwick, M.P.). The Fair, it was stated, would be

held from February 20 to March 2. Forms of application
for space in the respective sections would shortly be
issued by the Department of Overseas Trade and the
Birmingham Fair authorities, and preliminary arrange-
ments had been made for publicity overseas. In view
of the great success of the last Fair, a considerable
increase in the number of exhibitors is expected by the
Board of Trade.

Imported Petroleum

The Board of Trade has exempted petroleum and its
liquid products from the requirement that imported
goods bearing a British name or trade mark must be
accompanied by an indication of origin.

Safeguarding of Industries Act

Cadmium mass (consisting substantially of finely-
divided metallic cadmium and iron partially oxidised)
has been exempted from the duty imposed by Part 1
of the Safeguarding of Industries Act in respect of its
content of cadmium hydroxide.

The British Chemical and Dyestuffs Traders' Associa-
tion, Ltd., have been advised by the Board of Trade
that the Board do not propose to recommend H.M.
Treasury to issue Exemption Orders in respect of
cocaine and cocaine hydrochloride, as they understand a
home-maker is preparing to manufacture these products.
Further, the Board report that the application in respect
of hydroquinone is still under consideration

New Dyestuffs

The British Dyestuffs Corporation, Ltd., has issued
a pattern card illustrating Duranthrene Brilliant Violet
2B Paste. This new vat colour is of special interest
to the dyer of wearing and washing materials, embroi-
dery yarns, etc., because of its shade, excellent fastness
to light, and very good fastness to washing, hot pressing,
and water spotting. It is also used for calico printing,
the prints obtained giving good fastness to washing.

News from Advertisements

The Newcastle and Gateshead Gas Company invite
applications for the position of chief chemist (p. viii).

A technical and analytical chemist, with 20 years
wide industrial experience, wishes partnership in con-
sulting practice at home or abroad (p. viii).

The College of Technology, Manchester, invites appli-
cations for its prospectus, giving particulars of Degree
Courses in Technology (p. viii).

PUBLICATIONS RECEIVED

THE WORLD ECONOMIC CONFERENCE, GENEVA, MAY, 1927.
Final Report, C.E.1.44. Pp. 51. Publications Sales
Department, League of Nations, Geneva (Switzerland).
Price 1s. (\$0.25).

OLD CHEMISTRIES. By Edgar F. Smith. Pp. xi + 89.
London: McGraw-Hill Publishing Co., Ltd., 1927.
Price 12s. 6d.

ORGANIC CHEMISTRY. By F. E. Rice, Ph.D. Pp. ix + 303.
International Chemical Series, edited by H. P. Talbot,
Ph.D., Sc.D. London: McGraw-Hill Publishing Co.,
Ltd., 1927. Price 12s. 6d.

COAL CARBONISATION: HIGH AND LOW TEMPERATURE. A
TREATISE ON THE PRINCIPLES AND PROCESSES OF
MANUFACTURING COKE AND SEMI-COKE. By John
Roberts. Pp. xvi + 406. London: Sir Isaac Pitman
& Sons, Ltd., 1927. Price 25s.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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No. 23

EDITORIAL

Synthetic Aliphatic Chemicals

COMING events are said to cast their shadows before them, but occasionally, in the reported developments in commercial enterprises, we have detected more shadow than substance. This cannot be said, however, of the manufacture of ethylene glycol, ethylene dichloride, isopropyl alcohol and other higher aliphatic alcohols, the production of which has revealed a new and important branch of applied chemical endeavour. From many angles during the past few years we have been watching with interest the progress of research in the field of synthetic aliphatic chemicals, and there would appear to be no doubt now that production upon a large commercial scale has arrived. We are prompted to mention the subject more especially for two reasons. First, as noted in our columns recently, the Board of Trade has given notice that representations have been made under Section 10 (5) of the Finance Act, 1926, regarding the removal of ethylene glycol from the Schedule to Part I of the Safeguarding of Industries Act. Secondly, we recently received and published in our issue of May 20 an illuminating letter from Dr. Weidlem, Director of the Mellon Institute of Industrial Research, U.S.A., dealing with the present position of ethylene glycol.

There can be no doubt that ethylene glycol is being produced to-day in very large quantities—we have seen estimates of its annual production varying from ten to a hundred million pounds, and, at a price of about £110 per ton, it is approaching the battleground of competition with glycerin. Glycol dinitrate is a valuable material for explosives manufacture, and it possesses an important property not common to nitro explosives such as nitroglycerin, in that it confers non-freezing qualities upon the products with which it is incorporated. Glycol effectively replaces glycerin in anti-freeze solutions for the cooling systems of motor-car engines, and extended investigations into its physiological properties have shown that it may replace glycerin in many toilet preparations—materials which provide no incon-

siderable outlet for glycerin supplies. Further, the ethers of ethylene glycol have recently been shown to possess novel characteristics in regard to their use in compounded pyroxylin lacquer solvents, and the potential demand for glycol in this direction is very large.

In many of its uses, then, ethylene glycol appears as a competitor of glycerin, and British producers and exporters of glycerin will be carefully assessing the minimum cost of its production. That this can be brought below £140 per ton, and perhaps as low as the present price of glycerin, seems to be very possible. Ethylene, from which the glycol is made, is obtainable in enormous amounts at a very low cost from the huge resources of natural gas and petroleum cracking still gases available in the United States. By combination with hypochlorous acid, made by a continuous process from water and very low-priced chlorine, ethylene chlorhydrin is made and converted with reasonable ease into the glycol. The rapid progress of the manufacture of glycol and the equally rapid fall in the market price of the product leave little room for doubt that glycerin makers will shortly have a formidable competitor in the field. Glycerin is, however, a by-product of soap manufacture, and its price on the market can undoubtedly be considerably reduced in case of need. A parallel set of circumstances arose when synthetic acetic acid came strongly into the market a few years ago, for wood distillers reduced the price of acetate of lime, and hence of acetic acid, at the expense of methyl alcohol, which at that time was not being made synthetically. The situation in the glycerin market will soon be an interesting one.

Ethylene glycol is not the only important example of synthetic aliphatic chemicals which have recently come to the fore. Leaving out of consideration synthetic methyl alcohol—soon, we hope, to be a British product—there are ethylene dichloride, isopropyl alcohol, still higher homologues of ethyl alcohol and amyl acetate, to mention a few. Here, again, America holds a commanding position by reason of her supplies of natural gas, ethylene, propylene and pentane. From the last-

named, existing in natural gas gasoline, amyl chloride is made and readily transformed into amyl acetate, and so a valuable solvent is produced very cheaply. Similarly, ethylene dichloride is simply made from ethylene, and large amounts are coming on to the market. The first commercial quantities were offered in 1923 at about 1s. 6d. per lb. In 1924 the price was reduced to 1s. per lb., and in 1926 to 5d. To-day, ethylene dichloride can be bought in America in tank car quantities at the amazingly low figure of 3d. per lb. The significance of this fact becomes apparent when we remember that, in addition to its use as a solvent, ethylene dichloride may be made the starting material for the comparatively simple manufacture of such substances as glycol diacetate, ethylene diamine, dibenzyl (made from ethylene dichloride and benzene), benzaldehyde and benzoic acid (from dibenzyl), succinic acid, and so on, whilst many others will suggest themselves to the acute chemical technician.

In this country we are not blessed with immense supplies of natural hydrocarbon gases such as have made possible the production of natural gas carbon or gas black and the aliphatic chemicals noted above as an important American industry, but it is not impossible that other raw materials will be found by British manufacturing chemists. By suitably cracking hydrocarbon oils a gas can be made which contains 50% of ethylene hydrocarbons associated with paraffins and other bodies. Certain oil gases contain ethylene and propylene in approximately equal proportions, and by continuous fractional combination with chlorine or sulphuric acid the chlorhydrins or sulphuric acid esters of corresponding alcohols can be made. In this way we have possible sources of the glycols and alcohols made from very cheap starting material. Much work has already been accomplished, both in the laboratory and the works, upon the technique of the absorption of ethylene and propylene in sulphuric acid, and ethyl alcohol has been made on a works scale—but not at an economic price—from the ethylene existing in coke-oven gas. The commercial development of such a process and similar chlorination processes may only await the advent of cheaper and more abundant starting materials, and cheap oil gas of a suitable composition may provide this. Finally, we may note with satisfaction that solvent alcohols such as isopropyl alcohol and butyl alcohol are already being produced in comparatively large amounts in this country, the first by the hydrogenation of acetone and the second by fermentation processes from the starch of cereals. The world has long known the production of synthetic aromatic chemicals from coal tar. The manufacture of equally important synthetic aliphatic chemicals has already commenced in earnest, and who shall define the limits of its expansion?

The Oil, Colour and Chemical Exhibition

We are fortunate in that we are not old enough to possess personal memories of the days when Hyde Park was converted into the gigantic glasshouse which has taken permanent root in Sydenham. The Prince Consort on his monument remains as a token of those serious Victorian days, when science first became worthy to be

mentioned in polite company, and the distinguished band of 1851 exhibitors provides a tribute to the foresight of those who organised the first great Exhibition. It would be rather a serious disqualification for anyone who had to write about exhibitions but did not remember the Great Exhibition had there not been Wembley, that unequalled picture of the industries and resources of the Empire. We were fortunate in that we did see a great deal of Wembley, though, like everyone else, we were physically unable to see all we would have liked to see. After Wembley there came an impetus towards the provision of specialised exhibitions, and we had the excellent exhibition of chemical plant, arranged by the British Chemical Plant Manufacturers' Association, which was so conspicuous a feature at the last annual meeting of the Society of Chemical Industry; and, of course, we have also each year the splendid Chemical Section of the British Industries Fair, organised by the Association of British Chemical Manufacturers. Now we have another type of exhibition, in which the makers of plant and products have been drawn together, so as to present a picture of the activities of several related industries. This exhibition—the International Oil, Chemical and Colour Trades Exhibition—opens on June 11, and remains in activity during the following week. Judging from the account of the exhibition which we publish this week in a special supplement, there will be no lack of interest to the visitor, be he of commercially or merely of scientific bent. Various firms are showing ingenious devices which fill containers of various kinds with liquids or solids. Weighing machines will be on view which are so conscientious in the performance of their duties that they refuse to work if the operator does not perform one very simple movement correctly. There are mills of every kind, size and form, and the expert will be able to judge how truly cylindrical cylindrical rollers can be made, and discuss the merits of methods of adjusting rolls that work to limits which one associates rather with the microscope. Advocates of the finest grinding will have weary limbs before they have studied all of the many types of machinery devised to grind and dress the most varied substances. Blending is an operation which is equally cared for—one machine is able to blend an ounce of one material perfectly with a hundredweight of another—and there are machines which separate impurities with accuracy and economy. In addition to actual machines, there will be many working models, amongst which we note the interesting Raymond mill. Fullers' earth makes an interesting exhibit, and we shall look forward to an inspection of the many grades which are prepared from material mined in Surrey and Somerset, remembering a visit to a Pompeian "fullonica," excavated from the debris flung by stormy Vesuvius. The exhibit of filter papers reminds one that they have many important industrial uses, apart from forming a medium for calculations in the laboratory. Paints there will be in all their splendour, with enamels, lacquers and, of course, a variety of pigments, solvents, resins, and so on. Prime movers, such as fuel oil engines, will be displayed, and many other interesting exhibits will claim attention.

THE CHARACTERISTICS AND PROPERTIES OF THE MAIN TYPES OF ASBESTOS FIBRES

By J. N. LONGLEY

The name "asbestos" is applied indiscriminately in industry to several classes of fibrous minerals which fall into two main groups:—

1. Serpentine group, of which the principal member is chrysotile, the silky white fibre of commerce.
2. Amphibole group, which includes crocidolite (South African Blue), amosite, tremolite, actinolite, etc.

Of all the minerals comprising these main groups, only two find any important application in modern engineering problems. These, in order of importance, wide distribution and usage are—1. Chrysotile (white); 2. Crocidolite (blue).

The last two members of the amphibole group have attracted a little interest, and are, therefore, also described briefly, as a third, but much less important family, named "Hornblende."

CHRYSOTILE (WHITE)

This family is the one of greatest manufacturing interest, and 90% of the asbestos used in industry belongs to it. It occurs in veins or striations in the mother rock, "serpentine," and is very widely distributed, though quarried mostly in Canada and Rhodesia. The fibres are arranged perpendicularly to the wall of the vein, and are separated in compact masses from the adherent matrix of serpentine by crushing. These masses are resolved, by further crushing, into fibres, elongated crystals, the length of which is as the whole depth of the vein of which they were part. The diameter of each separated fibre appears to be fairly constant at about 1,500,000 in., i.e., about 1/100th of the diameter of the cotton fibre. They are white, silky, and very flexible, and their length may be as low as $\frac{1}{8}$ in., and as high as 5 or 6 in. Under a magnification of 1000 diameters, the fibres appear to be quite smooth, and square in section. The specific gravity of the family ranges from 2.25 to 2.27.

In general, chrysotile is a hydrated magnesium silicate, of the form $3\text{MgO} \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$, but it is seldom free from impurity. Other metals appear to replace partly the magnesium, to form uniform complex hydrated metallic silicates; these other metals are generally aluminium, iron, calcium, sodium and potassium, and their total amount varies but little. Typical analyses are shown in Table 1.

TABLE 1
Analyses of Chrysotile (White) from Various Sources

Type	High Grade Canadian %	Medium Grade Canadian %	Rhodesian Low Grade %	Rhodesian Medium Grade %	Rhodesian High Grade %
Carbonic Anhydride	—	—	3.0	1.81	0.35
Combined Water	15.2	13.15	10.55	11.43	14.42
Silica	39.04	41.66	40.46	42.82	39.59
Alumina	trace	3.42	7.08	2.28	0.24
Iron Oxide (ferric)	0.25	0.41	2.86	2.72	0.28
Iron Oxide (ferrous)	2.10	0.67	0.90	1.13	3.15
Calcium Oxide	0.51	0.83	0.96	—	—
Magnesium Oxide	42.57	33.38	34.04	38.02	41.77
Sulphuric Anhydride	0.10	0.08	trace	—	trace
Alkali and loss	0.23	0.50	0.15	—	0.20

CROCIDOLITE ("SOUTH AFRICAN BLUE")

This type, lavender blue in colour, occurs in banded gneiss in a manner similar to that in which chrysotile

occurs in serpentine. The individual fibres are not so strong as the white, nor are they so flexible. Their length again is as the length of the vein which they compose, and it ranges from $\frac{1}{8}$ to 2 in. Their diameter is roughly twice that of the white fibre, and the specific gravity of the family varies between 2.6 and 3.2.

In general, crocidolite is a hydrated ferrous and ferric silicate, complicated in a manner somewhat similar to chrysotile, by the partial replacement of the iron by sodium, and, to a smaller extent, magnesium, so that the ultimate iron content is about 35%. Its formula is of the type $\text{NaFe}(\text{SiO}_3)_2 \cdot \text{FeSiO}_3 \cdot \text{H}_2\text{O}$. Typical analyses are shown in Table 2.

TABLE 2
Analyses of Crocidolite (Blue) from different Sources

Type	Crocidolite High Grade %	Crocidolite Medium Grade %	Crocidolite Medium Low Grade %
Carbonic Anhydride	—	0.35	1.11
Combined Water	4.50	3.20	—
Silica	51.22	50.05	51.35
Alumina	—	1.95	0.18
Iron Oxide (ferric)	—	18.26	18.18
Iron Oxide (ferrous)	34.08	18.65	18.45
Calcium Oxide	0.03	0.06	0.21
Magnesium Oxide	2.48	2.10	3.03
Sulphuric Anhydride	—	—	—
Alkali and loss	7.17	5.38	5.24

Under the heading of crocidolite may be included the mineral "amosite." It is a grey or light brown fibre, of the amphibole family, closely allied to crocidolite. The fibres are of good length, but, as they tend to be harsh and brittle, have found little use in industry. Their composition and properties are almost identical with those of crocidolite.

HORNBLLENDE (INCLUDING TREMOLITE, ACTINOLITE, ETC.)

Most of these varieties differ from chrysotile and crocidolite mainly in that they are only semifibrous, and are very friable. They are, in fact, but little removed from the steatites. They are, as a class, white, but liable to much discoloration by ferric and ferrous compounds.

Their use in industry is limited, their most technical use being as filtering media. Their composition is of the type $\text{Ca}(\text{MgFe})_3(\text{SiO}_3)_4$, with the magnesium again partly replaced by iron. A typical analysis shows:—

Carbonic Anhydride	0.87
Combined Water	1.33
Silica	54.89
Alumina	Trace
Iron Oxide (Ferric)	Trace
Iron Oxide (Ferrous)	7.10
Calcium Oxide	12.04
Magnesium Oxide	24.23
Sulphuric Anhydride	—
Alkali, loss	0.04

All three classes have different properties, rendering them peculiarly suitable for different industrial uses. For instance, whilst all three successfully withstand boiling in weak or concentrated alkaline solutions, chrysotile suffers more than crocidolite and other amphiboles when subjected to boiling solutions of the common acids, and loses as much as 60% of its own weight under the severest of conditions (i.e., boiling in concentrated hydrochloric acid), whereas the others lose only 5% to 15% and that nearly all adherent impurity. Thus, for chemical engineering purposes, where the fibre has to withstand such treatment, it is possible to prepare, by previous acid washing, a cloth from amphibole asbestos, which will lose no more on further immersion.

The most important property of the fibres, however, is their ability to maintain their fibrous state and physical strength when subjected to high temperatures.

Asbestos is a crystalline formation, and each class has a fairly uniform content of water of crystallisation. The higher that content, the better the physical strength and flexibility—and correspondingly the more desirable to the spinner and weaver. The chrysotile family contains from 10% to 15% combined water, crocidolite from 4% to 10%, and hornblende from 0.5% to 1.5%. It has been established definitely that as asbestos loses its combined water (as distinct from ordinary adsorbed moisture), it simultaneously loses its physical strength and proceeds towards the amorphous friable state. Or, in other words, so long as it is not subjected to such a high temperature that it loses its water of crystallisation, its strength and fibrous character remain unimpaired. It follows then that the true merit of the asbestos types from various sources, depends mainly on the temperature at which dehydration commences. Several observers have recorded their findings, and they appear fairly unanimous.

Kersting in 1898¹ noted that high grade chrysotile heated at 1000° C. in a muffle became a little more brittle. Chrysotile of lower grade similarly treated became very brittle. Crocidolite heated at 1000° C. in a muffle broke down to a hard red powder. He concludes that crocidolite would be useless in places where the temperature ever rose to more than 200° C.

Van der Bellen² in 1900 determined the fusion point of fibre with high water of combination at 1550° C. to 1570° C., and of fibre with low water of combination at 1150° C.

Bobaricov in 1916³ observed that Russian chrysotile lost its combined water, and incidentally its strength, at from 500° to 700° C.

Bayer in 1916⁴, in an investigation for the purposes of testing the strength of asbestos at high temperatures, the influence of cotton content, and the heat insulating property of asbestos boards and mattresses, found that chrysotile does not change perceptibly in strength when exposed to 400° C., whereas the results of similar tests on South African blue indicated that it should not be used for insulation above 200° C., because it loses greatly in strength on exposure to high temperatures.

Henry Joseph⁵ tested chrysotile from various sources, and reports that they behave similarly in that they begin to lose their combined water at 450° C., and are completely dehydrated at 800° C. Crocidolite began to change below 300° C., and at the end of 1 hr. at 350° its fibrous character and strength were completely destroyed. The fusion points after dehydration he fixes at 1500° C. for Russian chrysotile, 1540° C. for Canadian chrysotile, and 1150° C. crocidolite.

The writer's investigations confirm Joseph's report, and establish that all types of chrysotile begin to dehy-

drate at 450° C., and that 1 hr. at 850° C. suffices to dehydrate completely. Crocidolite from one source commences to dehydrate at 322° C., from a second source at 382° C., and 1 hr. at 540° C. and 600° C. respectively suffices to dehydrate completely.

Against the above reports we have the article in this JOURNAL (CHEM. & IND., Aug. 7, 1925, p. 796), which states that blue asbestos will withstand a temperature of 425° C. indefinitely, and infers that chrysotile will not withstand a temperature much above 315° C. It has been definitely proved that this is not so, for, as recorded above, investigators are unanimous in stating that chrysotile does not begin to dehydrate until 450° C. is reached, no matter what its source; whereas crocidolite is not dependable above certain much lower temperatures, variously fixed at from 200° C. to 382° C.

The breakdown temperatures given above were all determined on crude fibre alone. The writer attempted to obtain confirmatory figures using spun and woven materials. A tubular electric furnace was inserted in a planished steel tube, wrapped with these woven materials. A pyrometer was inserted in the furnace tube. The fabrics were prepared in suitable form (frayed down to 1 in. of warp threads) so that the strength before and after heating might be determined. The results are tabulated. The specimens were heated under such conditions as obtain on steam pipe covering, and the temperatures refer to the heat of the steam in the pipe round which the specimens were wrapped. Each figure is an average of twelve test pieces.

TABLE 3

Showing effect of increasing temperature on white and blue asbestos fabrics

Per cent. original strength remaining after heating for :—	Chrysotile (White)	Crocidolite (South African Blue)
1 h. at 200° C.	100%	100%
1 h. at 300° C.	100	100
	100%	90%
1 h.	100	62%
3 h's. at 500° C.	100	40%

There are other features on which suitability for heat insulation purposes depends. In boiler mattresses, for instance, crocidolite being of a harsh springy nature, does not fall so closely together as does chrysotile, and, in consequence, makes a rather bulkier mattress for its weight; the mattress, having more air spaces, also tends to be rather more efficient from the point of view of specific insulation.

A disadvantage of the blue fibre is that it is largely a "ferrous" compound, and is, therefore, comparatively unstable. It is liable to oxidise under certain warm, damp conditions, and oxidation is accompanied by disintegration and loss of fibrous strength. In all cases where the conditions are such as encourage oxidation, it is preferable to use white fibre.

The harsh and springy nature of blue asbestos precludes its use in stuffing boxes and in lubricative packings.

Another desirable property is that of mechanical strength and ability to withstand abrasion and accidental damage. Weight for weight, a chrysotile yarn is much stronger than crocidolite, and can be spun more smoothly, and is more uniform in section.

¹ Kersting, Chemical Industry 21 (9) 171—174, J.S.C.I., 1898, p. 650.

² Van der Bellen (1900), Chem.-Z., (1900), 24 (37), 392—3.

³ Bobaricov and Mrianiarov (1916), Engineering, 102, 461—2.

⁴ Bayer (1916), Kunststoffe, 1916, 89-92, 119—121, 129—131, 146—149.

⁵ Henry Joseph (Chrysotile Fellowship), Mellon Institute of Industrial Research.

THE CHEMISTRY OF CELLULOSE*

The widespread occurrence of cellulose, the substance contained in the cell walls of plants, as well as the vast number of industrial uses to which it is put, renders this organic material one of the most fascinating from the point of view of the chemist. One has only to enumerate the industries which are dependent on cellulose for their existence to be assured of the great service which it gives to mankind. The cotton industry, with its related branches of bleaching, dyeing and finishing, the manufacture of paper, artificial silk, explosives, such as cordite, all go to this source for their raw material; nor should it be forgotten that the coal measures owe their existence to a pre-existing vegetation in which cellulose was largely represented, whilst the possibility of the use of waste cellulosic materials, such as sawdust for the production of industrial alcohol, is now one of the live topics of the day.

The name cellulose indicates the organised structure of the substance, which is usually found in the form of fibres in the vegetable world, and no study of the chemistry of this product would be complete without an adequate examination of its physical properties also. It is, indeed, a colloid, and most of its industrial uses depend on its fibrous or colloidal nature. Analysis reveals the empirical formula as $C_6H_{10}O_5$, but as the molecular weight is exceedingly large this must be multiplied by an unknown factor x . In each of these simple residues there are three free hydroxyl groups which take part in the esterification processes known as nitration, leading to nitro-cellulose or gun-cotton, and acetylation with the formation of cellulose acetate silk or films. Similarly, a trimethyl cellulose is known.

In the presence of alkali, cellulose combines with carbon disulphide to give a xanthogenate, soluble in water, which represents the first stage in the process of the manufacture of viscose silk; whilst the complete solubility of cellulose in cuprammonium solution affords still another method by which extruded filaments of pure cellulose can be obtained.

On complete hydrolysis with dilute sulphuric acid, cellulose is converted almost completely into glucose. Another simple method by which cellulose can be degraded is by acetolysis, which converts cellulose to the extent of 30% into cellobiose. Workers in this laboratory† have recently advanced experimental proof of a new formula for glucose, representing it as a substituted amylene oxide, *i.e.*, a six-membered ring containing five carbons and one oxygen, coupled with other addenda. The constitution of cellobiose has also been definitely determined.

Here then we have valuable information which serves as a preliminary to the new effective study of the constitution of this polysaccharide. It follows that the linkages with the other residues must involve the first and fourth carbon atoms of the $C_6H_{10}O_5$ unit, but even with the problem simplified to this degree, several modes of combination to give a complete cellulose molecule are possible, and various workers, on the basis of our earlier results, have suggested that the

cellulose molecule is represented by a repetition of cellobiose units joined to give either a cyclic form or long-extended chains, but the experimental basis for these assumptions is lacking.

Recent work by Hess has given rise to the conception that the linkages between one glucose residue and another are effected by residual valencies, and not by principal valencies. It must, however, be confessed that at present we know little experimentally on the subject of residual valencies, and on the whole it seems an inadequate representation to suggest that so stable a substance as cellulose should be built up on this plan. Indeed, from work recently done in this laboratory,† it would appear that in the simplest possible case that we could study, principal and not residual valencies are involved in polymerisation of simple to higher molecules, a conclusion which is also reached in the valuable work of Staudinger.

Fortunately, the chemist has at hand a valuable instrument of enquiry in the X-ray spectrograph. Knowing the facts so far ascertained as to the constitution of the simplest units, it is possible to utilise these in an interpretation of the X-ray data. Sponner and Dore have shown that the amylene oxide formula of glucose is in perfect agreement with the requirements of the X-ray measurements. The distance between units agrees with the required length to within 1%. Again, the arrangement of these units in the space lattice corresponds on the X-ray diagram with the intensity of the spacing represented by the actual positions of the carbon and oxygen atoms at their greatest density.

The arrangement of the glucose units proposed by these authors differs from that found in the cellobiose structure. They suggest that the linking of the glucose residues occurs through the reducing groups of position (1) of one pair and the groups of position (4) of the second pair, and that this arrangement is repeated throughout the whole pattern along the total length of the fibre. This brings the layers of the long chains of glucose units into positions which are consistent with the views derived from plant physiology that concentric layers are successively deposited from within the tube by the protoplasm of the cell.

Thus by combination of the methods of structural chemistry with those available by the use of the X-ray, attempts are being made to obtain a satisfactory structure for cellulose.

CANADIAN MINING AND METALLURGY

Quebec's second smelter will be built at Gros Pin, near Quebec, on land recently purchased by the Shawinigan Water and Power Co. The site for another smelter, to refine ores from Gaspé (zinc) Eastern Townships and Chibougaou, has not been definitely decided, but will undoubtedly be at a point where cheap power is available, and probably water transportation facilities. The Noranda smelter will serve the Rouen district.

The Ladysmith smelter, which has been idle for some years, has passed into the control of a subsidiary of the British Metals Corporation, and will be operated. Mining properties are being secured on the Portland Canal district to provide a regular supply of ore to the smelter, independent of customs shippers.

* From the Presidential Address given by Prof. W. N. Haworth before the Birmingham University Chemical Society.

† Chemical Dept., Birmingham University.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING, 1927

July 4 to 9

EXTENSION OF PERIOD FOR REDUCED RAILWAY FARES

Since the programme for the Annual Meeting was printed, the Railway Companies of Great Britain which agreed to issue tickets at the ordinary single fare and one third for the double journey to persons travelling to Edinburgh to attend the meeting have extended the validity of these tickets, and they will be available from Saturday, July 2, to Monday, July 11. These tickets will be obtainable at the time of booking on production of vouchers which will be supplied on application to Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

It is urgently requested* that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

PROPOSED EXCURSION TO ST. ANDREWS ON SATURDAY, JULY 9

The train will leave the Waverley Station, Edinburgh, at 9.30 a.m., arriving at St. Andrews at 11.22 a.m.

A visit to the University, including the Chemical Laboratories, will be arranged for the afternoon, and the St. Andrews University Court has kindly offered to entertain the members to tea in the University Buildings.

The return train will leave St. Andrews at 5.35 p.m., arriving in Edinburgh at 7.26 p.m.

Members will also have an opportunity of visiting other places of historic interest in St. Andrews or of playing golf.

OTTAWA SECTION

The annual meeting, held on May 19, at the University Club, was preceded by dinner at the same place with Mr. A. E. MacRae in the chair on both occasions. The secretary, Mr. R. D. Whitmore, presented a report of the year's progress showing that the section has advanced in a very satisfactory manner.

The following officers and committee-members were elected:—Chairman, Frank T. Shutt, M.A., D.Sc., F.I.C., Dominion Chemist and Assistant Director, Dominion Experimental Farms. Secretary, Mr. R. D. Whitmore. Executive Committee: Messrs. F. E. Lathe, A. K. Light and Clayton E. Watson, full members; Miss S. E. Wright and Mr. J. W. Davy, associate members. Auditors, Messrs. J. Dick and M. C. Fletcher. Trustee for Queen's Prize Fund, Dr. A. E. Macintyre.

The retiring chairman, Mr. A. E. MacRae, before presenting an address entitled "Patents, with particular reference to the public service," spent a few moments on an explanatory account of the Pan-American Union, indicating how Canada might be affected industrially and otherwise.

Returning to the subject of patents, the speaker first showed the distinction that the authorities endeavour to draw between what is merely a discovery and what is really an invention. Only the latter may be patented.

Basic principles or inherent, natural properties of matter cannot rightly be patented; new processes or new products can be. A new idea, and that idea then put into practice, are the two mutually dependent parts which constitute an invention, and one is useless without the other. The foregoing points were supported by quotations from judgments handed down by legal authorities and by concrete examples of patents granted, refused and disputed.

An amendment of 1923 to the Patent Act has placed members of the public service of Canada in a very favourable position. The civil servant may not expect such a full reward as an independent inventor because the former has used public time and money. Should such an invention be of use to a Government department, either the inventor or his department may obtain a Canadian patent, when the Canadian royalties are paid, half to the State and half to the inventor. The latter remains free to patent his invention in foreign countries and receive to himself all royalties from these sources.

Mr. MacRae noted that patentable ideas arising in the course of departmental research are often not published. In the course of time the same idea is perhaps patented independently by an individual outside of the civil service. The public has then to pay royalties on something already invented and paid for in public time and money. Therefore he would urge all departments who do not wish to obtain patents to at least publish the work and so render it unpatentable to others.

The Ottawa section is largely composed of civil servants who, at this meeting, showed their very considerable interest by a number of questions. Dr. F. T. Shutt, as chairman-elect, conveyed the thanks of the meeting to Mr. MacRae both for his address and for his splendid services through the past two years.

Attention was directed to the annual meeting of the Society to be held in New York in 1928, and the hope was expressed that Ottawa would be visited by those intending to be at that meeting from the British Isles.

YORKSHIRE SECTION

The annual meeting was held at the Great Northern Hotel, Leeds, on May 2. Mr. H. J. Hodsmen, the Vice-Chairman, who presided, alluded to the serious illness and long absence of Mr. B. A. Burrell, whose term of office as chairman was due to expire, and the Section expressed its gratitude for Mr. Burrell's services and their best wishes for his early recovery.

Officers and new members of Committee were elected for the ensuing Session as follows:—Chairman, Mr. H. J. Hodsmen; Vice-Chairman, Mr. W. B. Hill; Honorary Secretary and Treasurer, Prof. N. M. Comber; and Committee, Mr. B. A. Burrell, Mr. C. P. Finn, Prof. F. M. Rowe, Mr. J. A. Reddie, and Mr. J. B. Speakman.

Following the business, Prof. N. M. Comber read a paper on "Soil formation processes and the foundation of a new subject."

The chemistry of soils was far from simple, and in spite of the big advances made during the last fifteen years or so, a great deal of the fundamental chemistry of the soil still remained obscure. Indeed, it was quite likely that the state of our knowledge of general chemistry was a

limiting factor to the development of soil chemistry. Almost every new development in physical chemistry seemed to throw fresh light upon soil problems. As men of science gave more attention to the soil, not only did it become apparent that the higher ramifications of physical colloid and organic chemistry were involved, but also that microbiology and physics were involved along with chemistry in the study of soil fertility.

It was not unnatural, therefore, that the segregation of the science of the soil as a special subject, so to speak, with a name of its own, was suggested in various quarters. The suggestions first put forward did not receive a very warm welcome and were, in fact, opposed by some students of the soil in this country. Such opposition was quite sound, for the application of a particular science or several sciences to an industrial problem does not necessarily constitute a new subject.

In recent years, however, the outlook had been considerably changed by the outstanding work of the Russian School. It could fairly be claimed that the study of soil formation processes had given to Soil Science a fundamental characteristic which had been properly recognised by the adoption of the word *Pedology* to describe the science of the soil. The work of Sibirtzev, Glinka, Stebut, and others had put the backbone into the study of soils and turned that study into Pedology in the same way that William Smith put the backbone into the study of rocks and made it Geology.

The word Pedology had been almost unanimously accepted on the Continent and to a large extent in America, but in this country there were several eminent pedologists who were still reluctant to admit that description of themselves.

The chairman, in opening the discussion, remarked that the leaching of bases from clays was a matter of great importance in the manufacture of the refractories and ceramic materials, and that it was practically impossible to make refractory materials from clays that were half leached. Questions were raised by several members as to the effect of the leaching of bases from grassland upon the reaction of the soil, and the effect of this reaction upon the type of herbage which developed.

Prof. Comber, in replying, pointed out that the control of the reaction of grassland had to be considered in connexion with the purpose to which the grassland was to be put. The farmer, who was concerned with the feeding quality of the grass, was usually advised to counteract acidity by liming, in order to develop the more nutritive grasses, and particularly to develop clover, and so increase nitrogen. On the other hand, for playing fields and particularly golf greens, quite different considerations arise, and the wearing properties of the grass are most important. It was a great mistake to lime golf greens, which so far as existing work indicated, were best developed at a $p_H = 4$, or thereabouts. The majority of golf greens in this country were probably not sufficiently acid to admit of the satisfactory development of the particular grasses required.

The Calendar of Forthcoming Events will be found on p. 534, column 1.

CHEMICAL SOCIETY

At a meeting held on June 2, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., occupying [the Chair, Mr. U. R. Evans discussed:—

The Passivity of Metals. Part I. The Isolation of the Protective Film.

When vacuum-fused electrolytic iron is rendered passive in potassium chromate solution, and then subjected to anodic treatment in sodium chloride solution, the metal is dissolved away, leaving (along with certain secondary products) a transparent envelope which retains the shape of the original specimen. A transparent skin can also be removed from passive iron by dissolving out the metal from below by means of iodine. The same method can be used to remove the visible films responsible for the temper-colours of heat-tinted iron; in all cases the transparent films consist of ferric oxide. Relatively thick (visible) films tend to crack and are non-protective, whilst the films produced by unduly short exposure of cold iron to air are discontinuous. To produce passivity, the films must be continuous. The films responsible for passivity possess thicknesses too small to show interference tints, but the thickness varies with the conditions of production, and particularly with the presence of internal stresses in the metal, which tend to cause cracking and thus allow the films to thicken locally; the thickness varies considerably from point to point. (Chlorides favour the activation of passive iron, because chlorine ions can pass through the membrane, and under anodic conditions the metal is dissolved away below the skin, which becomes loosened; mere immersion in a chloride solution, under conditions which preclude the flow of local currents, causes no reversion to activity. The rather unreliable passivity produced in electrolytic iron by nitric acid has been investigated. Transparent films have been isolated from the surface of passive copper and aluminium.

The President asked whether the author was satisfied that the film consisted entirely of ferric oxide, and not ferrosferric oxide. When iron is rendered passive with steam ferrosferric oxide is formed, and, moreover, iron made passive with nitric acid loses its passivity on local heating. Treatment of the film with iodine or anodic chlorine might oxidise ferrosferric oxide to ferric oxide.

Dr. W. H. Hatfield emphasised the industrial interest and importance of investigations on passivity. It was not very long ago that resistant steels were made by rule-of-thumb methods. The speaker referred to the case of steel containing 14% Cr, which after suitable heat treatment is "stainless," and to its occasional failure to possess its normal resistance to oxidation.

Dr. Bengough remarked that confusion resulted from the use of the term "passivity" to describe different phenomena. The corrosion of pure iron in water containing a little chloride could be ascribed to the penetration of a passive film by chlorine ions.

Dr. W. H. J. Vernon said that the accumulated evidence showed that the films obtained with liquid reagents are identical with those produced by direct oxidation; thus copper rendered passive by chromate

solution or exposure to air lost its considerable immunity from tarnishing on treatment with ammonium chloride solution. By actually isolating thin oxide films the author had provided the most direct evidence regarding the nature of the process.

Mr. Evans replied that within the period allowed, iodine does not oxidise magnetite to ferric oxide. It was certain that the film on the air-passive region was ferric oxide; the film produced at higher temperatures is magnetite, both films being formed at intermediate temperatures. The films were distinct in appearance and properties. In reply to Prof. Bassett he said that the thickness of the film varies with the conditions of production from about 400 Å. probably to unimolecular thickness. The essential condition for passivity is that the film must be continuous.

Prof. T. M. Lowry contributed the following paper:—

Studies of Valency. Part VIII. The Molecular Structure of Vernon's Dimethyltelluronium Salts. [With (Mrs.) R. R. Goldstein.]

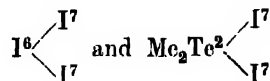
(a) The absorption of Vernon's dimethyltelluronium halides increases progressively from α - TeMe_2Cl_2 to α - TeMe_2I_4 . The α - and β -dibromides each show a marked step out; the α - and β -diiodides and the α -tetraiodide show the twin maxima already recorded in CH_3I and in KI_3 . The results are in harmony with a suggestion, derived from the electronic theory of valency, that only one halogen can be ionised at a time, as in the formula $[\text{TeMe}_2\text{X}]^+\bar{\text{X}}$.

(b) The dihalides give conductivities which indicate that one halogen is hydrolysed more or less completely, whilst the other persists as a halogen ion $[\text{TeMe}_2\text{X}]^+\bar{\text{X}} \rightleftharpoons [\text{TeMe}_2\text{OH}]^+\bar{\text{X}} + \text{HX}$. The hydroxy-halide itself undergoes a partial hydrolysis, however, when one equivalent of acid is removed from the solution, although silver oxide must be used in order to liberate the free base $[\text{TeMe}_2\text{OH}]^+\bar{\text{X}} \rightleftharpoons [\text{TeMe}_2\text{O}]^+ + \text{HX}$.

(c) In the quadrivalent compounds of tellurium, the third valency is a covalency and the fourth valency is an electrovalency. Similarly, in the quinquevalent compounds of phosphorus, arsenic and antimony, the fourth valency is a covalency and the fifth an electrovalency. In general it appears that, whenever the normal valency of an element is increased by two units, one of the additional valencies is a covalency, and the other is an electrovalency.

The President asked whether the compounds described as Vernon's were not, in fact, first prepared much earlier by Dr. Alexander Scott. The late Dr. R. H. Vernon had never claimed the credit of their discovery.

Dr. S. Sudgen said that two of the three substances giving the characteristic iodoform curve could readily be formulated by the theory of singlet linkings (J., 1927, 1174) as:



The iodides of the telluronium bases are feebly hydro-

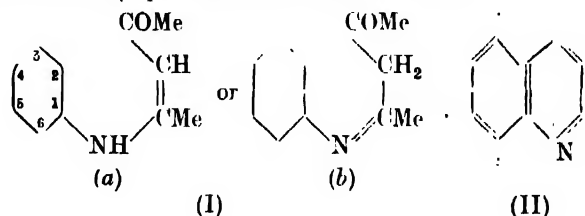
lysed and dissociated even at high dilutions in water, and some non-ionised formula seemed to be required for the substances in the free state or possibly in a non-ionising solvent.

Prof. Lowry replied that he had associated Vernon's name with the compounds under examination because that investigator had first shown that they form both α - and β -series. In reply to Prof. Bassett, Prof. Lowry said that for the absorption spectra the compounds were dissolved in alcohol, whereas for the conductivities they were dissolved in a little alcohol and then largely diluted with water.

Dr. E. E. Turner discussed:—

Factors controlling the Formation of Some Derivatives of Quinoline, and a New Aspect of the Problem of Substitution in the Quinoline Series. [With E. Roberts.]

The effect of substituents in the aniline-residue on the conversion of compounds of type 1 (a or b) into substituted 2:4-dimethylquinolines has been examined.



This condensation is greatly affected by the nature of the substituent. The effect produced is apparently due partly to the directive influence of the substituent, and partly to an influence it produces corresponding with its influence in diminishing the basicity of the aniline molecule when present as a substituent in the latter. Thus, provided one strongly *ortho-para* directing group is present in position 3 (\equiv 5) in I, ring closure readily occurs, even if a second similar group is present in the unfavourable positions. On the other hand, of the three anils derived from the chloroanilines, only the *meta* compound undergoes the condensation, whilst of the anils derived from 2:4-, 2:5-, 3:5- and 3:4-dichloroaniline, only the last has been converted into a quinoline derivative. The non-condensation of the 3:5-compound shows that steric factors may operate.

The Beyer method of quinoline synthesis is also influenced by steric factors, which do not appear to operate in the Skraup and Doebner-Miller syntheses.

The nitration of 2:4-dimethylquinoline and of a number of its chloro-derivatives leads to a new conception of the essential quinoline molecule which exhibits a marked resemblance to the naphthalene molecule, and is well represented by (II).

Substitution in the quinoline series is not controlled by the nitrogen atom, but simply by 5:8 reactivity, corresponding with the reactivity of the four α -positions in naphthalene. In substituted quinolines, 5:8 reactivity has as much orienting effect as the substituent itself, at any rate in the cases of Cl, Me and NO_2 .

The constitution of the anils (Ia or b) is discussed.

In reply to Prof. J. T. Hewitt, Dr. Turner said that nitration of 2-chloronaphthalene yields the 7-nitro-compound, the nitro-group entering the second ring.

SOCIETY OF GLASS TECHNOLOGY

Meetings were held in University College, London, on May 18 and 19, the President, Mr. W. Butterworth, Senr., M.A., in the chair. On the evening of May 18 the annual dinner was held in the Hotel Cecil, London, and during the morning of May 19 a visit took place to the Lamp Works of the General Electric Co., Ltd., at Brook Green, Hammersmith.

At the meeting on the afternoon of May 18 the following three papers were presented:—

"The decomposition of glass by water at high temperatures and pressures," by Dr. G. W. Morey and Dr. N. L. Bowen.—The glasses were heated with water in steel bombs for about 20 hrs. The bomb was then cooled and the product examined. In the case of optical glasses it was found that the barium glasses presented a consistent picture. The amount of attack was greatest with a light barium crown, and least with the very dense barium crowns which were remarkably resistant. The lead glasses as a whole showed a consistent and interesting relation between composition and resistivity. With small PbO content, as in the "soft crowns" or extra light flints, the glasses were badly decomposed at 300° C. and practically completely at 550°. As the lead content was increased, the glasses rapidly improved, the extra dense flints showing remarkable resistance towards water. Of all the glasses tested, a high lead glass was the most resistant to the action of water under the extreme conditions tested. In addition to the optical glasses, several commercial glasses, in the form of pieces of tubing, were subjected to a similar treatment, at the same temperatures. Jena combustion tubing withstood the action of water best, whilst the failure of Pyrex glass was outstanding. At lower temperatures the Pyrex was exceedingly good, but at the higher temperatures of the experiments the boric oxide was completely extracted. The crystals obtained with Pyrex glass at 520° were unknown, but were of particular interest, and their composition was being studied.

"The brittleness of opal glass," by Prof. Dr. G. Gehlhoff and Dr. M. Thomas.—For the determination of the impact strength a special apparatus was described; and Winkelmann & Schott's method was modified by using pebbled balls instead of ground and polished cubes. A dense opal glass containing much fluoride was used, the opacity being increased by the addition of zinc oxide. It was found that at a temperature of about 1040° C. some discontinuous changes took place, possibly explainable in the following way. At high temperatures the opal glass was clear. In cooling down, crystals of a uniform and small size of grain were precipitated. The glass kept below the devitrification temperature already contained (owing to its having stood longer) bigger crystals. On further cooling down, in conformity with the law of the yet undefined constitution diagram, small crystals were precipitated, whereas the existing big ones still grew. It might appear feasible that the opal-glass, containing only crystals of a uniform and small size, possessed greater mechanical strength than a glass consisting of crystals of various sizes, particularly larger ones. The investigation showed that opal glasses must necessarily be worked above the temperature where

precipitation of crystals caused opacity of the glass: it was suspected (from work being done) that similar phenomena held good in respect of clear glass.

"The new British 15-arm automatic suction bottle machine," by Francis Redfern, Junr.—This machine is composed of 15 separate bottle-making units, each complete in itself. There are approximately 40 tons of moving parts mounted on the stationary element, and the whole machine weighs about 60 tons. It will revolve up to speeds of between 6 and 7 revolutions a minute, and is electrically controlled. By means of an electromagnetic brake automatically applied it can be brought to rest from a speed of 6 revolutions a minute within 2½ ft. To accommodate the machine to the level of the pot, or the glass in it, it is raised or lowered by a small motor which is cut out automatically at the highest and lowest positions. At 6 revolutions a minute, the machine takes about 11½ horse-power to revolve it. The machine is constructed in such a way that it is possible to sit inside it while it works. The range in length of bottles (measured from the bottom to the parting line below the ring) which can be manufactured on the machine is from 15 in. to 2½ in., for a maximum diameter of blow mould of 9 in. and of parison moulds of 7 in. Wide mouth ware can be made in which the maximum outside diameter of the neck mould is 5¼ in., and the maximum length of plunger which can be inserted into the bottle is 2½ in. A week's production of merchantable reputed quart bottles is estimated at 2,800 gross. The machine can be produced in three sizes, 6 units, 10 units and 15 units. It was possible to make on it, at one and the same time, 6 different bottles all of different shapes, varying in height within a difference of 3½ in. Bottles varying in weight by 4 ozs. have been made on a 10-arm machine.

The meeting on the afternoon of May 19 was devoted to a discussion of *Furnace efficiency*. The discussion was opened by Prof. W. E. S. Turner, who gave a *résumé* of the paper he had presented at the April meeting, namely, "A brief review of furnace developments."

Mr. B. P. Dudding and Mr. E. A. Coad-Pryor suggested that the discussion be focussed under the following headings:—(a) Load-fuel consumption; (b) Age of tank; (c) Load and effect on total life; (d) Maximum efficient load; (e) Composition of the glass; (f) External conditions of all kinds, such as contour of neighbouring country, prevailing wind, etc.; (g) General design—ports, bridges, melting areas, etc. At the suggestion of Mr. J. H. Webster a further heading was added, namely, (h) The method of control of gas and air. Mr. Webster observed that too many pot furnaces and tanks suffered from insufficient control. It was quite a common thing to find neither gas nor air control. The question of the number of dog holes was under consideration. He had seen tanks with as many as four and the introduction of four was an easy proportion and could assist in overcoming those imaginary currents which were said to be set up in tanks having one dog hole. With regard to heat losses, these were discovered at three important places: (1) Producer, 17%; (2) furnace structure, 40%, and (3) chimney flues, 28%; 15% seemed to be the best figure obtained for heat utilised in actual practice. Reference was also made to waste heat boilers and to powdered fuel.

PERSONAL AND OTHER ITEMS

The official list of honours conferred by the King on the occasion of his 62nd birthday includes the following names:—Mr. R. J. Neville Neville, J.P., M.P., at one time chairman of the Brentford Gas Company, becomes a baronet; and Prof. C. J. Martin, C.M.G., D.Sc., F.R.S., Director of the Lister Institute, and Mr. E. Davis (in recognition of his services in connexion with the development of the mineral resources of the Empire) become knights. The Order of Merit is conferred on the Hon. Sir Charles Parsons, K.C.B., F.R.S., in recognition of his eminent services in scientific research and its industrial application. Sir Frank Heath, K.C.B., late Secretary to the Department of Scientific and Industrial Research, becomes G.B.E., as does Sir Richard Threlfall, K.B.E., F.R.S., in recognition of his public services. The honour of C.B.E. is conferred upon Mr. D. D. Davis, Government Analyst, Newfoundland, Mr. G. M. Stuart (for services in connexion with the Imperial College of Tropical Agriculture), and Mr. J. A. Jameson, Fields Manager of the Anglo-Persian Oil Company. Mr. John Crompton, chairman of the Council of the Textile Institute, receives the O.B.E.

The Ministry of Agriculture and Fisheries announces that Sir Daniel Hall has retired from the post of Director-General of the Intelligence Department of the Ministry, which will now lapse. At the request of the Minister, Sir Daniel Hall has agreed to continue as the Ministry's Chief Scientific Adviser in a part-time capacity, and he will retain the chairmanship of the Research Council.

Prof. Sir J. J. Thomson has been awarded the Mascart medal of the French Society of Electricians, which is given every three years.

On June 7, Prof. A. Smithells, C.M.G., F.R.S., spoke from the London and Daventry stations of the British Broadcasting Corporation, on "How it's done—The manufacture of gas."

Sir Donald MacAlister, K.C.B., and Sir Otto Beit have been reappointed members, and Lord Rayleigh, F.R.S., is appointed a member, of the Governing Body of the Imperial College of Science and Technology.

Dr. H. Houlston Morgan, past-president of the Oil and Colour Chemists' Association, and Dr. C. L. Parson, Secretary of the American Chemical Society, were guests at a dinner of the newly-formed Paint and Varnish Division of the American Chemical Society.

Sir Richard Tetley Glazebrook, K.C.B., F.R.S., has been appointed, by Order of Council dated May 26, 1927, to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

At the Annual Degree Congregation of Birmingham University on July 2, the honorary degree of LL.D. will be conferred upon Dr. Arthur Lapworth, F.R.S., professor of chemistry in the University of Manchester.

At the Oxford Encenia, on June 30, it will be proposed to confer the honorary degree of D.Sc. upon Sir Robert Hadfield, Bart., D.Sc., F.R.S., and upon Dr. R. Willstätter, professor of chemistry in the University of Munich.

Prof. F. G. Donnan, C.B.E., F.R.S., has been elected a member of the Royal Academy of Sciences of Amsterdam, thus filling the vacancy caused by the death of Prof. Golgi.

Dr. E. H. Archibald, head of the department of chemistry at the University of British Columbia, has resigned owing to ill-health. He will, however, continue as professor of analytical chemistry. Dr. R. H. Clark, associate professor, has been selected as the new head of the department.

Dr. M. J. Marshall has been appointed associate professor of chemistry at the University of British Columbia.

Prof. J. M. Eder, whose retirement from official duties is announced, has been awarded a large gold medal by the President of Austria for his services to the Republic. Prof. Eder has also been awarded the Peligot Medal of the French Photographic Society in recognition of his numerous contributions to technical and scientific photography.

An 1851 Exhibition senior studentship for biochemistry has been awarded to Mr. R. Hill, M.A., at Cambridge. At Emmanuel College, Mr. C. Rimington has been awarded a Sudbury-Hardyman Prize of £20 for a dissertation on a biochemical subject.

Mr. T. Hopkins, M.Sc., has been awarded the degree of Ph.D., by the University of London for a thesis describing a new type of dyestuff.

Mr. J. A. Singmaster, General Manager, Technical Department, and Mr. F. G. Breyer, Chief of Research, have resigned their positions with the New Jersey Zinc Company, and opened a consulting office at 1640, Graybar Building, 420, Lexington Avenue, New York.

Fire destroyed patterns and other stock and several buildings of the Mirrlees Watson Company, engineers, Scotland Street, Glasgow, on June 6. The damage is estimated at £20,000.

We regret to learn of the death of Prof. W. C. Williams, B.Sc., who was professor of chemistry at the University of Sheffield from 1883 to 1904.

We regret to learn of the death of Mr. A. B. Reckitt, managing director of Reckitt & Sons, Ltd.

Mr. T. W. Stainer Hutchins, managing director of Electro Bleach & By-products, Ltd., Middlewich, has died at the early age of 47.

Dyestuffs Licensing Committee

By a unanimous vote the Dyestuffs Licensing Committee, on which both the users and the manufacturers of dyes in this country are represented, has recommended that licences for the importation of foreign dyes may be granted from September 1 in respect of those dyes for which British producers demand over twice as much as the pre-war price. Hitherto the price factor imposed by the committee was two-and-a-half times the pre-war figure. In view of this decision, it seems probable that the price of British dyestuffs will undergo an equivalent reduction of 20%. The imports of dyes are mainly dyes which are not made in this country, as the British dyestuffs industry has captured the greater part of the home market.

The Explosives Industry

The 51st annual report of H.M. Inspectors of Explosives, for the year 1926 [Cmd. 2871, H.M. Stationery Office, price 9d. net], states that the total number of factories is now 101, two new factories having been established and five having become extinct. Two new licences and 55 amending licences were issued. There are also 20 toy firework factories and five small firework factories. The total number of accidents generally in connexion with explosives reported during the year was 276, causing 36 deaths and injury to 269 persons. The number was less than usual on account of the smaller number of blasting accidents owing to the coal mines having been closed for several months.

It is noted that by the passing of the Petroleum Act, 1926, H.M. Inspectors of Explosives have now a definite status under the Petroleum Acts.

Opening of the New Science School at Clifton College

Through the generosity of Old Cliftonians, who have already subscribed four-fifths of the requisite total of £50,000, a handsome new Science School has been erected at Clifton College. The building was formally opened on June 2 by H.R.H. The Prince of Wales, who emphasized the value of science to the community and expressed the hope that the college would prove the cradle of future Kelvins, Faradays, and Tildens. The Headmaster, Mr. Norman Whatley, remarked that the new building was to be the home of industry, variety, enterprise and cheerfulness, and hoped that it would not be considered an impertinence for him to suggest that it was most appropriate that a building in which these qualities were to flourish should be opened by His Royal Highness.

The Science School consists of a central block with side wings and contains six laboratories, four lecture rooms and a science library, together with a small biological laboratory, private rooms for research, workshops, polarimeter and dark rooms, preparation rooms, etc. It has been spaciouly designed and equipped according to the most exacting modern ideas, and, to ensure harmony with the rest of the College buildings, it is in a late gothic style of architecture. The architect, who, together with Mr. E. J. Holmyard (Head of the Science Department), and Mr. W. C. Badcock (Head of the Physics Department), had the honour of being presented to His Royal Highness, is Mr. Alan E. Munby.

Among the distinguished visitors at the opening ceremony were the Duke and Duchess of Beaufort, the Marquis of Bath, Field-Marshal Lord Haig (President of the College), Rt. Hon. J. H. Whitley (Speaker of the House of Commons)—through whose instrumentality the necessary funds were raised—Sir Richard Gregory, Sir Richard Threlfall, Sir Thomas Heath, Profs. Hutchinson, Lindemann, Francis, Tyndall, Darbishire, Fawcett and Reynolds, and Mr. F. B. Stead (H.M. Chief Inspector).

The Library, which is a fine room fitted throughout in oak, proved a special centre of attraction. Clifton possesses a large collection of scientific classics, including copies of works by Avogadro, Cannizzaro and Tyndall, with autograph inscriptions by the authors, a MS. volume of Rouelle's lectures, and many first editions of Dalton, Newton, Boyle and other celebrated scientists. Of local interest are "The Ordinall of Alkimy," by Thomas Norton, and a collectaneous volume of the alchemical

writings of Samuel Norton, Thomas's grandson, both Bristolians. The library was further enriched on June 2 by the addition of a photograph of the Prince, which H.R.H. was gracious enough to sign and which is to have the place of honour in memory of the royal inauguration.

Many well-known scientists have taught or been taught in the Clifton Laboratories. Debus, Worthington, Shenstone, Wollaston, Sir William Tilden, Rintoul and, for a short time, Prof. H. B. Baker, come into the former category, while in the latter are included Sir Max Muspratt, Prof. H. H. Turner, Prof. Norman Collie, Sir Richard Gregory, and Prof. A. Hutchinson.

British Non-Ferrous Metals Research Association

The Seventh Annual Report of the British Non-Ferrous Metals Research Association, which has just been issued, describes its work during 1926, which has been carried out at a cost of over £25,000. The report gives details of the 27 researches which have occupied more than forty investigators during the past year. The most diverse problems are being studied, such as atmospheric corrosion, the production of sound castings, locomotive fireboxes, lead pipes, materials for high temperature service and electro-deposition.

In connexion with the Annual Meeting of the Association, a luncheon was held at the Savoy Hotel on May 27. Mr. Thos. Bolton, as Chairman, made an earnest appeal for greater participation and support by all those who use non-ferrous metals and alloys. He pointed out that the Association was lop-sided and needed the co-operation of users, who stood to benefit even more than the producers in prosecuting research for improved materials. The feeling of comradeship which had developed in recent years between competitors in manufacture and between buyer and seller could find no more beneficial scope for its application in the Research Association. Both Mr. Bolton and Sir Alfred Mond, who followed him, emphasised the increasing influence of University trained men in industry; scientific training along broad lines was most important, not only in the research departments, but also on the production side and even in salesmanship.

Sir Alfred Mond urged the importance of research with a wide outlook directed to the development of new processes which do not exist at the present moment. He considered that there was no safer investment in the world than research, and its results would far outweigh the financial expenditure incurred. The prizes in metal research work are great indeed, for all the research work yet done on alloys has only touched the fringe of the subject. For this reason he promised the Association all the support in his power to command.

Sir Frank Heath, in making a last appearance before retiring from his post as Secretary of the Department of Scientific and Industrial Research, urged that research should be looked upon as a form of provision against depreciation. Knowledge, like plant and machinery, must be looked upon as a wasting asset, and new supplies, unlike the latter, could not be bought "off the shelf," but were only available to those who made them their own by active co-operation with the scientific workers who were providing the new knowledge. Sir Frank Heath specially referred to some sections of the metal industry for which the Association has already most valuable results to offer, but where support by the producers has not yet been awakened.

Biochemistry at Birmingham University

The Prime Minister has consented, formally, to open the new Biological Block of the Birmingham University, at Edgbaston, and the extension to Chancellor's Hall, which the Council of the University has fixed to take place on Thursday, October 20. The University will on that occasion confer upon Mr. Baldwin the honorary degree of LL.D. at a special Degree Ceremony to be presided over by the Chancellor of the University, Viscount Cecil. The new Biological Block consists of laboratories and departmental accommodation for the three biological departments—namely, the Department of Brewing and Biochemistry of the Fermentation Industries, Zoology and Botany. The present laboratories at Edmund Street, Birmingham, will be transferred to Edgbaston. The new block will cost, with equipment, over £100,000, and its completion may be regarded as one more stage towards carrying out the original scheme for the University as laid down in 1901. Towards the cost Sir William Waters Butler, who combines the skill of the brewer with that of the chemist, a member of the University Council, has contributed a sum of about £40,000, and the brewing department in the new block will bear his name.

CALENDAR OF FORTHCOMING EVENTS

- June 11. **BIOCHEMICAL SOCIETY.** The Museum, Oxford, at 3 p.m. The following papers will be presented:—(1) "Digestion of carbohydrates in the cockroach," by B. Wigglesworth. (2) "Oxidation of uric acid by hydrogen peroxide." (3) "Estimation of oxalic acid in urine." (4) "Estimation of oxaluric acid in urine," by P. C. Raiment. (5) "Chemistry of phosphagen," by P. and M. G. Eggleton. (6) "The Erlenmeyer amino-acid synthesis," by C. R. Harington and W. McCartney. (7) "Synthesis of vitamin B (torulin) by yeast," by F. Hawking and R. A. Peters. (8) "Use of norite in the concentration of torulin," by H. W. Kinnersley and R. A. Peters. (9) "Presence of a nucleotide in milk," by P. G. Marshall and H. D. Kay. (10) "The peptic digestion of gelatin," by R. M. Beck and R. K. Cannan. (11) "Metabolism of glucose by kidney tissue *in vitro*," by J. T. Irving. The following Demonstrations will be given during the interval for tea:—(1) "A colorimetric method for the determination of the pH of minute amounts of fluid," by V. B. Wigglesworth. (2) "Synthesis of a bacterial growth factor by *Meningococcus*," by J. Orr Ewing and V. B. Reader. (3) "A simple fluorophotometer," by J. H. Jeffree and R. T. Squires (introduced by R. A. Peters).
- June 15. **SOCIETY OF GLASS TECHNOLOGY.** 100th meeting at University, St. George's Square, Sheffield, at 2.30 p.m. (1) "Gaseous fuels for furnace heating," by R. Wigginton. (2) "The thermal expansion of some boric oxide glasses and some remarks on the influence of the inhomogeneity of the glass," by Prof. W. E. S. Turner and F. Winks.
- June 16. **CHEMICAL SOCIETY.** *Ordinary Scientific Meeting.* Burlington House, Piccadilly, W.1, at 8 p.m. (1) "Syntheses of cyclic compounds. Part I. Ethyl- β -dimethyl butane $\alpha\alpha\delta\delta$ -tetracarboxylate and some cyclobutane compounds derived therefrom," by I. Vogel. (2) "A new method of (absolute) potentiometric titration," by B. Cavanagh.

REVIEWS

TRATTATO DI CHIMICA GENERALE ED APPLICATA ALL'INDUSTRIA. By PROF. E. MOLINARI. Vol. I. *Chimica Inorganica*, Pt. II. Fifth edition. Pp. 681—1351. Price 45 lire. Vol. II. *Chimica Organica*, Pt. I. Fourth edition. Pp. xxiii + 660. Price 45 lire. Milan: Ulrico Hoepli.

The issue of the fifth revised and enlarged edition of "Molinari" makes one recall with regret that since it appeared the death of the author has been learned.

The present volume (Part II of Vol. I) completes the section devoted to inorganic chemistry and in it one notes throughout the author's unceasing care to keep the work up to date, much new matter having been incorporated, on subjects such as borax, titanium pigments, decolorising carbons; low-temperature carbonisation, pulverised coal, etc. An attempt has been made to bring the statistics of trade up to date, but the utility of such statistics, is, at least, doubtful.

Part I of Vol. II, devoted to organic chemistry, has now reached its fourth edition, the last revised by its author. No special notice of this part is required, save to note that it contains an obituary of Prof. Molinari, and that the work of revision has been as complete and painstaking as with former volumes. Future editions will be revised by pupils of the author: Prof. Henry, Ing. Chim. Vittorio, and Dr. Alessandro.

"Molinari" is now too widely known to need commendation; its merits have previously received detailed appreciation; and for those who can read Italian, the very moderate price should prove an additional inducement to make the acquaintance of a very useful treatise, which holds the balance between pure and applied science with considerable success.

A TEXT BOOK OF INORGANIC CHEMISTRY. Edited by Dr. J. NEWTON FRIEND, D.Sc., Ph.D. Vol. III. Part II. Beryllium and its Congeners. By JOSHUA C. GREGORY, B.Sc., F.I.C., and MAY SYBIL BURR, D.Sc. Pp. xxvi + 342. London: Charles Griffin & Co., Ltd., 1926. Price 18s.

This volume of the series of text books of inorganic chemistry edited by Dr. J. Newton Friend, deals with the elements beryllium, magnesium, zinc, cadmium and mercury. Chapter I gives an excellent comparative study of the elements dealt with in the following chapters of the book. Each element is discussed in detail under the headings of occurrence, history, preparation, physical and chemical properties, uses and alloys, followed by the preparation and properties of its compounds. A summary of the most important methods for the detection and estimation of the element completes the chapter. In addition there are paragraphs on the purification of zinc, cadmium and mercury, on the electrodeposition of zinc, on the preparation and properties of colloidal cadmium and mercury, and on the physiological action and isotopes of mercury, each of which is to be found in the chapter dealing with the metal concerned. The summary of the processes for the extraction of beryllium compounds from beryl is excellently written, the best conditions for the successful carrying out of the separation from aluminium and the quantity

of residual alumina in the beryllia being clearly stated. The history of the determination of the atomic weight of beryllium is vividly and very interestingly portrayed, as are numerous other studies in succeeding chapters of the book.

The arrangement of the minerals in tabular form, as was done in the earlier volumes of this series, would be an improvement on the present method as being more convenient for reference. It is noticeable that the commercial minerals are not so clearly described as they might be, whilst no mention is made of the very common iron-zinc-sulphide, marmatite. The industrial chemist would appreciate the book more if it contained more manufacturing details, more extensive notes on the alloys and uses of the compounds, coupled with the more liberal use of illustrations and graphs, but as the size of the book is limited, the authors have done the next best thing and supplied an excellent list of up-to-date references from which this information can be obtained.

The book contains very few errors, and these to the trained mind are usually self-evident as, for example, on pages 53 and 54, where it is stated that magnesium hypobromite and bromate are produced by electrolysis of potassium bromide solution; on page 136 that zinc thiochromite is prepared by heating zinc oxide with sulphur in a stream of hydrogen and then in sulphur vapour and on page 45 where it states that the melting point of Mg_2Au is $83^\circ C.$; the last is probably a printer's error.

The authors have, nevertheless, made an excellent summary and many portions of the book show, what is often absent in a compilation such as this, real literary ability.

ALBERT R. LUCAS

HISTORY OF THE SCIENCES IN GRECO-ROMAN ANTIQUITY.

By ARNOLD REYMOND, translated by RUTH GHEURY DE BRAY. Pp. x+246. London: Methuen & Co., Ltd., 1927. Price 7s. 6d.

We are glad to welcome in its English dress this excellent book by Prof. Arnold Reymond (University of Neuchâtel), which was published in French at Paris some three years ago. For a bird's eye view of classical science its only rival is Heiberg's book, and in many ways Reymond gives the better picture. After a short preliminary section on Egyptian and Chaldean science, the author describes in historical sequence the Hellenic, Alexandrian and Greco-Roman periods, passing thence to an account of the principles and methods of the various sciences as understood by contemporaries. As is perhaps only natural, the section on chemistry is extremely short and offers nothing that is new; chemistry in those ancient days was in a state which requires either a page or a series of volumes to describe. The book as a whole is one which can be emphatically recommended to all who are interested in, without being serious students of, the history of science. The translation has been carefully and elegantly made and the general format of the book is good. A school edition at a lower price is desirable, for Prof. Reymond writes in a manner which young people will find very attractive. Any science master who can secure the Classical Sixth for an hour or two a week would find this book admirably adapted for use as a class text-book.

E. J. H.

PARLIAMENTARY NEWS

British Industries Fair

Sir Burton Chadwick informed Lieut.-Commander Kenworthy that it was not proposed to hold the British Industries Fair in provincial cities other than Birmingham in future years. The Committee appointed by the Board of Trade in 1921 to consider the best policy to be adopted in respect of the Fair was opposed to new sections being initiated in other centres besides London and Birmingham.—May 26.

British Celanese Company (Government Representative)

In reply to Mr. E. Brown, Mr. McNeill stated that the Government representative on the board of directors of the British Celanese Company was Sir Philip C. Henriques. He was appointed with the ordinary powers of a director on February 28, 1920, and could not be removed without the consent of the Government so long as the Government held not less than 250,000 preference shares.—May 26.

Oil Imports from Russia

Replying to various questions, Sir B. Chadwick said that in the six months ended April, 1927, imports of Russian refined petroleum, amounted to 62.5 million gallons, and to 31.3 million gallons in the six months ended April, 1926. Imports of crude petroleum from Russia were negligible in both periods.—May 26.

Key Industry Duties

In reply to Mr. H. Williams, Sir P. Cunliffe-Lister said that the following table showed the value of the goods upon which Key Industry Duty was paid during the first four months of the present and previous year:—

Description	January to April, 1926 £	January to April, 1927 £
Optical glass, optical elements and optical instruments	95,778	100,400
Scientific glassware, lamp blown ware and laboratory porcelain	46,641	43,899
Scientific instruments: gauges and measuring instruments of precision	34,620	48,326
Wireless valves and similar rectifiers and vacuum tubes	57,488	44,393
Ignition magnets and permanent magnets	16,438	11,545
Arc-lamp carbons	9,343	6,073
Hosiery latch needles	21,235	22,191
Metallic tungsten, ferro-tungsten, manufactures of metallic tungsten and rare earth compounds	5,760	13,636
Synthetic organic chemicals (other than finished and intermediate organic dyestuffs and colours), fine chemicals and fermentation chemicals	176,375	187,956
Amorphous carbon electrodes	Not dutiable in this period	86
Ferro-molybdenum: ferro-vanadium: molybdenum and vanadium and compounds thereof		
Total of above	463,678	483,958

Gas Mantles

Sir P. Cunliffe-Lister informed Mr. Harris that the Safeguarding duty came into force at the end of December, 1925. The imports of gas mantles during 1925 amounted to 208,902 gross, and in 1926 to 47,708 gross. He was aware that there was an agreement between the largest English manufacturer of these mantles and the German manufacturers with regard to markets. But for the duty, the imports would be quite enormous, and it would be impossible to find a market for our own products.—May 31.

Condensed Milk (Tests)

In a written answer to Major Ainsworth, Mr. Chamberlain said that samples of condensed milk were examined

by the Government chemist and by public analysts to verify that it complied with the standard of composition laid down in the Public Health (Condensed Milk) Regulations, and was otherwise free from adulteration. The tests applied were matters for the discretion of the officers concerned, no standard tests being prescribed.—June 2.

COMPANY NEWS

L. AND N. BROWN COAL, LTD.

Underwriting has now been completed for an issue of £150,000 first mortgage convertible debenture stock in this company, which was formed to purchase 420,000 acres of land in Victoria, Australia, containing deposits of brown coal estimated at over 400,000,000 tons. The company proposes to mine and sell 1,000 tons of raw brown coal daily, and later to distil the coal by the L. and N. process, and to market the oil and residual fuel. The chairman is Lieut.-Col. J. T. Moore-Brabazon, M.P., who is also chairman of the L. and N. Coal Distillation Co., Ltd.

BLEACHERS' ASSOCIATION, LTD.

The trading profits for the year ended March 31, 1927, amounted to £627,906, plus a transfer from reserve for equalisation of dividends of £90,000, making £717,905, compared with £1,066,221 for the previous year. Depreciation fund received £200,000 (same), debenture interest absorbed £101,250 (same), leaving £416,655, plus £294,968 brought in. A final dividend has been recommended on the ordinary shares at the rate of 1s. 2d. per share, making 1s. 6d. per share, carrying forward £711,624.

YORKSHIRE DYEWARE AND CHEMICAL CO., LTD.

The net profit for the year to March 31, 1927, after providing for depreciation and all charges, was £11,736, plus £5,595 brought in, compared with £11,685 for 1925. Interest on debenture stock, less tax, absorbed £4,104. A dividend has been recommended at the rate of $7\frac{1}{2}\%$, making 10%, less tax, carrying forward £1,228.

SANITAS CO., LTD.

The report for the year ended March 31, 1927, shows an available balance, including £1,123 brought forward, of £61,486, compared with £54,008 for 1926. A final dividend has been declared, making 45% for the year, compared with 38.24%, leaving £1,834 to be carried forward.

LIQUID AIR, LTD.

The report covering 15 months ended March 31, 1927, states that after deducting outstanding legal expenses in connexion with the year 1925, now finally disposed of, providing for income tax, depreciation, bad debts, and certain award expenses of a non-recurring nature, the balance available for distribution was £3,668, which the directors consider should be carried forward. For 1925 a dividend of 5%, less tax, was paid and £5,046 carried forward.

SALAR DEL CARMEN NITRATE SYNDICATE, LTD.

The thirtieth annual general meeting was held on June 2, Mr. A. Naylor (chairman) presiding. After referring with great regret to the death of Mr. H. W.

Sillem, the late chairman of the company, Mr. Naylor said the results for the year were very unsatisfactory, but, in view of the condition of the industry, they were not unexpected. The accounts show a net loss of £33,715 for 1926, as against a net profit of £22,199 for 1925. The credit balance of £12,591 brought in is thus converted into a debit balance of £21,126, which has been carried forward. Owing to unsatisfactory sales and to the fact that it had stocks of manufactured nitrate sufficient to meet its expected participation in sales for the nitrate year 1926—27, the company closed down the maquina on April 30, 1926. The maquina had been reconstructed at a cost of £141,996, and was completed in October last year, the necessary funds being provided by an advance from the company's bankers. With regard to the present position and prospects of the industry, under the regulations of the Nitrate Producers' Association, producers have exercised their right to revert to free selling, commencing from April 11 last. It was generally anticipated that free selling and the holding of such large stocks would result in much lower prices, and to that extent fears on this score had not been justified. These prices would result in a loss on most of the stocks now held in Chile, and would not allow of any oficinas, except the cheapest producers, manufacturing at a profit. It was hoped that some relief would be obtained from the heavy export duty of £2 12s. 6d. per ton, but the Chilean Government have now stated that there would be no reduction before July, 1928. Meantime, the export duty on iodine had recently been increased by 60%.

INTERNATIONAL PAINT AND COMPOSITIONS CO., LTD.

At the nineteenth ordinary general meeting, held on March 16, Sir William Maxwell, K.B.E. (chairman), said that the year under review had been a most difficult one for all industries in this country. The coal strike had deprived the company of some of the raw materials essential to its business, thereby adding to the cost and the difficulties of production. Despite these difficulties, the results of the year's work were not unsatisfactory. The net profit was £64,871, compared with £67,496 in 1925, and a final dividend was declared of 3%, less tax, on the preference shares, making 6%, and a final dividend of 4%, less tax, on the ordinary shares, making 7% for the year. Reserve received £25,000, and £15,105 was carried forward. For many years the company had made at Felling-on-Tyne steel drums and containers for their own paints and compositions, and had found a ready market for their surplus production. It was now decided to transfer part of this business to the south. The new factory at Grays, on the Thames, had been in operation since November last, and, despite many difficulties, had given an output of 155,274 containers of large type. The company had made a good start in 1927, and there were promising signs in the shipping world.

JURGENS, LTD.

The net profit for 1926 amounted to £322,678, against £302,702 for 1925, and with £108,871 brought in there is an available total of £431,549. A dividend has been recommended on the ordinary shares of 5%, tax free, leaving £131,549 to be carried forward.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit. 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammiac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubbron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16½ Tw. per gal.
 Wood Creosote.—1s. 9d. per lb., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 8½d.—9d. per lb. Crude 60's, 2s. 6d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 8d.—2s. 0½d. per gal. Pure, 1s. 10d.—2s. 3½d. per gal.
 Xylol.—1s. 11d.—2s. 4d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/160, 1s. 10d.—1s. 11d. per gal. Solvent 95/160, 1s. 6d.—1s. 7d. per gal. Solvent 90/190, 1s. 1½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—70s.—80s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. £40—£43 per ton. Powder £44—£47 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 3½d.—1s. 5d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate. 3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal £24—£27 per ton, Powder £26—£29

per ton, according to quantity, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium.—1s. 10d.—1s. 11d. per lb. Sodium.—2s. 1d.—2s. 2d. per lb. All spot.
 Calcium Lactate.—1s. 2½d.—1s. 4½d. per lb.
 Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ether meth.—1s. 1d.—1s. 1½d., per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P. 1914).—2s. 3d.—2s. 4d., according to quantity.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiaccol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ½ lb., 9s. 6d. per doz.; ¼ lb., 6s. 6d. per doz.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 22s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 3d. per lb. net. Synthetic, 10s. 6d.—12s. per lb., according to quantity; Liquid (95%), 12s. per lb.; Detached cryst., 14s. 6d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonol.—11s. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. per lb.
 Phenazone.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s. per lb. spot.
 Saccharin.—55s. per lb.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 6s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.
Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
Sulphonol.—7s. 6d. per lb.
Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
Thymol, Puriss.—10s. 3d.—10s. 9d. per lb., according to quantity. Natural.—12s. 6d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
Anubine (*ex Anethole*).—10s. 6d. per lb.
Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
Cinnamic Aldehyde.—Natural, 17s. per lb.
Coumarin.—10s. 6d. per lb.
Citronellol.—14s. 6d. per lb.
Citral.—8s. 9d. per lb.
Ethyl Cinnamate.—10s. per lb.
Ethyl Phthalate.—2s. 9d. per lb.
Eugenol.—9s. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.
Methyl Anthranilate.—8s. 6d. per lb.
Methyl Benzoate.—4s. 6d. per lb.
Musk Ketone.—35s. per lb.
Musk Xylol.—8s. 6d. per lb.
Nerolin.—3s. 9d. per lb.
Phenyl Ethyl Acetate.—12s. per lb.
Phenyl Ethyl Alcohol.—10s. 6d. per lb.
Rhodinol.—32s. 6d. per lb. Safrinol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—14s. 9d. per lb.
Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 2s. 1d. per lb., Ceylon, Pure, 1s. 10d. per lb. Clove, pure—6s. per lb.
Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—8s. 3d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 6d. per lb. Peppermint.—Wayne County, 17s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than July 30th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on June 16th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Bishop, Elsmore, and Holford. Apparatus for treatment of sludge. 14,357. May 27.
Hammond and Shackleton. Heat-treatment of liquids and solids. 13,831. May 23.

Heylandt. Separating and liquefying gaseous mixtures. 13,823. May 23. (U.S., 24.5.26.)
I.-G. Farbenind. Carrying out exothermic reactions. 14,101. May 25. (Ger., 10.7.26.)
Imray (Monsanto Chem. Works). Catalytic process for oxidation. 14,090. May 25.
Kehren. Furnaces. 14,347. May 27. (Ger., 30.6.26.)
Kilmarnock Engineering Co., Ltd., and Shaw. Drying-apparatus. 14,190. May 26.
Paterson. Filtering-apparatus. 14,071. May 25.
Raw. Separation of solid materials of different sp. gr. 14,192. May 26.
Silica Gel Corp. Separation of gases etc. 14,095. May 25. (U.S., 24.6.26.)
Sturgeon. Grinding machinery. 14,238. May 27.
Williamson. Drying-apparatus. 14,190. May 26.

I.—Complete Specifications

1888 (1926). Chur. Separation of a mixture of liquids having different boiling-points. (271.130.)
12,131 (1926). Löffler. Apparatus for heating fluids. (252.163.)
19,563 (1926). Johnson. Kilns. (271.291.)
21,319 (1926). Martyn. Wet separation of the constituents of mineral and other pulp. (264.128.)
21,959 (1926). Poller, and De Trey Bros., Ltd. Plastic hydro-colloid compositions. (271.306.)
32,931 (1926). Schier. Refrigerating-machines. (271.358.)
6708 (1927). Sharples Specialty Co. Centrifugal machines. (268.321.)
*13,273 (1927). I.-G. Farbenind. Manufacture of agents for emulsifying, purifying, wetting, etc. (271.474.)

II.—Applications

Aktiebolslag Separator. Centrifuges for purification of oil etc. 13,855. May 23. (U.S., 24.5.26.)
Chilovsky. Apparatus for manufacturing gas from heavy oils. 14,334. May 27. (Belg., 16.7.25.)
Donald. Distillation of coal etc. 14,374. May 28.
Grant and Hanna. Production of artificial fuel. 13,986. May 24. (U.S., 10.7.26.)
I.-G. Farbenind. Valuable products from coal etc. 13,820. May 23. (Ger., 1.6.26.)
Production of hydrocarbons from mineral oils etc. 14,179. May 26. (Ger., 11.6.26.)
Koppers Co. Coking-retort ovens. 14,325. May 27. (U.S., 27.11.26.)
Coke-oven batteries. 14,359. May 27. (U.S., 12.4.27.)
Laing and Nielsen. Manufacture of water-gas. 14,430. May 28.
Novelli. Process of combustion for coal, lignite, etc. 14,147. May 26. (Italy, 27.5.26.)
Simon Extracting Machine Syndicate, Ltd., and Simon. Refining oils. 14,294. May 27.
Troeknungs-, Verschmelungs- und Vergasungs-Ges., and Bartling. Recovery of dry distillation substances from hot oven gases. 14,226. May 26.
Wetherbee. Production of artificial fuel. 13,986. May 24. (U.S., 10.7.26.)

II.—Complete Specifications

5137 (1926). Lymn. Producing high-grade combustible gases from bituminous fuel. (271.173.)
5219 (1926). Potts (Mineral A.-G. Brig.). Production of bitumen or oil emulsions. (271.177.)
15,117 (1926). Harrison and Drake. Apparatus for receiving coke discharged from retorts used in the manufacture of gas. (271.260.)
27,123 (1926). Koppers Coke Oven Co., Ltd. (Koppers). Method and apparatus for cooling coke. (271.327.)
*12,402 (1927). I.-G. Farbenind. Transforming hydrocarbons of high b.p. into those of low b.p. (271.451.)

*12,403 (1927). I.-G. Farbenind. Manufacture of hydrocarbons. (271,452.)

*13,267 (1927). Feige. Production and conversion of oils. (271,473.)

*13,389 (1927). Battig. Producing hydrogen by decomposing saturated or unsaturated hydrocarbons or gaseous mixtures containing the same. (271,483.)

*13,528 (1927). Battig. Producing hydrogen in the fractionation of coke furnace gases. (271,491.)

IV.—Applications

British Dyestuffs Corp., Davidson, and Shepherdson. Manufacture of vat dyestuffs. 14,217. May 26.

British Dyestuffs Corp., and Mendoza. Manufacture of dyes. 14,352. May 27.

Holliday & Co., and Shaw. Dyestuffs. 14,393. May 28.

I.-G. Farbenind. Manufacture of α -anthraquinonyl ketones. 14,091. May 25. (Ger., 25.5.26.)

Imray (I.-G. Farbenind.). Manufacture of black copying colours. 13,965. May 24.

Johnson (I.-G. Farbenind.). Production of amines for the hydroaromatic-aliphatic series. * 13,822. May 23.

Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. 14,333. May 27. (Switz., 29.5.26.)

IV.—Complete Specifications

4565 (1926). Brit. Synthetics, Ltd., and Higgins. Manufacture of intermediate products for the preparation of azo dyestuffs. (271,146.)

5758 (1926). Brit. Dyestuffs Corp., Rogers, Stubbs, and Emerson. Manufacture of halogenated indanthrones. (271,181.)

6245 (1926). I.-G. Farbenind. See XV.

8311 (1926). I.-G. Farbenind. Manufacture of aralkylamines and their derivatives and intermediate products. (249,883.)

16,671 (1926). I.-G. Farbenind. Manufacture of vat dyestuffs containing nitrogen. (254,742.)

V.—Applications

Brandwood. Production of viscose. 14,234. May 27.

British Celanese, Ltd., Bower, Dreyfus, Kinsella, and Taylor. Production of artificial filaments etc. 13,785. May 23.

Courtaulds, Ltd., Hazeley, Morton, and Topham. Manufacture of artificial threads etc. 13,819. May 23.

Du Pont Rayon Co., Inc. Production of artificial horsehair, films, etc. 13,805. May 23. (U.S., 21.5.26.) Manufacture of viscose. 13,806. May 23. (U.S., 12.6.26.)

Hovey. Making paper pulp. 13,789. May 23.

I.-G. Farbenind. Disintegrating vegetable fibre bundles. 13,842. May 23. (Ger., 21.5.26.) 14,178. See VI.

V.—Complete Specifications

11,507—8 (1927). I.-G. Farbenind. Fulling of animal fibres. (270,333—4.)

*3917 (1927). Soc. Brevets Étrangers Lefranc & Cie. Hydrolysis of cellulose substances. (271,410.)

*10,341 (1927). British Celanese. Products obtained with cellulose derivatives, and methods of reproducing them. (271,425.)

*13,805 (1927). Du Pont Rayon Co., Inc. Manufacture of rayon artificial horsehair, films and the like. (271,517.)

VI.—Applications

I.-G. Farbenind. Dyeing acetate silk. 13,966. May 24. (Ger., 24.7.26.) Dyeing cellulose esters etc. 14,178. May 26. (Ger., 8.6.26.)

Soc. Chem. Ind. in Basle. Producing fast tints on vegetable fibres etc. 14,332. May 27. (Switz., 27.5.26.)

VI.—Complete Specifications

28,281 (1925). Clavel. Dyeing, printing, or stencilling of products containing cellulose acetate. (270,987.)

VII.—Applications

Frischer. Producing volatile acids. 14,056. May 25. (Ger., 27.5.26.)

Grenier. Catalyser for preparation of hydrogen etc. 13,837. May 23. (Belg., 22.5.26.)

Johnson (I.-G. Farbenind.). Manufacture of carbon disulphide. 14,180. May 26.

Ormandy. Manufacture of nitric acid. 14,108. May 25. Titanium Alloy Manuf. Co. Obtaining zirconium compounds. 13,808. May 23. (U.S., 27.5.26.)

VII.—Complete Specifications

11,769 (1926). Deutsche Gold- u. Silber-Scheideanstalt vorm. Roessler, and Kerschbaum. Stabilising hydrocyanic acid. (271,236.)

12,979 (1926). Orkla Grube-Akt. Treatment of solutions containing zinc chloride. (252,388.)

*11,837 (1927). Meyerhofer. Producing soluble hydrates. (271,440.)

*13,388 (1927). Müller. Production of synthetic ammonia. (271,482.)

*13,389 (1927). Battig. See II.

*13,528 (1927). Battig. See II.

*13,741 (1927). Deutsche Gold- u. Silber-Scheideanstalt vorm. Roessler. See XXIII.

VIII.—Applications

Allen and Deering. Transfers for decoration of pottery etc. 14,065. May 25.

Matthews. Decoration of porcelain etc. 14,064. May 25.

VIII.—Complete Specifications

4276 (1926). Sidler. Manufacture of glass. (271,136.)

24,524 (1926). Riera. Manufacture of synthetic aquamarine stones. (271,316.)

*13,372 (1927). British Thomson-Houston Co., Ltd. Tinting glass. (271,481.)

*13,596 (1927). British Thomson-Houston Co., Ltd. Heat-resistant compounds. (271,503.)

IX.—Applications

Anderson. 14,360. See XIII.

Dickinson. Rotary cement kilns for aluminous cement manufacture. 13,901. May 24.

Thompson. Concrete. 13,961. May 24. (Australia, 12.6.26.)

IX.—Complete Specifications

7367 (1926). Anderson. Preserving stone, brick, etc. (271,203.)

25,302 (1926). Lindman. Producing porous concrete. (262,394.)

X.—Applications

Berzelius Metallhütten Ges. 13,829. See XI.

Billington. Copper alloys. 14,067. May 25.

Bischitzky. Recovery of metals from alloys etc. 13,786. May 23.

Krupp Grusonwerk A.-G. Working up ores etc. 13,943. May 24.

Lange. Aluminothermal pressure welding. 14,433. May 28.

Marguerat (Ringsdorf-Werke A.-G.). Drying and extracting gases from metallic powders. 14,422. May 28.

Patten. Chromium plating. 14,364. May 27. (U.S., 20.10.26.)

Soc. Gén. Métallurgique de Hoboken. Treatment of zinc ores. 14,362. May 27. (Fr., 30.12.26.) Roasting zinc sulphide ores. 13,863. May 23. (Fr., 27.5.26.)

X.—Complete Specifications

17,905 (1926). Wade (Internat. Nickel Co.). Treatment of mattes containing nickel. (271,282.)

19,727 (1926). Schmidt. Splitting up metal alloys into their component crystals by centrifuging. (271,293.)

20,776 (1926). Metals Production Corp. Treatment of iron and steel articles. (264,788.)

21,319 (1926). Martyn. *See* I.
8900 (1927). Oalberger. Copper-tin-nickel alloy (268,798.)

*12,454 (1927). Siemens & Halske A.-G. Copper-beryllium alloys and their treatment. (271,454.)

XI.—Applications

Allen Electrolytic Cell Corp. Electrolytic cells. 14,429. May 28. (U.S., 3.7.26.)

Berzelius Metallhütten Ges. Electrolytically refining metals etc. 13,829. May 23. (Ger., 21.5.26.)

British Thomson-Houston Co. Electric furnaces. 13,781. May 23. (U.S., 5.6.26.)

Internat. Copperlad Co. Apparatus for electrodeposition. 14,372. May 28. (U.S., 19.8.26.)

Patten. 14,364. *See* X.

Siemens Bros. & Co., Ltd., and Riber. Electric batteries. 14,187. May 26.

Trotter. Electric accumulators etc. 13,929—30. May 24.

Van Raden & Co., and Starley. Electrical storage batteries. 13,914. May 24.

Westfelt. Producing insulating material. 14,424. May 28.

Wolff. Electric cells. 13,836. May 23.

XI.—Complete Specifications

30,791 (1926). Siemens-Elektrowarme-Ges. Electric bright-annealing furnaces. (262,468.)

*13,544 (1927). Comp. Franç. pour L'Exploit. des Proc. Thomson-Houston. Manufacture of electric dry cells and dry batteries. (271,496.)

XII.—Application

Armstrong (Kokatnur). Anhydrous soap gels. 13,740. May 23.

XIII.—Application

Anderson. Coating for metal, wood, etc. 14,360. May 27.

XIII.—Complete Specifications

4632 (1926). Millar. Water paint or distemper. (271,149.)

15,676 (1926). Steppes and Traun. Manufacture of transparent and colourless condensation products of carbamide and solid polymerides of formaldehyde. (271,264.)

16,335 (1926). Dyk. Polymerised vinyl chloride modification and process of utilising the same. (255,837.)

XIV.—Complete Specifications

5195 (1926). Anode Rubber Co., Ltd. Production of rubber goods directly from latex. (252,673.)

27,239 (1926). Yates. Manufacture of a jelutong product. (271,329.)

XV.—Applications

Botson. Treatment of hides and skins. 13,945. May 24. (Belg., 2.6.26.)

German and Paiseau. Treatment of skins. 14,339. May 27. (Fr., 3.6.26.)

Guillomin. Impermeabilising leather etc. 14,198. May 26. (Fr., 2.6.26.)

Johnson (I.-G. Farbenind.). Artificial masses containing casein. 13,821. May 23.

XV.—Complete Specifications

6245 (1926). I.-G. Farbenind. Manufacture of coloured dressings for leathers. (248,767.)

9777 (1926). British Glues & Chemicals, Ltd., Duncalfe, and Cotes. Manufacture of artificial horn. (271,221.)

XVI.—Complete Specification

*13,370 (1927). I.-G. Farbenind. Fungicide. (271,480.)

XVII.—Applications

Chem. Fabr. vorm.-Schering. Manufacture of lævulose from inulin. 13,866. May 23. (Ger., 15.6.26.)

Gaspary. Manufacture of sugar. 13,763. May 23.

Sugar Beet & Crop Driers, Melrose, and Stead. Production of sugar from dried beet. 13,970. May 24.

XVIII.—Applications

Levin. Yeast preparation. 14,075. May 25. (Sweden, 26.5.26.)

MacLean. 13,778. *See* XX.

XVIII.—Complete Specifications

5191 (1926). Loon. Fermentation processes. (248,373.)

28,545 (1926). Jansen. Fermentation processes for the production of alcohol. (271,336.)

XIX.—Applications

Egg Patents, Ltd. (Milroy). Preserving eggs etc. 14,057. May 25.

Penfold. Preserving eggs. 13,856. May 23.

Sherman. Preservation of food. 13,964. May 24.

XIX.—Complete Specifications

4440 (1926). Scott & Son (London), and Riley. Drying chambers for vegetables etc. (271,143.)

5559 (1926). Potts (Gruyère Usines Laitières Soc. Anon.). Production of milk chocolate. (248,391.)

XX.—Applications

Comp. de Béthune. Preparation of ethylsulphuric acid. 14,211. May 26. (Fr., 24.6.26.)

Johnson (I.-G. Farbenind.). 13,822. *See* IV.

Kirkwood and Raymond. Production of eugenol etc. 13,963. May 24.

Ruzicki. Production of acetic anhydride. 14,328. May 27.

Stiepel. Manufacture of hydroxy-acids. 14,337. May 27. (Ger., 4.6.26.)

MacLean. Medicinal products obtained from yeast. 13,778. May 23.

Bruck. Medicinal preparations for diabetes etc. 13,850. May 23.

Carmael (I.-G. Farbenind.). N-alkylation with amino-alkyl halides. 13,952. May 24. Manufacture of substituted 4 : 4'-dihydroxybis-acylamino-arsenobenzenes. 14,343. May 27.

XX.—Complete Specifications

5047 (1926). Johnson (I.-G. Farbenind.). Manufacture of glycol ethers. (271,169.)

7136 (1926). Wyld. Manufacture of organic arsonic compounds. (249,515.)

9040 (1926). I.-G. Farbenind. Manufacture of aromatic aldehydes. (250,955.)

23,790 (1926). I.-G. Farbenind. Manufacture of esters. (259,204.)

27,588 (1926). Établ. Poulenc Frères. Preparation of a concentrated and stable solution of 3-acetamido-4-hydroxy-phenylarsinic acid from its ammoniacal salt. (264,797.)

28,111 (1926). Andersen, Liesbye, and Weitzmann. Production of complex aurothiosulphate compounds. (261,048.)

31,430 (1926). Hoffmann-La Roche & Co. A.-G. Manufacture of ureides of dialkyl- or arylalkyl-acetic acids. (264,804.)

*13,124 (1927). I.-G. Farbenind. Manufacture of acid derivatives of the 4-hydroxy-2 : 6-dimethylpiperidine-3-carboxylic esters. (271,467.)

*13,531 (1927). Chem. Fabr. vorm. Schering. Obtaining germ gland hormones from vegetable organisms. (271,492.)

XXI.—Applications

I.-G. Farbenind. Producing direct positives by reversal. 14,092. May 25. (Ger., 24.12.26.)

Joseph. Photographic developing apparatus. 14,367. May 27.

Martinez. Colour photography. 13,911. May 24.

XXI.—Complete Specifications

931 (1926). White (Rainbow Photo Reproductions, Inc.). Photoprinting. (271,127.)

16,680 (1926). Berthon. Manufacture of films for colour cinematography. (264,123.)

*13,274 (1927). I.-G. Farbenind. Photographic emulsions. (271,475.)

*13,631 (1927). Bernet. Producing light-sensitive films. (271,507.)

XXIII.—Applications

Deutsche Gold- u. Silber-Scheideanstalt vorm. Roessler. Fumigating etc. mixtures. 13,741. May 23. (Ger., 22.5.26.)

Prüss. Sewage treatment. 13,772. May 23.

Techno-Chemical Laboratories, Ltd., Boberg, and Testrup. Treatment of sewage. 14,346. May 27.

XXIII.—Complete Specification

*13,741 (1927). Deutsche Gold- u. Silber-Scheideanstalt vorm. Roessler. Production of fumigating mixtures containing hydrocyanic acid. (271,514.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Brass and copper ware, cut-glassware (554). *British India*: Crockery, glassware, stationery (556); Steelwork (The Director-General, India Store Department, Belvedere Road, Lambeth, S.E.1). *Canada*: Fireproof roofing, tiles (559). *Chile*: Black galvanised piping and fittings, leather beltings (584). *Germany*: Oilseeds (566), Steel tubes, brass and copper plates (567), Leather (568); Machinery, metals, chemicals (570). *Greece*: Sugar (571). *Hungary*: Tin foil, cocoa butter substitute (574). *Japan*: Leather (580). *New Zealand*: Tinsplate, perfumery (560). *Peru*: Iron (585). *Portugal*: Tinsplate (575). *South Africa*: Linseed oil (B.X. 3556). *Syria*: Metals, paper, cardboard (578); Paper (579).

Drugs and Merchandise Marks Act

The Board of Trade give notice of its intention to exempt uncompound drugs from the requirement that imported goods bearing a British name or trade mark must also bear an indication of origin. This exemption will not extend to proprietary articles, or to articles sold in their original packing. Any communication on the subject should be addressed to the Secretary, Board of Trade, Great George Street, Westminster, S.W.1, before June 9.

New Dyestuffs

The British Dyestuffs Corporation, Ltd., have recently issued two new pattern cards describing additions to their range of direct cotton colours, viz., Chlorazol Orange PO and Chlorazol Fast Helio 2 RK. Chlorazol Orange PO is applicable to all forms of cotton material, giving bright yellowish-orange shades of good fastness to light, hot-pressing and washing. It possesses good solubility and affinity and excellent level dyeing properties. It is also suitable for dyeing union material of cotton and wool and of silk and cotton. On viscose artificial silk it gives fairly even shades on material of irregular quality. It is suitable for dyeing silk, and also gives shades of good fastness to milling on wool, and in addition can be used for dyeing jute, tagal, and wood chip. Chlorazol Fast Helio 2 RK is a bright reddish violet, and is particularly interesting owing to its very good fastness to light coupled with excellent solubility and levelling power. It is

specially suitable for dyeing cotton yarn and pieces, and works well in circulating machines, although it is equally suitable for all other types of cotton materials. The dyer of artificial silks will find this colour of interest owing to its property of giving even shades on viscose material of irregular quality; it is also suitable for dyeing cotton-acetate silk mixtures, the artificial silk being unstained in pale and medium shades; also for dyeing silk, jute, and tagal, whilst the union dyer will find it of service for covering the cotton at low temperatures in wool-cotton mixtures.

A further B.D.C. pattern card describes a new union colour "Black D," which gives solid black shades on cotton, silk and viscose materials. Union Black D has been received with approval by many garment dyers, to whom the colour should be of great value.

In a further pattern card attention is drawn to the latest addition to the B.D.C. range of colours for cellulose-acetate silk, "Duranol Brilliant Blue G Paste." This colour gives very bright blue shades of excellent fastness to light and washing, and, owing to its non-staining property, is particularly valuable for the dyeing of cotton and cellulose-acetate mixtures. It can be used in combination with their other Duranol and Ionamine colours.

A new addition to the B.D.C. chrome colours is "Solochrome Black P.V.," which has excellent fastness to potting, being the fastest potting chrome black on the market. Dyers of loose wool and slubbing will find it indispensable because of its very good general fastness. Owing to its excellent solubility, it is suitable for dyeing in all types of machines.

News from Advertisements

The Newcastle and Gateshead Gas Company invite applications for the post of chief chemist (p. viii).

The City of Cardiff Education Committee make an amended announcement regarding the vacancy for the Assistant Lectureship in Pharmaceutical Chemistry (p. viii).

The City Council and University of Manchester invite applications for the Professorship of Technological Chemistry (p. viii).

An agency in Hungary for chemical products is required (p. viii).

A chemist wishes to obtain a partnership in a consulting practice.

PUBLICATIONS RECEIVED

SAFETY IN MINES RESEARCH STATION, BUXTON. A Description. Mines Department. Safety in Mines Research Board. Paper No. 34. Pp. 54. H.M. Stationery Office. 1927. Price 6d.

DIE REAKTIONSFÄHIGKEIT DES KOKSES. By Drs. R. Mezger and F. Pistor. Part 12. Kohle, Koks, Teer, Abhandlungen zur Praxis der Gewinnung, Veredlung u. Verwertung der Brennstoffe, edited by Dr. J. Gwosdz. Pp. viii + 88. Halle (Saale): W. Knapp, 1927. Price, paper, 7.20 r.m., bound, 8.80 r.m.

HANDBUCH DER ANORGANISCHEN CHEMIE. Edited by Dr. R. Abegg, Dr. Fr. Auerbach and Dr. I. Koppel. Vol. IV, Part I. Die Elemente der sechsten Gruppe des periodischen Systems. Pp. xii + 966. Leipzig: S. Hirzel. 1927. Price, paper, 60 m., bound, 64 m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW
SERIES

LONDON, JUNE 17, 1927

No. 24

EDITORIAL

The Messel Memorial Contributions

THE generosity of the late Dr. R. Messel endowed the Society with a sum, which, including undistributed income, now amounts to £25,000, and the income is available for most of the wishes of the Society. The Council recently decided to ask a small number of distinguished men to write articles on topics of interest to the chemical industry as Messel Memorial Contributions, and to offer an honorarium from the income of the Messel Fund. It is hoped that five or six of such articles may be published every year, and we think that the project will be very satisfactory to our readers. The articles will be important ones, contributed by men of reputation, and they will appear in CHEMISTRY AND INDUSTRY. Hitherto most of the really important contributions to our knowledge have appeared in *Transactions*; this anomaly has been convenient, but the effect of the new departure will be to maintain a more even level of excellence in both these two branches of our JOURNAL. We publish this week the first of the Messel Memorial Contributions, an article on the Production of Clean Coal, by our past President, Professor Louis, whose experience in chemistry, in engineering and in mining, especially coal mining, has been very exceptional. We hope that this will be followed by a Messel Memorial Contribution by Professor Sabatier on Catalysis, and that the other articles will be by writers who are equally well-known. The production of clean coal has become a matter of prime consequence to the community, and lack of attention to the necessity and the cost of this production has been one of the obstacles which have hindered the development of low-temperature carbonisation. As Professor Louis points out, we can hardly expect or desire to remove all the ash from coal before it is burned, but we can remove so much extraneous inorganic matter as to leave a coal the improvement in which outweighs the cost of the cleaning. We suppose that the experience of the next six or twelve months will throw a great deal of light on the commercial possibilities of low-temperature carbonisation, and it seems hardly overstating the case if we say that there is a reasonable

hope that this development may prove to be commercially profitable. Many other developments in our fuel industry are the objects of investigation, and the production of clean coal is one factor in many of these. We are able to congratulate Professor Louis and our readers on the appearance of this important paper, the first, we trust, of a long and honourable list of such contributions.

Our Buyer's Guide

We think we are right in stating that the chemical industry is the sixth largest in this country, and that it is steadily growing in numbers and importance. Partly because it is a new industry and the profession of chemist is a new one, the periodical literature dealing with the chemical industry is very much smaller than the industry deserves. Twenty years ago two comparatively small journals sufficed for what was then a small industry; to what extent is the periodical literature dealing with the chemical industry now adequate to the needs of the industry and the profession? How does the industry compare in this respect with agriculture, engineering, brewing, chicken-farming, shipping and so on? How does our profession compare in this respect with medicine and the law? We claim that this JOURNAL caters extremely well in its abstracts, transactions, articles and news, for the chemists who are engaged in industry, and is necessary to many other chemists. It is, moreover, becoming of increasing value to many who are engaged in the chemical industry, but can hardly claim that coveted, and perhaps almost over-priced, title of chemist. One proof of the increasing number of such readers is the growth of our buyer's guide. During the last few months this has doubled in volume, but in our opinion it should grow much more. The chemists know, by tradition, where to buy nitric acid, copper sulphate, beakers and spectrometers. But many buyers are not chemists, and we think that we members of the Society of Chemical Industry should have in front of us week by week, in our own JOURNAL, a far more complete epitome of our great industry. It should be so complete as to be of great value to all in the industry. We cannot say yet

that it is so complete ; it is more complete than it was ; it is more useful than it was ; it is slowly growing, and it should continue to grow. Let us as members of the Society take a broad and long view of the position of this JOURNAL in relation to the industry ; let us consider what we ought to attain to, what we deserve to have ten years hence, and what steps we ought to take to obtain our hearts' desire. These problems can only be faced piecemeal and gradually ; on the other hand those who face them in due course will be building up for themselves a secure position in the future. Our JOURNAL has during the last generation increased from a monthly journal to a weekly one ; since it became a weekly one it has been converted from a liability into an asset, looking at it solely from a pecuniary point of view ; it is destined, if we members of the Society of Chemical Industry have faith, to become larger and even more useful. We speak feelingly on this subject and quite sincerely, bearing in mind the views we held when we were keenly interested in the work of the Society, but had no editorial or other responsibility. We think the next step we should take is for us all to watch with interest every week the slow growth of our buyer's guide : those of us who have any ideas for its improvement should not be shy of giving advice ; a little co-operation and a little patience, a little *esprit-de-corps* and a little thought will enable us to have a much bigger and a much better buyer's guide. This will be to our advantage.

The Detection of Poisons

A year or so ago we commented on the fact that the oyster is inadequately obedient to the precepts of our health authorities, as it frequently contains arsenic in excess of that minute quantity permitted by the regulations. The oyster is not the only offender, the mussel, the lobster, the crayfish, and the prawn are sometimes even worse sinners. We were careful neither to hint nor to suggest that our national regulations were unduly strict ; knowledge does not always advance in a straight line, but sometimes in a sinuous curve ; it was from the crest of one wave, representing our then utmost advance that our careful government decided to protect us against the poison arsenic : was it perhaps from the crest of another wave that our careful government decided to protect us against the poisons, benzoic acid and boron ? The crest of the wave is succeeded by the trough, but governments pay little attention to the troughs ; they wait until a new crest of suitable eminence arises and then promulgate new ordinances. Mr. King points out a new method of detecting arsenic so delicate as to be almost incredible, and we think a systematic investigation of the fish, and shell-fish, commonly eaten in this country would show unsuspected quantities of arsenic and many other poisons which we refrain from mentioning lest other nutritious and palatable foods become in danger of government interference. Mr. Chaston Chapman, in a paper which recently appeared in the *Analyst*, points out that caramels may contain an acid which is neither benzoic nor salicylic, but may easily be mistaken for these ; also, benzoic acid is a normal constituent of the cranberry and bilberry. He reminds us that heated sugar and all the sweets that our children buy in the shops contain the poison formaldehyde, which is also

prohibited by the regulations ; it seems that nature knows much less about the dangers of preservatives than our government does, and we ought to be very grateful to our government. Edible sea-weeds, according to Mr. Chaston Chapman, contain boron ; this perturbs us not. Few children when on the sea-shore will eat enough sea-weed to contain any great quantity of boron, and the grown-ups who cheerfully, nay even gladly devour the lobster and the scallop, may ignore the much slighter risk from a salad of algæ. Whether we shall ever have any slight misgiving that the new regulations may increase a risk of poisoning by ptomaines or any other products of change or decomposition we do not know. If we were interested in the preservation of potted meats we should try the effect of essence of cranberry, after the removal of its sweetening materials. It seems probable that the use of preservatives in food will become more and more common, and we shall in time become quite accustomed to the flavour of sulphur dioxide, which hitherto we have associated with only the inferior brands of Chablis.

The Propagation of Useful Knowledge

Some of the large companies make a point of circulating to their staff and a few privileged friends at regular intervals information of interest to them. We receive every month from Lloyds Bank a very valuable summary of the world's trade, and other banks make a practice of this nature. The Woodall-Duckham Companies circulate still more frequently a confidential Technical Press Review containing a note, or in some cases almost an abstract, of all the recent publications about fuel. Such journals as CHEMISTRY AND INDUSTRY, *Colliery Engineering*, *Engineering*, the *Gas Age Record* and the *Gas World*, with many other journals, both British and Foreign, are diligently read, and so far as we are able to judge are carefully noted. It must be of considerable advantage to the staffs of such companies to have this information so promptly circulated, and the practice is one which seems to be worthy of extensive adoption. Obviously, the preparation of such a list entails a good deal of time and trouble, but it must be worth a good deal to have a staff kept thoroughly up-to-date in all technical publications. In spite of the numerous publications on industrial chemistry and on the problems of gas, oil, coal and other fuels it takes an unnecessarily long time for the knowledge of recent developments to penetrate the recesses of the human industrial mind. The man who has to decide on the expenditure of money is shy of new methods ; he often prefers that the experiment shall be made by some intimate friend who will run the risk and afterwards divulge in an expansive moment, perhaps after a successful re-double or a run of fluky hazards, what results are really worth noting. This is all very well for the man with the necessary social qualities ; the average man must rely on communications by respectable men in a respectable journal. He is very seldom let down by these, and the expert in his own industry can avoid the few pitfalls which exist. We almost think from the number of extracts from CHEMISTRY AND INDUSTRY that we have seen quoted by the Woodall-Duckham Companies that they and our JOURNAL may almost hope for a reputation for respectability.

THE PRODUCTION OF CLEAN COAL

By **EMERITUS PROFESSOR H. LOUIS, M.A., D.Sc., A.R.S.M.,
M.Inst.C.E., Etc.**

The problem of supplying the industries of the country with coal in the highest possible state of purity is one, the importance of which has only been generally recognised in this country during the last few years. We in this country had the immense advantage that Nature had been generous to us in past geological times, and that our coalfields contained an abundance of thick seams of beautifully clean coal; as long as these were being worked carefully by hand, the coal produced was clean enough for all practical purposes, and needed no further treatment to render it applicable for any industrial purpose. With the gradual exhaustion of some of our thickest and cleanest seams, and the necessity for extracting coal from thinner and inferior seams, with the immense expansion in the quantity of coal produced and, therefore, the need for more intensive methods of mining, in which machine work has largely supplanted hand work, and with, it must unfortunately be admitted, less care and less pride in his work on the part of the miner, the high quality of our coals has gradually declined; whereas at one time we were producing coals of a quality that no other coalfield in the world could equal, to-day we are little, if any better off in this respect than our competitors. Many of these, notably Germany, Belgium and France, and, in more recent years, the United States of America, have found it necessary to employ various mechanical devices for cleaning the naturally inferior coal which their seams yielded. There was no difficulty in devising methods and no lack of appliances, because methods and appliances which had from time immemorial been used in the sister branch of metalliferous mining could be readily adapted to the purposes of coal cleaning, so that the technique of the subject presented no serious difficulties, once the need for the operation was made evident. In this case, as in so many others, a correct statement of the problem was a very long step towards its solution. It is owing, therefore, mainly to our original natural advantages that we in this country have lagged behind the rest of the world in the study of the subject of coal cleaning, but now that the need for it has become apparent here, as it did long ago in other countries, we are energetically making up for lost time, and though we cannot claim to be pioneers, we are readily adopting methods and appliances, introduced in other countries, to our own special needs, for it may be stated at the outset that there is no royal road to the production of clean coal. Each coal must be treated on its merits, and methods thoroughly adapted to dealing with one coal seam may very well prove inefficient with a different one; there is no more any one best method of cleaning coal than there is any one best method of coal mining.

No more striking example of the need for a fuller study of the subject of coal cleaning in this country can be given than the fact recently published in the Press that we have lost certain Scandinavian Railway coal contracts, which were in the habit of coming to this country, to Germany, not, it is stated, on the score of price, but because the German coal is more carefully cleaned than the coal produced in this country.

Perhaps the first question to be answered in any logical discussion of this subject is, "What is meant by clean coal?" Chemists are in the habit of reporting coal analyses upon the dry and ash-free constituents of the coal, and no doubt such a material, if it in fact existed, would represent truly clean coal. There is, however, no such material in Nature, and as we have to do with a natural product, it is useless to set up an ideal standard which, in practice, is impossible of attainment. All coal necessarily contains at least the two impurities which such analytical statements eliminate, namely, inorganic matter and moisture. Coal, as we all know, is the product of partial decay and subsequent chemical changes in vegetable matter, which grew profusely in what appears to have been swampy ground, perhaps in many cases in the deltas of great rivers or along the margins of shallow lakes. All vegetables contain in their substance a certain amount of inorganic matter which is apparently essential to the existence of the plant, and in some cases, at any rate, this assumes considerable proportions. Furthermore, as the coal plants grew on swampy ground, their decaying remains must have been carried down with them a certain proportion of mud, possibly in a colloidal state; some of the inorganic salts dissolved in the water in which the plant remains were submerged must have become concentrated in the vegetable matter, either by adsorption or by evaporation of the water, whilst the plant, both during its lifetime and after its death, is likely to have collected a certain amount of dust brought down by wind or rain. All such inorganic matter may be looked upon as an essential part of the coal substance. When coal is burnt, this inorganic matter, or at any rate a proportion of it, necessarily remains behind in the form of ash, and is usually spoken of as the intrinsic ash of the coal. As a general rule, sufficient distinction is not drawn between the ash left after combustion and the inorganic matter present in the coal itself; if, as is generally the case, the inorganic matter consists of a hydrate such as clay, or of a carbonate such as calcite, or of a sulphide such as iron pyrites, the ash left after combustion has a lower weight than the inorganic matter originally present, and this fact must always be borne in mind in any discussion of the problem. In practice, however, it is impossible to determine inorganic matter in coal save in the form of ash, for the intrinsic inorganic matter, at any rate, cannot be separated from the organic constituents of the coal save by the destruction of the latter.

In addition to the intrinsic inorganic matter, there is in practically every case a certain proportion of extrinsic inorganic matter. This latter is due partly to natural and partly to artificial causes. The extrinsic or accidental impurities may have been introduced into a coal seam either simultaneously with its deposition or formed after the conversion of the vegetable matter into coal is partly or wholly completed. Thus layers of mud and silt or even of fine sand, relatively free from inorganic matter, may have been deposited between the layers of vegetable matter, and now present themselves as shaly or sandy "dirt" partings in the coal seam, ranging from excessively thin layers to beds many inches in thickness. At a later period there must have been introduced the carbonates of lime, magnesia and iron,

which are so frequently found lining the division planes of a coal seam. These are sometimes spoken of as ankerite, but are usually more calcareous than the true mineral ankerite. In the same way thin films of gypsum sometimes occur, and iron pyrites, both cubic and rhombic, is a substance of frequent occurrence in coal seams, being apparently produced by the reduction of solutions of ferrous sulphate circulating through the coaly matter probably during the later stages of its conversion into coal, though it may conceivably in some cases have been produced in quite the early stages of the decay of the vegetable matter. Other accidental impurities are artificially introduced during the operation of coal getting. Generally speaking, coal is mined in the first instance by "kirving" or undercutting a relatively thin slice. As a general rule, when kirving is performed by hand, this is done in the coal substance itself, the thill or floor upon which the coal rests being in many cases too hard to render kirving in it by hand an economic proposition. With the introduction of coal-cutting machinery, however, kirving in the fireclay or shale thill beneath the coal has become quite usual, and this is especially necessary when the coal seam is a thin one, so as to avoid breaking too large a proportion of the total thickness into smalls. Some of the dirt thus cut is very liable to find its way into the coal and thus adds to the extrinsic ash. Again, when the roof is poor, falls are practically inevitable, and even if only small quantities of roof matter fall, quite insufficient to be a source of danger to the miner, these droppings also find their way into the coal and still further add to the accidental impurities. It depends entirely upon the nature and thickness of the dirt partings in a coal seam whether these can be kept out during the operation of mining or whether they are sent to bank with the coal to be subsequently eliminated during the cleaning operation. Until comparatively recently it was difficult, in some cases impossible, to discriminate between intrinsic and extrinsic ash, but within recent years methods for doing this by the application of X-rays have been developed; since the coal substance is organic, composed of elements of relatively low density, coal is highly transparent to X-rays, whilst the various impurities are opaque, and an X-ray photograph of a piece of coal thus shows whether the inorganic constituents are so uniformly disseminated as to be in effect a portion of the coal substance and therefore intrinsic, or whether they occur in compact masses of more or less considerable size, and are therefore extrinsic.

The distinction is one of the utmost importance, because no treatment that can be applied to the coal will remove the intrinsic inorganic impurities, whereas, theoretically at any rate, it is possible to get rid of all such extrinsic matter. As far, therefore, as inorganic matter is concerned, we may define pure coal as coal containing only intrinsic inorganic constituents. Coal is, of course, not a single homogeneous substance, but consists of a number of different constituents mingled in various proportions. The classification of these constituents, originally proposed by Dr. Marie Stopes, is now generally accepted, these constituents being: (1) Durain, the dull, lustreless portion of the coal, (2) vitrain and (3) clarain, the bright shining constituents,

and (4) fusain, the soft, more or less pulverulent portion. It has been found that the proportion of ash varies considerably in these different components: Vitrain and clarain are low in ash, the percentages found by different experimenters ranging from 0.3 to 0.75%; durain generally contains from 4 to 8% of ash, whilst fusain ranges from 10% to 16%. The ash left by vitrain and clarain is largely soluble in water or acids, and apparently represents mainly the inorganic matter which formed an essential portion of the plant structure; the ash left by durain is largely insoluble, and apparently consists to a great extent of the clayey matter introduced in the manner already described; the ash of fusain is often largely calcareous, and is probably due to the infiltration of salts of lime during or after the completion of the conversion of the vegetable matter into coal.

Whilst it is possible to select small specimens of coal containing as little as 1% of ash or exceptionally even less, the intrinsic ash of most coals varies from 2% to 6%, and by our definition this constitutes a practically pure coal, namely, one that contains none except intrinsic inorganic matter.

As regards the other invariably present impurity, namely, water, here, again, it is possible to discriminate between what may be called intrinsic moisture and what may be called adventitious moisture. Under the former head may be included the percentage of moisture adsorbed by coal and retained by it under ordinary atmospheric conditions. Needless to say, the percentage varies with the hygrometric condition of the surrounding air, and probably in most cases ranges from 2% to 4% under ordinary conditions and with coal of ordinary sizes. Coal as it comes from the pit may carry only this amount of adsorbed water, or it may be thoroughly wet, with 10% or even more of water. A good deal of information as to the percentage of water that coal can carry has been accumulated by the investigation of washed coal. Such coal, as it comes from the washery, is, of course, thoroughly wet, and is usually allowed to drain in specially designed drainage hoppers or silos. Under normal conditions such coal generally drains as completely as possible in 48 hrs.; for the next 48 hrs. it may lose a little more water, chiefly by evaporation, and after this the moisture remains practically constant, though it would take a long time for it to get down quite to the intrinsic percentage; after 48 hrs. draining, lump coal, say, above 3 in., usually drains to from 5 to 8% of water, nuts, from 3 in. down to, say, $\frac{3}{4}$ in., may drain to from 8 to 10% of water, and smalls will usually retain over 10 and even up to 30%. These figures are, however, quite approximate, and depend largely upon the character of the coal itself. It is obvious, for instance, that a coal with a large percentage of clarain or vitrain will retain less water than a coal with a large proportion of fusain.

Reference may also be made to certain impurities, which, although they are, in fact, classified as ash, seeing that they are essentially inorganic impurities, nevertheless deserve notice on account of their effect upon the uses to which the coal may be put. One of these is iron pyrites, which occurs in both the cubic and the rhombic form; it may be present either in the form of

concretions or masses of considerable size, or may be very finely disseminated. Its importance is due to the fact that it is one of the principal sources of sulphur in coal, which sulphur may be present in three different forms, namely, as organic sulphur, as a sulphate, generally a sulphate of lime, and as pyrites. Pyrites has a high specific gravity ranging from 4.7 to 5.2, and, therefore, as will be seen in the sequel, it is easily separated from coal when present in a tolerably massive form; it is only the exceedingly finely-divided pyrites or pyrites occurring in the form of excessively thin plates or facings in the joints of the coal that causes serious difficulties in this respect. The presence of sulphur in coal is objectionable for practically all uses to which coal may be put, though it must be admitted that its injurious effect is not very noticeable in house-coal unless the quantity be very great. The presence of sulphur in coal for coke-making is particularly objectionable when the coke is to be employed, as the greater portion of it is, in the manufacture of pig iron, as a considerable proportion of the sulphur present in the coke tends to pass into the iron. In the process of coking, iron pyrites is decomposed, half of the sulphur being evolved and the other half being left behind in the form of ferrous sulphide. When calcium sulphate is present this is probably all reduced to calcium sulphide through the operation of coking. The behaviour of the organic sulphur is by no means thoroughly understood at present, but it would seem tolerably certain that a proportion thereof remains with the coke. Again, sulphur is very objectionable in coal which is used for gas-making, on account of the contamination of the gas with sulphur compounds, both organic compounds and sulphuretted hydrogen being evolved in the process of gas-making. It has been shown experimentally that some of the sulphur present as iron pyrites is evolved in both these forms. It is obvious that in no case can the sulphur which is actually in organic combination with some of the constituents of the coal substance be removed by any process of purification, but the removal, more or less complete, of sulphur present in other forms is possible, and requires special attention in the process of coal cleaning.

The presence of phosphorus is objectionable in the case of coke which is to be used in the manufacture of hæmatite pig iron. Apparently this element always occurs as a phosphate, generally of lime, which is one of the constituents of the ash; the extent of its removal will therefore depend upon the degree to which the ash itself is got rid of, and, in spite of the economic importance which this element may occasionally present, it requires no special attention, since the problem of its removal forms part of the larger problem of the purification of coal from its inorganic impurities.

Another impurity, to which a few words may be devoted, is salt. It is probable that iron pyrites (in many cases) and sulphate of lime are introduced into the coal after the process of the conversion of vegetable matter into coal has been more or less completed; on the other hand it is probable that the salt present has been adsorbed from the water in which the original plants grew or were deposited. Salt is particularly objectionable when coal is to be distilled at high temperatures, whether in the process of coke making or of

gas making; it volatilises at a temperature below that required in either of the above processes, and exerts an injurious effect on the walls of the chamber in which the coal is being treated, more especially perhaps upon coke-oven walls. As is well known, in the presence of moisture salt attacks silica, silicate of soda and hydrochloric acid being formed; it would seem probable that in a reducing atmosphere and in the absence of moisture there would be no action, but it is obvious that water vapour must always be present, and sometimes in considerable quantities, as for example, when wet coal from a washery is being coked. Prof. W. A. Bone* quotes experiments which show clearly that a firebrick is much more strongly attacked by a salty coal when the latter is wet than when it is dry. Some results recently obtained by Mr. C. W. H. Holmes indicate that coal, which contains a good deal of fusain, after crushing showed a much higher percentage of salt in the finer portions than in the coarser portions, and these figures indicate that in all probability it is the fusain that carries the larger proportion of the salt.

This review of the impurities in coal enables an answer to be given to the question, what we mean in practice when we speak of pure coal, and we may set up the definition that pure coal is coal containing only its intrinsic inorganic matter and its intrinsic moisture. There is this difference between these two impurities that the percentage of intrinsic moisture depends not only upon the coal itself, but upon outside conditions, and is therefore variable for one and the same coal, whereas the intrinsic ash of a coal is determined by the character of the coal itself; it varies widely as between the coals from different seams and even as between the coal from different parts of the same seam, but for any particular coal it may be looked upon as a constant. It by no means follows, however, that the object of coal cleaning is to reduce the ash down to intrinsic ash alone; one of the most important problems that present themselves in practice is the question how far any given coal ought to be cleaned so as to give the most economic results. It is in most cases possible to clean a coal so thoroughly that it shall retain only its intrinsic ash, but to do this would often involve the sacrifice of so large a proportion of the valuable coal substance that this is rarely, if ever, attempted in practice. It becomes necessary to set up a standard to which each coal shall be cleaned, that standard being determined by the nearest approximation that can be attained to pure coal as above defined without involving excessive loss of valuable matter. The determination of this standard involves the study of each particular coal, and is perhaps best done by the construction of what is known as a washability curve or Henry curve. A sample of coal to be examined is broken down to a convenient size and a weighed portion placed in a solution of a specific gravity such that a portion of the coal will float and another portion sink; the portion that floats may be further sub-divided by means of solutions of progressively lower specific gravity, and the portion that sinks by solutions of successively higher specific gravity. In this way the coal is fractionated into a number of parts, each having a definite specific gravity; the percentage of each part

* Coal and its Scientific Uses, 1918, p. 48.

is determined by weighing, and the ash in each is then determined by incineration. By setting the percentages of the various fractions off as vertical ordinates, whilst the percentages of ash in each are set off as horizontal abscissæ, a curve is obtained, it is usual to set out also two other curves, derived from the first one, which show the integration of the ash contents in the floats and sinks respectively. From the shape of these curves it is easy to deduce how much valuable coal must necessarily be sacrificed in order to obtain coal in any desired degree of purity. This method is now quite well known, and is becoming very widely employed as a preliminary to the design of a coal-cleaning plant. As far, therefore, as the ash is concerned, the object of coal cleaning is rarely to produce a truly pure coal, but a coal sufficiently pure to satisfy the industrial applications for which it is to be used. Similarly with regard to moisture; within the last few years the dry-cleaning of coal has become an economically practical operation, and although to-day used on a relatively small scale, its employment is rapidly extending, and it will no doubt be generally applied in all cases where the coal itself is not naturally too wet, and where the purposes to which the coal is to be applied demand that it shall be in as dry a state as practicable.

Undoubtedly the removal of the inorganic impurities is the first problem which the coal cleaner has to attack; subsequently he must turn his attention to delivering the coal in the driest possible condition; it is only within the last few years that the latter problem could only be solved with any reasonable measure of success, although its desirability had long been recognised.

The separation of the inorganic impurity or dirt, as it may conveniently be termed, from the coal necessarily depends upon the difference between certain physical properties of the one and of the other, and of these the most important is the difference of density—pure coal, as ordinarily understood, having a specific gravity that does not, as a rule, differ greatly from 1.3, whereas ordinary dirt has a specific gravity of about double that figure. If a given sample of coal consisted of nothing but practically pure coal and pure dirt, the cleaning of the coal would be an easy matter, but, unfortunately, most coals consist of mixtures ranging from pure coal, through coal carrying increasingly larger quantities of dirt, until it becomes what is usually spoken of as bone coal, through carbonaceous shales with continually decreasing proportions of organic matter until pure dirt is reached at the other end of the scale. It is this fact that complicates immensely the problem which the coal cleaner has to solve, and it is on this account that it becomes necessary in the first instance to draw up washability curves, and from these to decide how much of the impure coal shall be taken in with the cleaner coal, and what proportion of bone coal or carbonaceous shale shall be allowed to go off with the dirt. The process of separation, therefore, is not merely designed to separate a light substance from a substance double its own weight, but to separate sharply substances lying on either side of a definitely drawn dividing line, the substances on either side of this line differing but little from each other in density, although all the substances on one side of that line are specifically

lighter than any of the substances lying on the other side thereof.

In order to separate substances of different specific gravity from each other, the separation must take place in a medium which is practically always lighter than the lightest portion of the coal. The only exception to this statement met with in practice is in a recently introduced process known as the Chance sand-flotation process, in which the separating medium consists of water in which sand is maintained in mechanical suspension in such a way as to be equivalent to a liquid of specific gravity higher than the coal though lower than the dirt, so that the former will float whilst the latter sinks in it. The process has been used to some extent, but not sufficiently for a definite opinion to be formed as to its merits. With this one doubtful exception, separation takes place in a lighter medium, which necessarily, however, offers a certain amount of resistance to the movement of any substance through it, the media universally employed being either water or air. The behaviour of bodies falling in such a resisting medium has been elaborately investigated, one of the most recent studies on the subject being that by Dr. Geoffrey Martin.* The falling of a single particle in a medium, as long as that particle exceeds a definite size, appears to follow pretty closely the law first enunciated by Rittinger some seventy years ago, who showed that such a particle tended to move ultimately with a uniform velocity, which can be expressed by the equation

$$V = c \sqrt{D \frac{(S - s)}{s}},$$

where V is the ultimate falling

velocity, D the diameter of the particle, S its specific gravity, s the specific gravity of the medium in which it is allowed to fall, and c is a constant, the value of which depends upon the units in which V and D are expressed, as well as upon the shape of the particle; the above expression, strictly speaking, applies only to spherical particles, but Rittinger has extended its use by postulating a sphere, the mass of which is equal to that of the particle under consideration; necessarily c will vary with the shape of the particle itself. The ultimate falling velocity is only attained at the end of an infinite period, but the increase of velocity from zero is rapid in the first part of the fall, and a practically constant velocity is attained at the end of a relatively short period; furthermore, the expression is important, because it has been found that an ascending current having a velocity exactly equal to the terminal falling velocity, as above calculated, will just keep the particle in suspension, whereas it will fall in a current of lower velocity than this and be carried upward in any current of higher velocity. There is thus indicated a principle by which particles of different specific gravities can readily be separated from each other. Unfortunately, however, Rittinger's principle is frequently applied under conditions which do not warrant its application. Strictly speaking, it should only be applied where a single, roughly equidimensional particle is allowed to fall in a practically infinite volume of medium, and may be considered to be true where single particles are allowed to fall in a body of the medium so large that any upward

* Researches on the Laws of Air Elutriation. The Institution of Chemical Engineers. December, 1926.

current due to the displacement of the medium by the particle is negligible. Such conditions, however, nowhere obtain in practice. In all coal-cleaning appliances the quantity of solid material bears a very considerable proportion to the bulk of the medium enveloping the particles, or, to employ the customary expressions, Rittinger's law only holds true of free-falling particles, whereas in all coal-cleaning appliances a condition of hindered falling prevails. It cannot be said that the laws of hindered falling are as yet properly known. The writer is inclined to think that the ultimate falling velocity attained by a mass of particles falling in a medium under a condition of hindered falling may probably be expressed by equation having somewhat this form:—

$$V = c \sqrt{D \frac{S - s(1 + m)}{s}}$$

in which m is a constant for any given set of conditions, and may be defined as a coefficient of mass concentration, or as a function of the closeness together of the solid particles, or of the ratio which the cross section of the solid particles bears to the cross section of the enveloping fluid medium. In a heap of ordinarily sized coal it is found that the coal occupies about 55% of the total volume, and certain experiments would appear to lead to the inference that for ordinary coal and shale falling in water under normal conditions m probably lies between 0.1 and 0.3. Its value can only be deduced from experimental results; it is, however, clear that its lowest value is 0, which represents the condition of free-

falling, and its highest value is $\frac{S - s}{s}$, which would be the condition when the mass consists wholly of the solid particles.

It must be emphasised, however, that this expression is put forward only tentatively, and that it must not be looked upon as by any means established; although no complete demonstration of its correctness can be given, there would nevertheless appear to be some logical justification for it, because in hindered falling in a medium, upward currents of that medium are set up, and these add to the buoyant effect of the medium in somewhat the same way as though the density of the medium had been increased. It would follow that if two particles of diameter D and D_1 and specific gravities S and S_1 respectively are allowed to fall in a medium of density s , these particles will have an equal ultimate

velocity under free-falling conditions when $\frac{D}{D_1} = \frac{S_1 - s}{S - s}$

and will attain it under hindered falling conditions when $\frac{D}{D_1} = \frac{S_1 - s(1 + m)}{S - s(1 + m)}$. These are, therefore, the rela-

tions that fix the ratio of the sizes of particles of coal and shale of any given specific gravities which allow of the smallest of the shale particles falling faster than the largest of the coal particles, and the ratio is evidently larger in the case of hindered falling than in the case of free-falling particles. This is quite a familiar fact, namely, that when a mass of particles, which would be equal falling under free-falling conditions, are exposed

to the conditions of hindered falling, the smaller and specifically heavier particles fall more rapidly than the larger and specifically lighter ones. This consideration explains why it is that in the majority of appliances in which minerals are separated by their rates of falling through vertical currents of water, it is not necessary to size as closely as the Rittinger formula would indicate, and that the closest sizing appears to be necessary in such appliances as the Draper washer, in which the conditions approximate more nearly to free-falling. In practice the only media that need be considered are water and air, for which s is practically equal to 1 and to 0 respectively; in air, however, m would appear to be comparatively large, so that $s m$ must not be taken as 0, but probably has, on the contrary, a definite value. It is further worth noting that particles falling in air practically never attain the condition of uniform velocity, whilst in the case of particles falling in water that velocity is practically reached when the particles have fallen through a distance given

by the expression $\frac{0.55 D (S - 1)}{S}$ ft., where D is ex-

pressed in inches. It has already been pointed out that the above laws only hold when the falling particle is above a given size, although it cannot yet be stated what that limiting size in fact is. For spherical particles of sand falling in water the limit appears to be about 0.08 inch. For very small particles, the accelerating force of which is so small that the resistance due to viscosity is no longer negligible, the falling velocity is given by an entirely different law, known as Stokes's law, according to which $V = k D^2 (S - 1)$ for particles falling in water, where k is a constant which can be determined as indicated by Stokes. The radius of the particles above which Stokes's law no longer holds good is given by the expres-

sion $\frac{0.00333}{\sqrt{S - 1}}$ inch, so that for coal of density 1.35 the

largest particle that obeys Stokes's law has a radius of 0.0047 inch. Starting with reasonably large particles, as particles progressively smaller are considered, they will reach dimensions when they become too small to obey Rittinger's law; as they become smaller and smaller, they reach a size below which their rate of falling follows Stokes's law; both these laws show a parabolic relation between velocity and diameter and, between the dimensions where these two laws hold good, there is an interval within which a straight line law appears to hold; it can, however, hardly be stated definitely whether this is a true straight line law, whether the exponent of the diameter increases gradually from $\frac{1}{2}$ to 2, or whether the exponent is actually or approximately equal to 1 throughout that interval. There is still room here for much experimental research before the incidence of these laws is fully understood.

It must also be borne in mind that the ultimate falling equation is true only when the régime of equal-falling has been practically established, that is after the particle has fallen through a definite distance as given above; the conditions of falling before the equal-falling condition is attained have never yet been properly

investigated ; it can only be said that of a group of equal-falling particles, the smaller and specifically heavier start more rapidly and fall faster at the outset than do the larger and specifically lighter particles ; in fact, at the very commencement of the period of falling, it is density alone and not the size of the particle which determines its falling velocity. This again accounts for the fact, now beginning to be generally recognised, that close sizing is unnecessary when coal is washed on the familiar bash or jig, perhaps the most widely employed of all coal washing appliances. It was at one time thought that satisfactory washing could not be attained in bashes unless this was preceded by fairly close sizing, but both practice and theory indicate that this view is incorrect, and that relatively quite coarse sizing is all that is needed in order to obtain satisfactory results.

Another principle which is quite widely adopted for coal cleaning purposes is the principle of the trough washer ; generally speaking, every trough washer consists of an inclined trough or its equivalent, in which the material to be cleaned is allowed to flow down in a shallow stream of water. A number of actions take place under these conditions ; in the first place, there is a well-marked tendency to stratification, the shale or dirt tending to form the lowest layers on the trough, whilst the coal occupies the upper layers. This stratification has the effect that the dirt is exposed to greater friction in the course of its passage down the trough, whilst, furthermore, it is acted on by slower moving films of water than is the superimposed stratum of coal. Again, this effect is intensified by the fact that shale tends to break up into relatively thin, flat pieces, whilst coal tends to break into pieces more nearly cubical, and this difference in shape reinforces the effect already explained, the pieces of coal tending to roll down, whilst flat pieces of shale can only slide. The net result is that under such conditions the coal forming the upper layers will travel down the trough more rapidly than the shale which forms the lower layers, and the latter will tend to accumulate on the floor of the trough, especially if this is furnished with dams or weirs behind which it can collect. The earliest trough washers were intermittent in their action, and had, therefore, to be worked in pairs, one being cleaned out whilst the other was in operation, and they also required a good deal of attention and labour. Subsequently, automatic, continuously working, trough washers were introduced, such as the Elliott washer, the Blackett washer, and more recently the Rheolaveur ; the last-named appliance continuously evacuates the dirt and cleaned material against ascending water currents, and, furthermore, differs from the two previously-named appliances in that it is able to produce one or more grades of middlings at the will of the operator.

Another set of appliances, usually spoken of as shaking tables, particularly adapted to small coal, say, under half-an-inch, work on the principle of jerking or throwing the impure coal to be washed in a given direction, whilst a stream of water flows over the appliance usually at right angles to the direction of throw. There are quite a number of different forms of these shaking tables, differing mainly in the mode in which the vibrating action of the table is set up and in the suspension of

the table. All may be described as thoroughly efficient, producing a good separation of clean coal and impurities, and capable of making intermediate classes or middlings as may be required. The production of a class of middlings is a principle which is being adopted with advantage in many coal cleaning appliances, some being so arranged as to return the middlings into the stream of coal to be washed ; this arrangement has the advantage of separating more widely the clean coal and the dirt to be rejected, and thus enabling a more satisfactory separation to be produced, whilst a portion of the middlings may be allowed to go off either into the stream of clean coal or into the rejected dirt according to the market requirements from time to time.

This principle of the vibrating table is, furthermore, of especial importance, because it is the basis of the principle upon which practically all present-day dry-cleaning appliances operate, the essential difference being that the surface of the table is in these appliances composed of a permeable material through which an upward current of air is caused to flow. This upward current of air has the same effect as the current of water in the wet-cleaning appliance, that is to say that it tends to stratify the material, the heavier shale and dirt forming, of course, the bottom layer ; the motion of the table is, therefore, more readily communicated to the material more directly in contact with it, and thus the dirt and the clean coal are caused to move in different directions, more or less at right angles to each other. When the construction of the table is such that anything approaching free-fall is impossible, sizing is not necessarily so close ; in some of the earlier dry-cleaning tables close sizing was indispensable in order to obtain satisfactory results, but this difficulty has been largely overcome in some of the more recent forms.

As already stated, all the successful dry-cleaning plants at present in operation, of which there are quite a considerable number, employ a shaking table in conjunction with an upward air current. There seems to be no good reason why appliances working with puffs of air like the Paddock air-jig and the Krom pneumatic jig, which have been used experimentally in the United States for the dry-dressing of heavier minerals, should not be capable of being so modified as to clean coal successfully ; the fact remains, however, that, up to date, no such appliance has been practically successful.

In connexion with the air-cleaning of coal there is another point of great practical importance to be considered :--

It has already been shown that when particles are below a certain size, they no longer obey the laws of falling upon which all wet-cleaning processes are based, and these fine particles in the ordinary process of coal washing form a slime or sludge, the disposal of which is one of the greatest difficulties of the process. The nature of the sludge requires, in every case, to be carefully investigated. In many coals it naturally consists largely of fusain, which, from its fine, acicular structure, readily breaks up into dust. Since fusain is essentially non-coking, and since the object of coal cleaning is in the majority of cases to produce a clean coal suitable for making a high-class coke, the importance of keeping

out the fusain dust is self-evident. On the other hand, there may be coals in which brittle clarain or vitrain occurs in thin layers, and under such conditions these layers would break up and form a considerable portion of the dust, which, under these circumstances, it would be advantageous to retain with the coal to be coked. In either case, it is becoming more and more clearly recognised that for successful coal washing it is advisable, wherever possible, to eliminate the dust before sending the rest of the coal for treatment. There are conditions when the coal is naturally so wet that the removal of dust without preliminary drying is impossible, and it may be taken as a fairly universal rule that the drying of coal as a preliminary to its treatment is not an economic proposition. With such naturally wet coal, probably the only available method is to wash the coal by one of the wet methods above indicated, and to treat the residual sludge afterwards; occasionally it may be possible to wet-screen the coal first, and to screen off the dust in the form of sludge. In either case this sludge has to be treated, and its method of treatment depends upon its character. If, as is sometimes, though not very often, the case, the fine material is clean enough without further treatment, it may be settled in tanks. In America Dorr settlers are largely and successfully used for this purpose, giving an overflow which is very nearly clear, or at any rate clear enough to go back to the washery, whilst the thickened slime may be turned into the drainage hoppers. If, on the other hand, the fine material contains a large proportion of dirt, as is often the case, especially when the impurities are largely of a clayey nature, probably the best method is to send it to a flotation plant, the principle of which will be presently described. In every case, however, where the coal is not too naturally wet to interfere with successful dry separation of the dust, this should be the first step, whether the coal is afterwards to be treated wet or dry.

Within relatively recent times there have been introduced a number of vibrating screens which are especially well adapted for the efficient screening out of fine material, the Hummer screen being typical of this class. These screens consist of a tightly stretched surface of wire gauze which is kept in rapid vibration by appropriate means, the surface being usually inclined at a pretty steep angle. A screen of this type will sieve out fine particles efficiently, and has at the same time quite a large capacity. Another method, which is also extensively used, consists of sucking or blowing the fine particles out, generally from a falling stream of coal, the fine particles thus extracted being afterwards collected by bag filters, cyclones, or other suitable means.

It has to be admitted that the efficient collecting of this dust is a problem which cannot be said to be completely and satisfactorily solved to-day, though various appliances for the purpose are in practical use. This difficulty of collection certainly constitutes a drawback to this method as compared with the vibrating screen. The method is decidedly an old one, the first patent for thus treating coal going as far back as the year 1849. The advantages of separating the finer particles as a preliminary to cleaning is unquestionable, and with the extension of the modern methods of dust firing, the

product should find a ready, and immediate application. There are cases where the whole of the power required for coal cleaning can be economically generated by means of boilers fired with dust separated from the coal to be treated. It is hardly necessary to emphasise again that this method of utilising the dust is especially suitable when the dust consists wholly or largely of fusain. It will be gathered that the dry-cleaning of coal is especially important because it gets rid of both of the impurities, ash and moisture, which detract from the calorific value of the product. Apart, however, from this consideration, even where for any reason wet methods of cleaning are preferred, as may well be the case when, for example, a costly washery has been installed, or when a relatively wet coal is required for coking, as is the case with certain coals low in volatile matter, the dry separation of the dust before the coal goes to the washing plant constitutes a very important improvement in the entire operation. It must not be forgotten that there are, in this country, not a few cases where the water required for washing has to be paid for, and in any case the circulation of the washery water and the disposal of dirty effluents cost money, and the most obvious means of economising in this respect is by getting rid of the fine sludge-forming particles as a first step.

It need hardly be emphasised that the method of cleaning by all the appliances above considered is based essentially upon the difference between the specific gravities of the coal and the dirt respectively. There are, however, a few processes which depend upon differences in other physical properties of the two materials. One such process is that of flotation.

The principle of flotation is too well known to-day to require description; it depends upon the greater surface tension of a shale-water interface than of a coal-water interface, in consequence of which when two particles of these two substances are introduced into water through which streams of air bubbles ascend, the shale being thoroughly wetted, sinks to the bottom, whilst the particles of coal attach themselves to the air bubbles and are carried upwards into the froth; certain reagents are added, which have the effect of accentuating the difference of surface tension between water and coal and water and shale respectively, and of stabilising the froth. These reagents are inexpensive, substances such as cresol and various cheap oils being used. Various mechanical means are used for producing the flow of air bubbles and for drawing off the froth from the surface of the pulp, and the process acts most satisfactorily, producing a very clean coal and an equally clean reject. The difficulty in the practical application of this process lies in dealing with the froth, which is usually a very tenacious one, and holds a large proportion of water, from which the coal can be separated only with considerable difficulty. Various types of filters and of centrifuges have been tried, but so far without any great success. The method now generally adopted is to mix the froth with the coal washed in some other process, *e.g.*, in bashes, and allowing the mixture to drain in suitable drainage hoppers. Even this method is effective only if care be taken that the froth is thoroughly mixed with the washed coals; if the former is allowed to form distinct layers in the hoppers, it forms a kind of

water-proof sheet, which not only will not drain itself, but greatly hinders the drainage of the other coal. If, however, properly and effectively mixed with the washed coals, it has been found in certain cases that the mixture will drain as effectively, *i.e.*, down to 10% of water, in 36 hrs. as the washed coal without the froth would do in 24 hrs.*

Another interesting process is based on the difference between the frictional resistance experienced by coal and dirt respectively when sliding over any given surface. The most recent application of this process is to be found in the Pardee spiral separator; this consists of an inclined spiral track down which the coal to be treated is allowed to slide. Assume that the material to be treated consists of pieces of coal and of shale, of which the shale, breaking up into flat pieces, moves with more friction than the coal, which tends to break up into more or less cubical blocks. The result will be that the coal will acquire a greater velocity, and if the spiral is suitably arranged the velocity thus acquired may be rendered sufficient to cause the coal to jump over the edge of the spiral track and to fall into a spiral trough running alongside of it. The shale on the other hand will hug the inner edge of the spiral track, and it is possible to so arrange the appliance that material intermediate between the two, such as bone coal, will be delivered separately, thus making three different grades. The appliance was first introduced in the United States for the cleaning of anthracite, which it did very successfully. Many years ago the same principle was utilised for separating anthracite from shale, the appliance then consisting of an inclined shoot down which the material was allowed to slide; at a given distance down there was a gap in the shoot; the more rapidly moving anthracite acquired sufficient velocity to jump over the gap and continue its course down the shoot whilst the slower moving shale dropped into the gap. This form was never used for bituminous coal, but the spiral separator has been thus adapted; it must, however, be emphasised that the appliance is not of universal application, there being cases where the coefficient of friction of the coal and of the shale are so close together that separation on this appliance becomes impossible and examples can even be found where the shale has a lower coefficient of friction than the accompanying coal. The moist or dry condition of the materials also affects the proper working of the appliance. Whilst, therefore, in some cases it has been applied quite successfully, there are others in which it is not applicable, and apparently every proposition for the employment of this separator must be tried out practically before it is possible to state whether or not it will be successful in the given case. In any case the separator does not work successfully on ~~the lower limit~~ the lower limit being usually about $\frac{3}{4}$ -in., and the coal to be treated requires tolerably close sizing. It is quite possible that in the Pardee separator the greater elasticity of coal as compared to shale also comes into play; the spiral track is often intentionally roughened, so that the coal would tend to proceed along it by a kind of bounding or rolling motion, and thus acquires a greater velocity than the sliding shale. Quite recently the principle of difference in elasticity

has been utilised in the Berrisford separator, which causes the impure coal to rebound from an inclined surface, the coal bounding off further than does the shale. This process is quite in the experimental stage, and it is impossible to say whether it will or will not prove to be successful in practice.

It will thus be seen that there are a number of different principles that can be brought into play for the cleaning of coal and that each one of these principles can again be utilised in a number of different appliances. The designer of a coal cleaning plant has, therefore, before him a very wide choice both of principles and of appliances, and whilst it may probably be said that reasonably good technical results can be attained in a variety of different ways, very careful study is required in order to obtain the best economic results in any given case. The one thing to be borne in mind is that every coal cleaning problem is a problem by itself, and that no general solution can be advanced; each proposition must be studied on its merits, and the adoption of any given process or appliance at one pit, merely because it has given good results in another colliery, invites failure unless all the conditions in both cases are fully and carefully investigated. This much, however, can be said without much hesitation: whilst we can no longer in this country depend upon being furnished by nature with the high-class pure coals for which Britain was at one time famous, there is no doubt at all but that pure coal, in the sense in which that term has been used here, can be produced economically by a suitable selection of cleaning appliances, and there is no reason why collieries in this country should put upon the market coal containing either more ash or more water than there is being left in the coals offered to the world's markets by our competitors.

THE INVENTION OF LITHOPONE

By RANSOME W. COOPER

A casual glance at some of the technical books dealing with lithopone reveals an astonishing haziness as to the invention of that highly-useful material. Not only does there appear to be an uncertainty as to the name of the inventor, but also as to the dates involved and even to the first use of the name itself.

For instance, Henry A. Gardner, in his recent book, "Paint Researches and their Practical Application" (p. 39), states: "This pigment (lithopone) was apparently first produced by Orr in 1874." Maximilian Toch, "Chemistry and Technology of Paints," 1926, p. 41, says, "John B. Orr, of England, in 1880 discovered that when (lithopone) is heated to dull redness, suddenly plunged into water, ground in its pulp state, thoroughly washed and dried, its characteristics are totally changed."

Yet J. B. Orr's original specification is dated February 10, 1874, and claims the chilling action as an integral part of the patent.

The date of 1874 is given by Allen Rogers, "Industrial Chemistry," Uebele, "Paint Making and Colour Grinding," J. G. Bearn, "Chemistry of Paints, Pigments and Varnishes," Holley, "Lead and Zinc Pigments," and W. G. Scott, "White Paints and Painting Materials,"

* Rev. Ind. Min., 1926, p. 355.

who all ascribe the invention to J. B. Orr, as does also G. Hurst.

On the other hand, Ullmann's German Encyclopædia (No. 12, p. 245) states that lithopone was first prepared on factory lines in 1853 by De Doudet (misprint for De Douhet),¹ by precipitating zinc sulphate with barium sulphide. He goes on to say that J. B. Orr produced the material in a similar manner, but subjected it to a roasting and cooling process which made it whiter, and more compact, and adds that Boulez introduced the name of lithopone in 1877.

This last statement is incorrect, for we find the name used by V. Leger in the opening words of his patent No. 28,834, May 30, 1871. Moreover, he uses the word as though it were even then of sufficient general employment to require no explanation: "It is noticeable in the manufacture of lithopone, as described in patent No. 26,423 . . ."

It will have been noticed that V. Leger refers to a prior patent dealing with the manufacture of lithopone. This No. 26,423 is that of a patent taken out by himself in Brussels on October 18, 1869. Its method of procedure is so simple, and, moreover, describes so closely the present method of manufacture, that we give it verbatim:—

"En agglomérant intimement quatre parts sulfate de baryte, deux parts sel marin, une part charbon, les exposant ensuite à un feu violent, jusqu'à ce que fusion du sel s'ensuive, j'ai pour résultat de cette opération du sulfure de barium mélangé de chlorure de sodium. De ce produit bien lessivé, décanté clair, j'obtiens le blanc précité en versant dans la moitié de la liqueur une part utile de chlorure de zinc, pour former un précipité de sulfure de zinc et du chlorure de baryum, en liqueur. Je précipite ensuite le chlorure de baryum par du sulfate de zinc, qui fait un précipité de sulfate de baryte, en refaisant du chlorure de zinc. L'autre moitié, du sulfure de baryum étant ajoutée à ces précipités, il devient évident que j'ai par cette triple opération, deux équivalents de sulfure de zinc, contre un équivalent de sulfate de baryte, et pour résidu du chlorure de baryum mélangé de sel marin. Le précipité étant mis sur toile, égoutté, desséché, calciné au rouge cerise, jeté dans l'eau froide pour l'étonner et le rendre opaque; broyé à l'eau en pâte impalpable, lavé et séché, il fait une couleur blanche d'un excellent emploi en peinture."

It will be seen that the whole process, including that of chilling the resulting product, is covered by Leger's patent; but as De Douhet had taken out a Belgian patent on December 25, 1850, covering substantially the same ground, we can only assume that Leger's patent was only a detailed improvement of an existing patent, and not an independent discovery.

With regard to Ullmann's mention of De Douhet,

¹ Lithopone . . . wurde zuerst 1853 von De Doudet (misprint for De Douhet) durch Umsetzung von Zinkvitriol mit Schwefelbarium fabrikmässig hergestellt und als Metallweiss in den Handel gebracht. J. B. Orr in Glasgow (E.P. 517, 1874) gewann die Farbe auf gleiche Weise, unterwarf sie aber einem Glüh- und Abschreckungsprozess, um sie dichter und weisszer zu machen. Diese Operation ist als eine wesentliche Verbesserung aufzufassen. Boulez führte 1877 den Namen Lithopone ein, der sich Anerkennung erlang.

² "On voit que dans la fabrication de la céruse lithopone telle qu'elle est décrite au brevet no. 26,423 . . ."

reference to the latter's patent makes it fairly clear that the invention of lithopone must be laid to his credit. On October 5, 1850, De Douhet³ registered an invention in France (No. 5176), which not only covers what is now known as lithopone, but claims all lithopone-type products resulting from the double decomposition of a soluble metallic sulphate with the sulphides of barium, strontium and calcium. He advises bringing the resulting product to a red heat and plunging into cold water, draining, drying, etc., and finally remarks, "Working, for example, with barium sulphide and zinc sulphate, one obtains an excellent 'céruse'" (white pigment).

There is a suggestion in a previous patent of De Douhet that he was already on the track of his epoch-making discovery. (French Patent, November 6, 1847.)⁴ He brings precipitated barium sulphate to white heat and plunges it into cold water or into a solution of zinc sulphate or lead acetate to render it more opaque. The roasting process will have reduced some of the barium sulphate to the sulphide, and a corresponding interaction with zinc sulphate will have produced a certain amount of lithopone. Hence, one may look upon 1847 as possibly the year when lithopone was first discovered, and certainly 1850 as the year when the first patent for lithopone was taken out, the honour of the invention going to the French chemist, De Douhet.

All the foregoing details are culled from books in the Patent Office, London, and the patents cited may also be referred to there.

3 Brevet d'invention de 15 ans, No. 5176, Oct. 5, 1850.

Il s'agit, dans ce nouveau brevet, de ces doubles fabrications et combinaisons mi-partie alcalines et métalliques, considérées dans leur application exclusive à la peinture à l'huile sans vernis.

Les sulfates qu'il s'agit d'él de désoxyder pour en former des couleurs sont usuellement au nombre de trois: les sulfates de zinc, de cuivre et de fer. La grande disposition qu'ont les sulphydrates alcalins en général, et même les sulfures de chaux préparés par la décoction dans l'eau bouillante du soufre et de la chaux, de précipiter les sulfates métalliques à l'état de sulfures hydratés insolubles, en s'emparant de leur oxygène forme la base de ma découverte.

Si l'on veut avoir la base métallique unie au soufre, mais libre d'autre substance, il faut mélanger ensemble deux solutions: l'une d'un sulfate métallique, l'autre d'un sulphydrate alcalin, dont le sulfate est soluble; tel que celui de soude ou de potasse. Mais, dans l'ordinaire des cas, il est préférable d'obtenir un sulfate métallique hydraté. On le mélange avec un sulfate insoluble, baryte, strontiane, chaux, qui lui donne du corps et le fait foisonner: c'est alors du sulfure de barium, de strontium ou de calcium dont il faut se servir. Le précipité est alors double et coloré, d'après les métaux qui servaient de base.

Pour donner à ces produits toute leur intensité colorante, il est nécessaire de les porter au rouge dans un fourneau et de les éteindre dans l'eau froide; cependant les couleurs à base de cuivre et de fer peuvent couvrir à la rigueur sans cette opération, ainsi que celles obtenues par la double précipitation d'un sulfate métallique avec un polysulfure hydraté de chaux; mais dans ce cas de fabrication, comme il reste dans les liquides une proportion notable d'hyposulfite et de sulfate métallique ou calcaire, il faut, pour les précipiter entièrement, saturer ces liquides avec des sulfures de barium ou de strontium. On les décharge de la sorte de toutes les bases qu'ils tiennent en dissolution. Le dépôt est ensuite décanté, desséché, puis étouffé avec soin; il en résulte, quand on opère, par exemple, avec du sulfure de barium et du sulfate de zinc, une excellente céruse.

Ainsi l'objet du brevet est la confection décrite des couleurs formées par, la double précipitation des sulfures et polysulfures de barium, de strontium de calcium, ainsi que de la baryte, de la strontiane, de la chaux, préparée par voie humide, avec les divers sulfates métalliques solubles.

Certificat d'addition, Aug. 16, 1851.

Et le double précipité thus obtained is mixed with artificial or natural sulphate, brought to a red heat in a furnace and plunged into cold water "les molécules de ces nouveaux composés éprouvent une transformation et, en devenant opaques, constituent des couleurs bonnes à l'employer à l'huile, au vernis et à l'essence."

4 Patent, De Douhet, Nov. 6, 1847.

Quant au sulfate de baryte obtenu en quantité, on l'utilisera, soit en le faisant servir d'excipient à la céruse, après l'avoir préalablement éteint à l'état incandescent dans l'eau froide pure ou chargée de sulfate de zinc ou d'acétate de plomb, pour le rendre plus opaque en l'étonnant . . . Tous ces procédés sont brevetés dans le premier titre.

COL. G. P. POLLITT, D.S.O.

Colonel Pollitt is a man who has both a considerable capacity for work and a quiet determination which is almost unaffected by small obstacles. He quickly and surely makes up his mind as to what he wants, and brushes awkward men or positions firmly aside so that he may pursue his undeviating course; he indulges neither in flattery nor chicane, and he probably learned his ideas of life from watching a tank steadily proceeding through entanglements of wire and brushwood to its chosen terminus. He is courteous without wasting time, but if he is compelled to suffer fools his period of gladness is brief. He is a great asset to British chemical industry.

Born in 1878 at Mellor, near Blackburn, Colonel Pollitt received his early education mainly abroad. His scientific education commenced at Manchester University, where he took the degree of M.Sc.; it was followed by a period of study at the Zurich Polytechnicum. While he was in Switzerland he was awarded the degree of Ph.D. by the University of Basel, for a thesis on the contact process for the manufacture of sulphuric acid. In 1903 he was appointed assistant chemist at Woolwich Arsenal, and in 1904 he became research chemist and manager of the high explosives department of Kynoch, Ltd., at Kynochtown, in Essex. His next appointment was in 1905, as departmental manager for Brunner, Mond & Co., Ltd., where he remained until 1912. In that year Messrs. Brunner, Mond acquired the firms of Messrs. Crosfield and Gossage, and Colonel Pollitt acted as a liaison between them and his firm.

The outbreak of war found him acting as general manager to Hydrogenators, Ltd., and Administrateur Délégué of the Société Anonyme d'Hydrogenation de Marseille, posts which he had occupied since 1913, but in August, 1914, he was serving as despatch rider in the 4th Division in France with the rank of Corporal R.E. From November, 1914, to May, 1915, he served as a second lieutenant in the Intelligence Corps in France, and thereafter until 1917 he held various commands in the Special Brigade R.E., including that of O.C. Trench Mortar Battalion. In 1917 he joined the Infantry and spent six months with the 4th Battalion of the Grenadier Guards, subsequently commanding the 6th and 11th Battalions of the Lancashire Fusiliers. He was wounded four times, and when wounded the last time—in June, 1918—was taken prisoner. For his services he was awarded the D.S.O. and two bars and the 1914 Medal, and was granted the rank of Lieut.-Colonel on demobilisation.

Since the war he has become a director of Brunner, Mond & Co., Ltd., and is the managing director of Synthetic Ammonia & Nitrates, Ltd. He is also a director of The Castner-Kellner Alkali Co., Ltd., The Magadi Soda Co., Messrs. Chance & Hunt, Ltd., The Buxton Lime Firms, Ltd., Messrs. Nitram, Ltd., The United Alkali Co., and The International Combustion Co., Ltd., a member of council and chairman of the Technical Committee, British Sulphate of Ammonia Federation, Ltd., and a director of The Coal Carbonisation Co., Ltd., and Imperial Chemical Industries, Ltd.

We may complete this brief biographical sketch by adding that Colonel Pollitt is a member of the Windham Club and the Royal Thames Yacht Club, and that he is unmarried.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

ANNUAL GENERAL MEETING, 1927

July 4 to 9

EXTENSION OF PERIOD FOR REDUCED RAILWAY FARES

Since the programme for the Annual Meeting was printed, the Railway Companies of Great Britain which agreed to issue tickets at the ordinary single fare and one third for the double journey to persons travelling to Edinburgh to attend the meeting have extended the validity of these tickets, and they will be **available from Saturday, July 2, to Monday, July 11**. These tickets will be obtainable at the time of booking on production of vouchers which will be supplied on application to Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

PROPOSED EXCURSION TO ST. ANDREWS ON SATURDAY, JULY 9

The train will leave the Waverley Station, Edinburgh, at 9.30 a.m., arriving at St. Andrews at 11.22 a.m.

A visit to the University, including the Chemical Laboratories, will be arranged for the afternoon, and the St. Andrews University Court has kindly offered to entertain the members to tea in the University Buildings.

The return train will leave St. Andrews at 5.35 p.m., arriving in Edinburgh at 7.26 p.m.

Members will also have an opportunity of visiting other places of historic interest in St. Andrews or of playing golf.

CHEMICAL ENGINEERING GROUP

A lunch for Members of the Chemical Engineering Group and their guests is being arranged for Wednesday, July 6, at 12.30 p.m., immediately after the meeting of the Group. The lunch will be held in the University Union, Park Place, Edinburgh. Price of tickets 5s., exclusive of wine and gratuities.

Members of the Society who are not Members of the Group are welcome to attend the lunch.

Charabancs will call at the University Union at 1.55 p.m. for those going to the Gasworks, and at 2.5 p.m. for those proceeding to King's Buildings. Application for tickets should be made **immediately** to the Secretary of the Group, Abbey House, Victoria Street, London, S.W.1. Communications regarding the lunch **after July 1** should be addressed to Dr. W. T. H. Williamson at 13, George Square, Edinburgh.

BUREAU OF CHEMICAL ABSTRACTS

The following are the prices at which copies of the Index to British Chemical Abstracts, 1926, can be purchased:—

By members of the Chemical Society or the Society of Chemical Industry—5s. post free; by subscribers—10s. post free.

MEMBERS ELECTED

June 10, 1927

- Barker, Arthur, 30, New Lane, Moorside, Cleckheaton, Yorks.
 Baxter, Harold R., c/o Messrs. J. & G. Cox, Ltd., Gorgie Mills, Edinburgh. Manager.
 Bowrey, Stanley E., 3, Haydon Street, Minories, London, E.1. Chief Chemist.
 Clemo, George R., Armstrong College, Newcastle-on-Tyne. Professor of Organic Chemistry.
 Fleuret, John B., 47, Walsingham Road, Hove, Sussex. Micro-Analyst.
 Keyes, Alfred W., 14, Wilson Street, Richmond, Auckland, N.Z. Student.
 Prins, Jan A., Bureau voor den industrieelen eigendom, Oostduinlaan 2, The Hague, Holland. Director of the Dutch Patent Office.
 Read, Wilfrid H., Experimental and Research Station, Cheshunt, Herts. Research Chemist.
 Salerni, Edoardo M., 31, Rue Tronchet, Paris. Chemical Engineer.
 Tavrogos, Joseph, c/o West Surrey Central Dairy Co., Ltd., Guildford, Surrey. Chemist.
 Wai, Mao P., National Women's Normal University, Sho Foo Ma Ta Chai, Peking, China. Principal.

BIRMINGHAM AND MIDLAND SECTION

The seventh and last meeting of the session was held at the Birmingham University on April 5, Mr. Collis presiding.

The following lecture on "Ultra-Violet Light" was given by Mr. A. A. King.

More than 250 years ago—in the year of the great fire of London—Newton discovered the spectrum of visible light. In 1777, one hundred and eleven years afterwards, Schegle discovered the action of rays beyond its violet end by means of a sensitive plate. By 1800 Faraday and Boeckmann were exposing substances to violet light, to burning sulphur, to Indian white fire for chemical effects. But it was not till 1912, during the last fifteen years in fact, that Lyman and Milliken and others explored and approximately defined the region of the ultra-violet spectrum. There are yet large gaps, particularly where ultra-violet and X-rays meet.

Until we had means of obtaining arc light our only source of ultra-violet rays was the sun. It is now fifty years since the carbon arc and about twenty-five since the tungsten arc were placed at our service. Still more recently we have been supplied with the mercury vapour arc, and this has now become the source of these rays, of greater or less intensity, both for popular and scientific purposes.

We will first get a precise idea of the geography of the spectrum of the electromagnetic waves from a diagram published by the Royal Society and first exhibited at Wembley. It gives in concise form the relationship and wave lengths of the various regions of radiant energy. From the radium-emitted gamma rays of shortest wave-lengths, one three-hundred-millionth of an inch, to those of 30 miles, beyond the wireless region, given out by our large alternating current machines, there is this simple difference of wave-length. Their frequencies mount from 10^8 to 10^{20} . But their velocity, 186,000 miles per second, is the same. The least explored regions are in the infra-red-Hezian and from X-rays of 100\AA to

ultra-violet rays of 1000\AA . The chart shows that the rays reaching the surface of the earth from the sun lie between $3,000,000\text{\AA}$ in the infra-red and about 3000\AA in the ultra-violet. This second limit is due to the filtering effect of the atmosphere, of ozone and oxides of nitrogen in the outer and of the turbidity and water vapour in the closer atmosphere. As for the ultra-violet rays reaching us, we may consider their approximate limits are 4000\AA , where they meet the visible spectrum and 3000\AA . We may contrast this with the practically effective limits of ultra-violet rays emitted by electrical means of 4000\AA to 1800\AA . Waves of higher frequency are absorbed by the air.

I should like to point out that there is an enormous gap between the longest X-rays which have been produced and the shortest ultra-violet rays which our lamps can yield. Therefore, one could predict with confidence that there is little or no danger of the kind which the early workers with X-rays suffered. Practical experience has fully proved this prediction. While X-rays will penetrate all matter more or less, the shortest ultra-violet rays cannot be made to penetrate anything. The lining of the eye socket is all that needs protection in ordinary work: tinted glass well-fitting goggles are quite sufficient.

As we have stated earlier, the carbon arc was the first artificial source of our rays. This gives a line spectrum fairly evenly dispersed in the ultra-violet, extending from the visible to 2000\AA . The first ultra-violet light treatment for diseases of the human body was practised by Finsen with this arc, which is still much favoured by medical men for certain treatments. It has disadvantages for laboratory and therapeutic purposes: a large current consumption, large emission of heat waves, the difficulty of making it automatic in action, the difficulty of enclosing it completely and avoiding the naked intensely hot flame.

The carbon arc is too well known to need demonstration.

Of the three arcs, carbon, tungsten and mercury, the tungsten arc gives the most evenly distributed line spectrum in our region; within reasonable limits it gives a constant emission of our rays. It is exceedingly valuable for spectrographic work. It, too, has its disadvantages for laboratory and therapeutic work: emission of heat, the necessarily naked flame, fumes of tungstic oxide, the difficulty of totally enclosing it for experiments in fluorescence. From the point of view of cost both carbon and tungsten arcs compare very unfavourably with mercury vapour lamps. We have two general types of mercury vapour lamps, the "vacuum" type where the mercury is enclosed in a hermetically-sealed fused quartz tube and the "atmospheric" where the fused quartz tube is open. In the latter type the dangerous mercury "hammer" is avoided, but it has other advantages. Until quite recently the only method of obtaining cold ultra-violet radiation was by using one of these "vacuum" lamps, in water-cooled jacket.

My earlier experiences in the use of ultra-violet radiation gave me a strong bias in favour of the "atmospheric" type, and it was in my desire to combine the advantages of both types and, as far as possible, to avoid

their disadvantages that I designed the air-cooled medical lamp now on the market. It is far more robust than any vacuum mercury vapour lamp. It can be made to provide a stream of sterilised ozone-charged air for therapeutic practice. The forced draught of air removes the excessive heat, and at the same time has not the absorbent effect upon the ultra-violet rays which accompanies the use of water cooling. A much more intense ultra-violet beam can be produced from the arc tube. This is even more marked in the improved pattern I have constructed, and which I show here for the first time, particularly for all kinds of laboratory work. As you see it combines, in the one instrument, fluorescent cabinet, open lamp for sun baths, medical lamp for applicator work. Experimental cells placed in the rays are kept beautifully cool. I should have liked to carry through some experiments with this lamp here to-night, but the time is too short, and I must content myself with pointing out the convenience of its use for scientific work: the applicator fitting is conveniently replaced by the various forms of quartz vessel.

I have a selection of quartz accessories on this table, including one which has a filter cell combined with a reaction cell. Almost any type of apparatus can be obtained in fused quartz. This substance is remarkably transparent to ultra-violet, as well as to visible and infra-red rays. You will see from the experiment that the ultra-violet rays can be made to describe a complete circle through a quartz rod bent into this shape.

Before I go any further I ought to say a few words about light filters. One of our urgent needs is practical filters by means of which one may isolate any selected region in the ultra-violet spectrum. When a filter is discovered which will pass the shortest ultra-violet rays, a wide field will be open, particularly in medical research. None is at present available, and we are driven, when we would get approximately the result we desire, to compare differences in reaction obtained with filters which still allow visible as well as more or less U.V. rays to pass through them. Perhaps the most useful filter for fluorescence work is Chance Bros.' U.V. glass. This glass, while cutting out all but the extreme red of the visible spectrum (a very faint region between "7000 and 7500 Å"), transmits rays from 4000 Å to 3250 Å. The longest rays in the ultra-violet will also pass through ordinary glass, wherefore fluorescence experiments can be conducted in ordinary glass vessels with this range of radiation. The fluorescence in the glass itself must be allowed for.

We may note in passing that it is physiologically impossible to experience complete darkness in a room into which invisible U.V. rays are emitted. Even though every other material within range is non-fluorescent, the lens of the eye is fluorescent in these rays, and the retina becomes aware of a blue misty illumination. This principle was made use of during the war for invisible light signalling. You will observe here how a beam of U.V.R. which we concentrate in a quartz lens is "picked up" by fluorescent materials.

A much more important application of this effect for the chemist to-day is that of distinguishing by their fluorescence certain imitation gems and precious stones from the pure stones. The method is not confined to

such materials, and it promises important developments. The presence of minute impurity in some substances can be detected by its fluorescence, and afterwards identified by chemical methods.

Even laboratory "distilled" water may profitably be examined in the rays. You will see how certain impurities otherwise unsuspected, show up in this sample, and how it needed a succession of redistillations, culminating in double distillation in platinum vessels, to obtain a practically fluorescence-proof sample of distilled water.

But you will probably be more interested in a super-refinement for testing the presence of arsenic.

Arsenic test.—Some twelve months ago I had recourse to the most refined of the known methods of detecting and estimating minute quantities of arsenic in food substances. Finally, I selected the Gutzeit method, which gives a mercury-arsenic yellow stain, as most suitable for further examination. At attempt to intensify the stain in monochromatic light served its purpose, but it occurred to me to expose the stains to ultra-violet radiation. The work was carried out wholly by the laboratory staff of Messrs. Albright & Wilson, Ltd., of Oldbury. It was discovered that by the method one may estimate quantitatively arsenious oxide of an order of minuteness beyond what has been hitherto possible, with normal Gutzeit, Marsh, or any other method with which I am acquainted. Adsorption of the rays by the mercury-arsenic stain makes this intensely black, so much so that stains which are quite indistinguishable in ordinary light stand out a startling black upon a fluorescent background. We have been able to estimate with certainty as little as 0.0000005 gram As_2O_3 , and to detect even smaller masses. A pleasing by-product of the investigation was the demonstration that it is possible to get materials, such as zinc and sulphuric acid, so pure that an all but perfect blank can be obtained. You see here, in the rays, a series of arsenic stains ranging from 0.000001 gram to 0.0000001 gram As_2O_3 , the last five of which are quite invisible in ordinary light, whether monochromatic or otherwise. The last two slips on the card are the blank and the unused paper, which, as you perceive, itself fluoresces with a gentle bluish light.

Arising from this work here is an interesting example of detection of impurity. You see some quite good samples of crystallised mercuric chloride fluorescing in the rays—some parts of it are a bright pink, while others are very faintly blue. It is noteworthy that a pink fluorescing lump when broken up will yield some pink, some blue fluorescing pieces. This mercuric chloride twice recrystallised in the laboratory showed no sign of the pink fluorescence, which was found to be due to the presence of mercurous chloride, and you see here a sample with a most pleasing pink fluorescence. I have since learnt that the same phenomenon has been observed by O. Wolf, *Chem. Zeit.*, 36, 197.

I must hurry through a few other demonstrations: distinction between vegetable and mineral oils; amber—genuine and artificial; uranium acetate and nitrate; salicylic acid; vaseline; ivory; natural and false teeth; some organic and inorganic pigments. The last fluorescence experiment is one which opens up for the laboratory a new field of titration work. It was suggested by work done by Mellet and Bischoff in detecting

obliterated and forged signatures on cheques etc. by exposing them to U.V. radiation. My only example is the titration of phosphates which I have found useful for muddy liquors. You have ordinary sodium phosphate in neutral solution, to which has been added a drop of a saturated solution of quinine sulphate. You will see that as long as the solution is alkaline there is but a trifling fluorescence, but the approach to acidity is heralded by an intensely blue fluorescence. This is due to the temporary, and eventually permanent, formation of the acid sulphate of quinine. I would suggest that the method may lend itself to the investigation of the mixing of reactive and other solutions.

Before leaving this side of our subject, I should like to indicate to you the scale of absorption of wave length 3000 to 4000 Å, from almost none to almost the whole spectrum, by various glasses, from vita glass to the latest synthetic resin glass; with 'crookes' glass occupying an intermediate position in this respect. The uranium glass by its fluorescence will detect the invisible ultra-violet rays anywhere.

Here you will see that when I place vita glass in front of the filter of U.V. glass there is no further diminution of fluorescence of the uranium glass. But when I substitute the vita glass by the resin glass the fluorescence of the uranium glass all but ceases. Both vita and resin glass are, of course, quite transparent in ordinary daylight.

There are many promising commercial applications of our rays, most of which are still in the experimental stage. One that has passed into daily practice is that of testing the fastness of colours on various fabrics, and perhaps even more interesting, the detection (and destruction) of mildew in wool. The slide I show here is a photograph of the cabinet used by the Woollen Research Association. I can recommend any of my hearers who are interested to visit the Exhibition now open at the South Kensington Museum. I may add that in this testing full and elaborate precautions are taken to give the effects of humid air.

The sterilisation of water on the large scale has been accomplished for public baths and for potable water.

Aliphatic alcohols have been chlorinated, using U.V. radiation as activator, but I have no personal knowledge as to the success on the works scale.

I should like, but that the hour forbids, to relate work which biochemists have done upon the so-called "activation" of various food substances and pure substances such as cholesterol, or their still more fascinating attempts to prepare the elusive vitamin by this means.

Work is awaiting the chemist and physicist in the measurement of the intensity of U.V. radiation. Its quality and its relative intensity can, of course, be determined with considerable accuracy by a combination of quartz spectro-photometer and spectrograph. This excellent photograph was taken for me by Dr. Judd Lewis when I was at work on the decomposition by U.V.R. of pure carbon tetrachloride. I know no method which will enable me to state intensity of the radiation from an arc in terms of ergs. I am waiting to know the heats of formation of carbon hexa- and tetra-chloride. Many and varied methods of testing have been published

for comparing the intensity of one's lamps at different times and of investigating the intensity after passing through filters. Of these simplest to use, I may mention Dr. Leonard Hill and Dr. Eidenow's methylene blue test which you will see before you and Messrs. Moss and Knapp's oxalic acid and uranium acetate test. The carbon tetrachloride test, to which I have already referred, and which I have simplified for medical men's use, is suitable for rays below 2750 Å. Not one of them is perfect. Carbon tetrachloride may be used as a filter, fairly accurate in stopping rays below the figure given. The trouble with all actinometers which depend upon chemical action is that the co-efficient of extinction changes with the accumulation of decomposition products. My own method, when using carbon tetrachloride as a filter, is to pass a constant stream of it through the quartz cell you see here. I cannot discuss the more scientifically accurate methods involving the use of spectroscope and bolometer, and of the photoelectric cell employing colloidal forms of the alkali metals. Potassium is peculiarly sensitive to the blue violet spectrum and cadmium to the ultra-violet nearer the visible end. There is still room for improvement in the second type.

Mercury vapour lamps gradually fall off as regards the intensity of their emitted ultra-violet rays, and their effective life will depend upon the purpose for which they are used. For therapeutic purposes the "atmospheric" type has an average "life" of about 1000 hrs. Then they will need cleaning: an operation the chemist can do for himself. Eventually a new arc tube will be fused in. The actinometer will indicate with certainty when these attentions are desirable.

Mr. A. W. Knapp remarked that Mr. King still spoke of ultra-violet *light*, although the radiation was invisible. It was pleasant to note that although the modest ultra-violet was born to blush unseen, it was receiving a great deal of attention. Considering that we had at present no method which gave us at once the quality and quantity of the radiation, that was the intensity of each wave length, and that doctors must have very little knowledge of the differences in the radiation given by different sources, it was remarkable the results they achieved. For example, the mercury vapour lamp and the carbon arc gave very different spectra—presumably they produce different therapeutic effects! Again, an old mercury vapour lamp would not only give a less intense radiation than a new one, but also a different mixture of rays.

What was the relation of the intensity of the radiation from a mercury vapour lamp to that of June sunshine? It seemed to him it might be more economical to spend one's money not on ultra-violet treatment, but on a holiday on the South Coast. Mr. King's modification of the mercury vapour lamp promised to be very useful, but it would be of still greater use in the laboratory if he could send the rays vertically down, as then one need not use expensive quartz vessels to hold solutions etc. Mr. King had suggested that the Moss and Knapp method of measuring ultra-violet radiation suffered because it did not measure particular rays. Perhaps he did not know that it had been shown by absorption spectra of the depth of solution used in the test, that the range of rays which were measured was from 320 μ

That was important, because it was in just that range that there occurred those rays which produced the therapeutic and bactericidal effects, and therefore the method should prove of great use to doctors and others.

CALENDAR OF FORTHCOMING EVENTS

- June 17** SOCIETY OF CHEMICAL INDUSTRY AND THE INSTITUTE OF CHEMISTRY, *Newcastle Section*. Armstrong College, Newcastle-on-Tyne, at 6.30 p.m. The Second Bedson Club Lecture on "The photo synthesis of naturally occurring compounds," by Prof. E. C. C. Baly.
- June 17 & 18.** ASSOCIATION OF ECONOMIC BIOLOGISTS. June Meeting, The South-Eastern Agricultural College, Wye.
- June 18.** NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS. General Meeting, at 2.30 p.m.
- June 23.** SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY, *Edinburgh and East of Scotland Sections*. Visit to Messrs. Webb & Co.'s Crystal Glass Works, Norton Park, Edinburgh, at 3 p.m.
- June 29.** ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2., at 4 p.m. Annual General Meeting.
- July 4 to 9.** SOCIETY OF CHEMICAL INDUSTRY. Forty-sixth Annual Meeting in Edinburgh. (*See CHEM. AND IND., May 20, 1927, p. 464.*)
- July 4 to 8.** SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group*. Annual Meeting in Edinburgh. "Some aspects of the manufacture of fibrous cellulose," by Dr. J. L. A. Macdonald. A discussion will follow.
- July 15 & 16.** INSTITUTION OF SANITARY ENGINEERS. Annual General Meeting and visits in Birmingham.
- Aug. 20.** NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, Newcastle-upon-Tyne. Annual Meeting at 2.30 p.m.
- Aug. 31** BRITISH ASSOCIATION FOR THE ADVANCEMENT OF TO SEPT. 7. SCIENCE. Annual Meeting (97th year) at Leeds.

CANADIAN PULP AND PAPER

The St. John Power & Paper Co., is preparing to erect a 200-ton newsprint mill on the upper end of Lake St. John, Quebec, on the Mistassini river, about 21 miles from St. Felicien. The mill will cost about \$6,000,000.

The International Paper Company is negotiating with the government for a pulpwood limit on the Nelson river, Manitoba, and for the power site at White Mud Falls, the greatest water power site in Canada, not excepting Niagara Falls. The company already possesses about 1,657,699 acres of freehold pulpwood lands and 11,099,528 acres in crown timber limits under lease, all situated in Quebec, New Brunswick and Newfoundland. The company owns, in the U.S.A. and Canada, 27 pulp and paper mills, 7 hydro-electric power plants, and 12 saw-mills.

The physical testing, chemical laboratory and wood preservation department of the Forestry Laboratory of the Dominion Government is being removed from Montreal to Ottawa. The pulp and paper department will remain at McGill University.

BIOCHEMICAL SOCIETY

A meeting of the Biochemical Society was held on June 11 in the Biochemical Department of The Museum, Oxford, when the following papers were read:—

"The digestion of carbohydrates in the cockroach," by V. B. Wigglesworth.—The p_H of the saliva of the cockroach (*Blatella germanica*) has an average value of 6.9, and that of the contents of the mid-gut 6.3. The reaction of the crop, where digestion is mainly carried on, is dependent on the food, being about 6.2 with protein food and 5.0 with carbohydrates, the acidity in the latter case being due to the action of micro-organisms, especially yeasts, upon sugar. The enzymes of the cockroach have been compared with those of yeast and of the human jejunum. The amylase of the salivary glands and the invertase, maltase and lactase from the gastric caeca and mid-gut all have an optimum zone of p_H from about 5.0 - 6.2, being adapted to work at the reaction normally present in the crop. With this exception their properties are closely similar to those of the enzymes with which they have been compared. They are, for example, similarly affected by neutral salts, by heavy metals, by glycerol, and by various adsorbent materials.

"The Erlenmeyer amino-acid synthesis," by C. R. Harington and W. McCartney.—As observed during the synthesis of thyroxine (*Biochem. J.*, 1927, **21**, 169), the Erlenmeyer amino-acid synthesis may be modified by direct conversion of the benzoylamino-cinnamic acid (or ester) into the amino-acid by boiling with hydriodic acid and red phosphorus. In the case of β -[3, 5-diiodo-4-(4'-hydroxyphenoxy)phenyl]- α -aminopropionic acid, the yield of 25% first recorded has been improved more than three times by the further simple modification of using a mixture of equal parts of constant boiling hydriodic acid and acetic anhydride. The method has been applied successfully to the synthesis of the following amino-acids, the yields being constantly higher than those obtainable by Erlenmeyer's original method, and the saving of time effected being very considerable. The yields are calculated on the benzoylamino-cinnamic acid or ester (it is a matter of experiment to decide which is the more suitable in any given case), which itself is always readily obtainable in good yield from the corresponding aldehyde. Phenylalanine 88%, tyrosine 60%, 3, 4-dihydroxyphenylalanine 45%, desiodothyroxine 61%, β -[3, 5-diiodo-4-(4'-hydroxyphenoxy)phenyl]- α -amino-propionic acid, 82%.

"The presence of a nucleotide in milk," by P. G. Marshall and H. D. Kay.—A substance containing adenine, a pentose and phosphoric acid, and corresponding in its chemical and physical properties with adenine nucleotide has been isolated from the filtrate after precipitation of the proteins of goat's milk. It is present in small quantities only—to the extent of some 3.3 mgm. per 100 c.c. milk. It appears to be the first of the phosphoric esters present in goat's milk to be definitely identified. So far it has not been found possible to isolate it from cow's or from human milk.

"Metabolism of glucose by kidney tissue *in vitro*," by J. T. Irving.—The metabolism of glucose by chopped kidney tissue *in vitro* proceeds at a rate which is probably linear aerobically, but is completely inhibited *in vacuo*. It is also markedly inhibited by cyanide.

The following papers were also read :—"The oxidation of uric acid by hydrogen peroxide," "The estimation of oxalic acid in urine," and "The estimation of oxaluric acid in urine," by P. C. Raiment; "The chemistry of phosphagen," by P., and M. G. Eggleton; "Synthesis of vitamin B (torulin) by yeast," by F. Hawking; "Use of norite in the concentration of torulin," by H. W. Kinnersley and R. A. Peters; and "The peptic digestion of gelatin," by R. M. Beck and R. K. Cannan.

During the tea interval demonstrations were given by V. B. Wigglesworth on "A colorimetric method for the determination of the p_H of minute amounts of fluid"; by J. Orr Ewing and V. B. Reader on "Synthesis of a bacterial growth factor by meningococcus"; and by J. H. Jeffree and B. T. Squires on "A simple fluorophotometer."

PHYSICAL SOCIETY

At the meeting of the Physical Society held on June 10, a paper on "The latent heat of evaporation of sulphur" was read by J. H. Awbery. The method employed for the determination of the latent heat at the boiling point (444.5°C) is based upon a measurement of the loss of weight in a vessel containing sulphur when electrical energy is dissipated in the vessel at a known rate. The value found for the latent heat is 79 cal. per gm. with an estimated accuracy of 2%. Previous determinations by other experimenters give values 362 cal. per gm. at 316°C . (Person), and 64.8 cal. per gm. (Beckmann and Liesche). The latter value is based upon an estimate, from chemical data, of the proportion of S_8 and S_6 molecules present, and the assumption is made that this proportion is the same in the vapour and liquid phases.

In a paper by P. K. Kiehlu on "Regularities in the spectrum of ionised neon," certain lines found by L. and E. Bloch and Dejardin in the spectrum of neon, developed by electron bombardment, are definitely assigned to singly ionised neon, and are shown to conform with Hund's theory of complicated spectra.

H. Lowery submitted a paper on "The refraction and dispersion of gaseous carbon tetrachloride." The refractive index of the vapour for the green mercury line ($\lambda 5461\text{\AA}$) is 1.001799, the result being corrected for density, so as to indicate the refractivity of the vapour containing the same number of molecules as 1 c.c. of hydrogen contains at N.T.P. The dispersion of the vapour over the range $\lambda\lambda 4800\text{--}6700\text{\AA}$ is represented by the relation $\mu - 1 = (13.543 \times 10^{27}) / (7831.7 \times 10^{27} - \nu^2)$, ν being the frequency of the light concerned.

A demonstration of the Schönherr-Hessberger nitrogen fixation arc was given by Capt. G. I. Finch. This comprised a working model of the arc, about 1 ft. long, useful for instruction purposes. The relative advantages and disadvantages of the Birkeland-Eyde, Paulin and Schönherr-Hessberger processes of nitrogen oxidation were briefly referred to. The principal objection to the last of these is that the limit of size of plant is reached with an electrical input of about 750 kw. Birkeland-Eyde plants utilising up to 6000 kw. are in operation at present. The erection of a plant consuming 8000 kw. is contemplated. This type of plant suffers from the handicap of high initial cost.

CORRESPONDENCE

VERBIAGE?

SIR,—The suggestion, made on p. 494 of your issue of May 27, 1927, is verbiage, in so far as a view is attributed to me which I cannot hold. My interpretation of the interaction of hydrogen chloride and hydrone and of the activity thereby developed does not resemble, in the least degree, the view which represents the product as an ionised oxonium salt. Ionisation in a solution, in my opinion, does not involve the freedom of any ion. I am not aware that the current view is as stated—that such a view has been advanced I know. To me it is interesting as a half-acknowledgment of my contention, at Leeds, in prehistoric times, that the compounds HCl and H_2O must be put upon the same footing: that it was absurd, in fact, to treat hydrone as a neutral.

Yours, &c.,

HENRY E. ARMSTRONG

PERSONAL AND OTHER ITEMS

Prince Ginori Conti is now in London on a short visit.

Prof. A. V. Hill, F.R.S., has been elected an Honorary Fellow of King's College, Cambridge.

Mr. E. J. Holmyard (Clifton College, Bristol) has been appointed Foreign Editor (England) of *Archivis di Storia della Scienza*, the Italian history of science quarterly. He will be pleased to receive articles for publication and books for review, and will supply any information about rates of subscription etc. Probable subscribers may obtain specimen copies on application.

Dr. A. Jaques has been appointed manager of the By-Products Department of the Shotts Iron Co., Ltd.

Preparations are being made for the celebration of the tercentenary of the discovery of oil in America at the Seneca Indian oil spring at Cuba, New York.

The late Dr. A. Liebmann, M.A., left £44,484, with net personalty £39,229.

The late Mr. C. Hovenden, vice-chairman and managing director of Hovenden & Sons, Ltd., wholesale perfumers, left £78,831.

Presentation to Mr. E. V. Evans

On his retirement from the office of Hon. Treasurer, Mr. Evans was entertained to dinner at the Connaught Rooms on Thursday, the 9th inst., by a large number of his colleagues on the Council, including the past-presidents, Mr. W. Reid, Sir William Pope, Dr. E. F. Armstrong, and Mr. W. J. U. Woolcock, and the now president, Mr. F. H. Carr. Mr. Evans was the recipient of a vellum book containing the signatures of the past and present members of council during his term of office, and of a cigarette case of precious metal, and of many grateful speeches acknowledging his services.

A Key to Specialised Information

Just as the practical utility of a book is impaired by the want of an index, so the vast aggregation of knowledge

that has been built up and is in many cases being added to day by day is largely lost to mankind owing to the lack of a master-key to its whereabouts. Throughout this country there are numerous centres of specialised knowledge and experience of the most varied description, whose existence has only to be known for them to prove of the greatest service to the world in general. It is with the object of bringing these to light and recording their salient features in concise form that the Association of Special Libraries and Information Bureaux is compiling a Directory under the editorship of Mr. G. F. Barwick, late Keeper of Printed Books at the British Museum. At a meeting which was held some time ago at the Royal Institute of British Architects, Mr. Barwick spoke on the present position of the work. It has been decided to go forward with the printing of a first edition of the Directory at midsummer of this year, but much still remains to be done. It is recognised that completion in any one subject is well-nigh impossible in so short a time. It would, however, greatly further this end if libraries, organisations, firms or individuals which have special information on any subject would communicate with the Association (38, Bloomsbury Square, W.C.1), at the earliest moment. This applies equally to the various bureaux of information established under one name or another in different parts of the country.

Chemical Industry Committee in France

The Comité des Industries Chimiques de France has been founded with the object of providing permanent contact between the chief chemical undertakings. The president is M. Level, of the Cie d'Alais, Froges et Camargue; and the vice-presidents are M. A. Bernheim (Comptoir des Textiles Artificiels), M. H. E. Boyer (Soc. Chim. des Usines du Rhône), Comte de Vogue (Cie de Saint-Gobain, Chauny et Cirey). The secretary is M. D. Agache (Etablissements Kuhlmann), the treasurer M. Lheure (Soc. de la Grande-Paroisse). The Soc. Ammonia, the Grande-Paroisse, the Huiles, Goudrons et Derivés have also joined the committee.

Vitamin Content of Stored Butter

Research work is being begun at Otago University, New Zealand, on the effect of storage on the vitamin content of butter.

The Treatment of Garbage

A new method of garbage treatment has been developed which, it is claimed, eliminates obnoxious odours, is more economical to operate, and produces a more valuable product than other methods. This new process is a dehydrating treatment, following which grease is extracted by means of naphtha. About 25% more grease is recovered by this method than by former methods, and the residue is secured in the form of a solid substance which can be readily ground for fertiliser. U.S. Patents for this process have just been issued to Dr. R. D. McLaurin, air filtration purification expert, and C. G. Smith, superintendent of the Cleveland Municipal Garbage Disposal Works.

The Toxicity of Benzol

Field studies carried out in the United States (*J. Ind. Hyg.*, Feb., 1927) have indicated that the use of benzol

as an industrial solvent is attended with health hazards which can only be avoided by the provision of local exhaust ventilation and the maintenance of a system of medical supervision. Laboratory investigations have shown that certain of the higher homologues of benzene, such as toluol and xylol, are relatively free from the special hazards which attend the use of benzene. These substances, in large doses, are even more powerful narcotics than benzene, but their low volatility and marked odour make it unlikely that they will occur in workroom air in sufficient concentrations to become harmful, whilst they are almost wholly lacking in the specific effects on the nerve tissue and blood-forming organs which are characteristic of benzol.

The German Dye Trust

The I.-G. has filed papers of incorporation in Louisiana, U.S.A., as it is intended to erect a plant at Monroe, in the centre of the natural gas area.

Three new units are being erected at the Leuna Werke, the nitrogen-fixation plant of the I.-G. The present capacity is 300,000 tons of fixed nitrogen per annum. The coal hydrogenation plant is practically finished, and small-scale working is believed to have begun. The "Nitrophoska" plant, which makes the new complete fertiliser, will, it is expected, produce 10,000 tons a month, while the new calcium nitrate plant, also at Leuna, will probably turn out 10,000 tons a month of this new mixed fertiliser.

It is reported that a cheaper process has been developed for producing hydrogen, the hydrogen-containing raw gases being led over lignite mined on the spot, instead of coke.

The I.-G. is reported to have obtained control of the Cia. Nacional de Colorantes y Explosivos, the Spanish dyestuffs company, which produces some 300 tons azo dyes and 400 tons sulphur blacks, its intermediates being produced in excess of requirements in a factory at Barcelona.

At the general meeting of the I.-G. Farbenindustrie (the German Dye Trust) held on June 2, a dividend was declared of 10%. It was stated that the new plant for the liquefaction of coal at Merseburg was already working, the results so far achieved having come up to expectations, giving promise of satisfactory development. The total number of the Trust's employees was 67,760 workmen and 20,292 clerks, an increase of 2500 compared with last year.

New Aluminium Alloy

It is announced that a new aluminium alloy has been produced by the Central Aerodynamic Institute at Moscow. The alloy, known as "K.A.," is claimed to represent a considerable advance on duralumin, and is being used for the construction of aeroplanes.

New German Cutting Alloy

The Röchling-Buderus A.-G., of Wetzlar, has put on the market a new cutting alloy, "Miramant," containing molybdenum and tungsten, which is claimed to render possible the working of materials hitherto considered unworkable or commercially hard to work. The alloy is said to have given good results with manganese steel, chrome nickel steel, etc.

Note from Germany

The *Gewerkschaften Sachtleben* and *Sicilia*, of Cologne, and the *Schwarzwalder Barytwerke Schulte & Co.*, of Wolfach-Baden, have amalgamated to form a new company, the "Sachtleben" A.-G. für Bergbau und Chemische Industrie, with headquarters at Cologne.

Third Census of Production (1924)—Paper Trade

The returns for the paper trade show that the total value of goods made and work done in 1924 was £36,495,000, as compared with £15,956,000 in 1912, and £13,621,000 in 1907. This total value includes during 1924 printing paper valued at £17,704,000; writing paper at £5,189,000; packing and wrapping paper, £3,307,000; coated papers, £3,082,000; tissue paper, £982,000; blotting paper, £373,000; paper, other than printing, writing, packing and wrapping and coating papers, £2,648,000, and other papers £2,388,000.

It would appear that, taking the output as a whole, prices in 1912 were about 10% below those of 1907, and that in 1924, prices were about double those of 1912, or 80% higher than in 1907. With a view to obtaining a more exact record of the quantity of paper and board made in the industry, manufacturers were required to state their total make in the year 1924, whether the paper or board was sold as such or was used by them in the manufacture of bags, boxes, etc., during the year of return. The aggregates returned for each class were 22,706,200 cwt. of paper of all kinds made; 2,135,000 cwt. of cardboard and pasteboard; 106,800 cwt. of millboard; 29,900 cwt. of strawboard; and 77,000 cwt. of leatherboard, making a total of 25,054,900 cwt. The total weight of paper and board made in the year 1907 was not required to be stated by manufacturers, but was estimated as about 17,000,000 cwt. The total weight of paper and board made in 1924 exceeded that made in 1912 by about 23%, whilst the increase in output between the years 1907 and 1912 was about 20%. Taking the main classes of output separately, it appears that since 1907 a progressive increase has occurred in the production of printing paper, of cardboard, millboard, etc., and of unclassified products, such as boxes and other manufactures of cardboard, whereas the output in 1924 and in 1912 of packing and wrapping paper shows a decline compared with the previous survey. Of the total make of paper in the year 1924 (22,706,200 cwt.), about 18% was exported in the form of paper, while out of the 2,348,700 cwt. of cardboard, millboard, etc. manufactured, only 156,500 cwt., or under 7%, were exported as such. Retained imports of paper were nearly 39% of the total quantity manufactured in this country, whilst those of millboard, strawboard, etc. very largely exceeded the home production.

The total quantity of paper of all kinds available for use in the United Kingdom during 1924 may be roughly stated as 27,300,000 cwt., of which at least 17,000,000 cwt. consisted of newsprint and other printing paper. The quantity of news paper available amounted to about 30 lb. per head of the population, and of other printing paper to 14 lb. per head, of writing paper to about 5½ lb. per head, and of wrapping and packing papers to 17 lb. per head. In 1912 the quantity of paper that was available for writing or printing per head of the

population was about 40 lb., and that of packing and wrapping paper amounted to about 14.7 lb. The net output of the factories covered by returns amounted to £12,814,000, that sum representing the amount by which the total value of the output (£36,495,000) exceeded the cost of the materials purchased and used (£23,681,000).

The net output per head of persons employed during 1924 was £253, in 1912 £126, and in 1907 £111. The average number of persons employed in 1924 at the factories included in the returns was 50,707, of whom 47,351 consisted of operatives, and 3356 of management, clerical and technical staff. In 1907 the number of persons employed was 40,356, compared with 41,454 in 1912. The total capacity of engines at the factories in 1924 was shown as 242,518 h.p., a little over 12% of this total being idle or in reserve during the year. The capacity returned in 1912 was 189,432 h.p., and in 1907 168,274 h.p. The capacity of electric generators in the industry in 1924 was 79,032 h.p., compared with 32,075 in 1912, and 14,914 in 1907. There were also returned for the year 1924 electric motors of a total capacity of 108,374 h.p., driven by electricity generated by engines at the factories. Of these motors nearly 16% were in reserve or idle during the year. The total capacity of motors driven from firms' own dynamos in 1912 was returned as 33,970 h.p.

Third Census of Production (Artificial Silk Trade)

In 1924 the output of artificial silk, inclusive of artificial silk used by the makers as material in the manufacture of more finished goods, amounted to 25,525,000 lb., compared with 3,000,000 lb. in 1912. Figures are not available for the 1907 output. Exports of artificial silk from the United Kingdom during 1924 were 6,351,000 lb., and net imports 10,151,000 lb., or about 25% and 40% respectively of the quantity produced in that year in Great Britain. The total quantity of artificial silk available for consumption in the United Kingdom was thus 29,325,000 lb., rather over 65% being of home production and nearly 35% imported. The total quantity of thrown silk and spun silk yarn available for use in the year was estimated to have amounted to approximately 2,550,000 lb. The net output of the factories and workshops engaged in the silk and artificial silk industry during 1924 was £9,997,000, that sum representing the amount by which the total value of the output (£19,784,000) exceeded the cost of materials purchased and used (£9,167,000), and the value of work given out (£820,000). The net output per person was £255 in 1924, £72 in 1912, and £55 in 1907. The average number of persons employed during the year 1924 in the industry was 39,211, compared with 31,668 in 1907, and 34,500 in 1912. The total capacity of engines engaged in the industry in 1924 was shown as 35,949 h.p., of which slightly over 20% was in reserve or idle during the year. The capacity returned in 1912 amounted to 23,599 h.p., and in 1907 to 18,848 h.p. The capacity of electric motors at factories in 1924 was 17,732 h.p., driven by purchased electricity, about 21% of the capacity of these motors being in reserve or idle during the year. The capacity of electric generators in the industry in 1924 was 16,910 kw., compared with 1660 kw. in 1907.

REVIEWS

THE CHEMISTS' YEAR BOOK, 1927. Edited by Dr. F. W. ATACK. Pp. 1179. Manchester: Sherratt & Hughes. New York: The Chemical Catalog Co., Inc. Toronto, Canada: The Westman Press, Ltd. 1927. Price 21s.

Dare one propose a change of title? Why not The Chemists' Daily Book, for this is no year book. It contains no calendar, no diary, and it is in daily use year in, year out; an old and tried friend. Perhaps it is because one knows it and uses it so well that one is more critical of it than of less important works. Critical with a difference, because one asks so much of it, and would fain ask more; critical, too, because criticism is asked for and welcomed if helpful, and that is surely the desire of every user of this book.

Generalisations about so comprehensive a work as this are well-nigh futile, and the ground covered is such that no one man is competent to deal with the whole. What can be done is to draw attention to the particular wants one has noted and failed to satisfy, in the hope that space may be found in later editions to fill the lacunæ. And here are some of them.

In the section on viscosity (p. 19) no mention is made of the falling sphere viscometer, now so largely used in industries using viscous liquids, and mention might also be made of the work of the British Engineering Standards Association specifications, which have done so much to co-ordinate industrial viscosity methods and measurements.

The paragraphs on X-ray analysis (p. 199) might be expanded and reference made to the volume of important work done since 1919.

In the list of properties of organic compounds, a remarkable omission is the commoner citrates. The acetates, oxalates and tartrates are included, and the citrates are of sufficient importance to find a place.

It is doubtful whether the earlier part of the section on qualitative analysis, *e.g.*, pp. 517-527, serves any useful purpose, and one can but think that the space might be utilised in amplifying the specific tests given for some of the acids. It is not sufficient to say (p. 546): "Tartrates, malates, and citrates: In presence of these hydroxy acids, ferric chloride does not give a precipitate on addition of alkali." One must plead for specific tests in a book of this description. It is exactly that class of information which is looked for.

In the section on volumetric analysis a notable omission is any discussion of indicators; that, possibly, is to be incorporated in the section on the determination of p_H which is promised in the preface. Whilst discussing indicators it may be pointed out that the choice given in the paragraphs on silver nitrate and ammonium thiocyanate, potassium ferrocyanide and sodium sulphide do not generally commend themselves in technical practice, being replaced by iron alum for thiocyanate, ammonium molybdate for ferrocyanide, and ferric hydroxide for sodium sulphide.

In the section on organic analysis some mention should be made of the micro-methods which in so many laboratories are rightly superseding the older procedure; and with this mention of micro-methods may not a

plea be uttered for a larger recognition of microscopic methods in qualitative analysis. There can be no comparison between the old crude test-tubing and the modern micro-chemical tests. The beauty, certainty, and economy of micro-chemical tests has not been sufficiently advocated or taught, and one does appeal to the editor of this book to help in that direction if it be at all possible.

In the section on electro-chemical analysis one sentence surely needs excision. Page 628, "Accumulators are invariably used for electro-chemical analysis."

In spectroscopy it is doubtful whether anyone to-day uses the old arbitrary scale, and the space occupied by it might well be devoted to a fuller list of the standard lines of the iron arc and the mercury-vapour arc spectrum, both of which are so frequently used for calibration purposes.

Cellulose and paper bulk largely to-day in industry, and we could wish that a little fuller details had been given of the commoner sizing reactions, and that in the section on textile fibres the various staining tests had been included. Reference might also have been made to Sindall's book on "Paper technology" and Matthews, on "Textile fibres."

In the section on the examination of blood (p. 1060) staining is mentioned, but no detail is given apart from an obsolete method of permanent mounting. One at least of the modern differential stains might be included, and it might be well to mention one or other of the micro-methods of estimating sugar in blood, which have become so important an adjunct to the insulin treatment of diabetes.

In conclusion, welcome to the new edition, and may every year which passes see the book fuller, more complete, and more perfect. In this spirit the above criticisms are offered.

H. W. GREENWOOD

ENEMIES OF TIMBER: DRY ROT AND THE DEATH-WATCH BEETLE. By E. G. BLAKE, M.R.S.I. Pp. xii + 206. London: Chapman & Hall, Ltd., 1925. Price 12s. 6d.

In this book an account is given of the two worst enemies of timber, together with a thorough discussion of the damage that they cause, and of the methods for destroying them. The book opens with a chapter on the decay of timber, the remaining being divided into two sections, the first dealing with dry rot, the second with the death-watch beetle. The treatment is thoroughly practical, and the description of the methods of control is very full. Such a book should have a valuable educative influence, and as it is written from the view-point of the user of timber, should appeal to all who realise that much of the present waste of timber is preventable.

MICROSCOPIC FRESH WATER LIFE. By F. J. W. PLASKITT. Pp. xi + 278. London: Chapman & Hall, Ltd., 1926. Price 13s. 6d.

This book consists of an account, written by an experienced naturalist, of the micro-organisms found in fresh water. The treatment is popular, and the English is reasonably clear, though awkward constructions are too frequent. The organisms covered include aquatic

plants, algæ, diatoms, desmids, infusoria, rotifera, bugozoa, entomostraca, hydracarina, and so on. For those interested in the flora and fauna of fresh water, the book provides a handy introduction to the subject. There are numerous illustrations, both line drawings and photographs, of varying merit, and the book is well produced.

ANORGANISCHE CHEMIE. By Dr. ROBERT SCHWARZ. *Wissenschaftliche Forschungsberichte, Naturwissenschaftliche Reihe*, edited by Dr. R. E. Liesegang. Band XVI. Pp. xi+139. Dresden and Leipzig: Theodor Steinkopff, 1927. Price: paper, 8 m.; bound, 9.50 m.

This "report of progress," which forms a convenient adjunct to the text books, is concerned almost entirely with experimental inorganic chemistry; the complex compounds are briefly considered, but the section dealing with theoretical matters—molecular structure, theories of colour, etc.—is limited to 12 pages. Hence, although in a sense the book is self-contained, it is rather a fractional part of a general survey, other volumes of the series dealing with atomistics, analytical, physical, colloid, organic chemistry, etc. The period under review, 1914—1925, seems, within the apportioned limits, to have been reasonably well covered, and the text bears evidence of critical selection and consideration. If it be remembered that such a book is a handy guide to the literature rather than a substitute for it, the picture which it presents of the advance of knowledge will be found to be of more than ephemeral interest and value.

A. A. E.

CHEMISTRY IN THE WORLD'S WORK. By H. E. HOWE. "Library of Modern Sciences." Pp. vii+244. London: Chapman & Hall, Ltd., 1926. Price 15s.

Mr. Harrison E. Howe, a well-known American editor and author, has given, in his latest book, a stimulating account of the part played by chemistry in modern civilisation. Starting with the contributions which chemistry has made to the reduction of human isolation, both physical and mental, the author discusses the work of chemists in relation to fuels as "allies of the sun," food and famine, clothing, decoration ("Escape from monotony"), materials of construction, the fight against corrosion and decay ("Permanency of possessions"), sanitation and health, power, the abolition of drudgery, national defence, and concludes with suggestive chapters on chemistry as a tool, analysis and synthesis, and the trend and purpose of modern research.

The author has successfully avoided the pitfalls presented by the wealth of material available, and has both chosen his subjects and discussed them in such a way as to make a story which is both impressive and cumulative in effect. Eminently readable, the book, though not without its purple patches, makes a worthy companion in the "Library of Modern Sciences" to the volume previously contributed by Arrhenius. The book is primarily intended for the layman interested in the development of our modern civilisation, but the ground covered is so wide, and the treatment so interesting, that it will appeal to more than the merely curious.

PARLIAMENTARY NEWS

Gas Mantles

The following new clause is proposed in connexion with the Finance Bill: The Customs Duty imposed under the Safeguarding of Industries (Customs Duties) Act, 1925 (Geo. V., c. 79), mantles for incandescent lighting, whether collodionised or not, shall be reduced from six shillings the gross to one shilling the gross as from the first day of August, 1927, and the Customs Duty imposed under the same Act on impregnated hose or stockings for use in the manufacture of such mantles shall be reduced from four shillings and sixpence the pound to sixpence the pound from the first day of August, 1927.

British West Africa (Oil Palms)

Mr. Amery informed Sir John Power that last year agricultural officers of Nigeria and the Gold Coast were sent to the East Indies to study and report upon the methods in use there for improving the yield of oil palms. They had now returned, and were submitting their reports to the Governments of Nigeria and the Gold Coast, who were giving close attention to the problem of improving palmeries by planting better-yielding varieties and improving methods of native extraction. Discussions in regard to the establishment of central mills were in progress.—June 13.

Oil Drilling in Iraq

In reply to various questions, Mr. Amery stated that drilling for oil had actually taken place in Iraq, but he was not in a position to give details of the operations of individual oil companies. The Turkish Petroleum Company did not start drilling operations until April 5 last, and any statement as to results would be premature. The Anglo-Persian Oil Company was drilling near Kharakan, and the Turkish Petroleum Company was conducting its investigations in the old Mosul vilayet.—June 13.

COMPANY NEWS

BRITISH CELANESE, LTD.

The report for the year ended February 28, 1927, shows trading profit amounting to £793,850, an increase of nearly 68% over that for the previous year. The net profit, subject to depreciation, amounted to £223,193, which it is proposed to place to the credit of the depreciation reserve account, making that account £536,932. The loan of £50,000 from the Government was reduced by £10,000 during the year, and the balance of £40,000 has since been repaid. At the end of the year the company had a greater production and a larger turnover than ever before during its existence, supported by very substantial cash resources available for meeting all the company's foreseen requirements or for financing further expansion.

UNITED INDIGO AND CHEMICAL CO., LTD.

A dividend has been declared on the preference shares at the rate of 5% per annum, subject to tax, for the six months ending June 30.

BOOTS PURE DRUG CO., LTD.

The thirty-ninth annual ordinary general meeting was held on June 9, Mr. John C. Boot, J.P., chairman,

presiding. After briefly reviewing the accounts (cf. CHEM. AND IND., June 3, 1927, p. 515) the chairman said that the company had suffered from the general strike and the coal strike—fuel alone costing £10,000 more—the retail branches in mining areas being badly affected. With the exception of the new shop-fitting department, which was completed during the past year, the company had had no new manufacturing buildings for nearly ten years, and as the tonnage sent out from Nottingham had increased 22½% during the past three years, new factories were urgently required. Accordingly, the directors had bought 200 acres of land between Dunkirk and Beeston, which is within three miles of the Nottingham Market Place, and proposed to build a section for the soap and toilet departments and develop the remainder of the land as and when required. The sum of £100,000 had been set aside as a fund to provide for the expense of transferring departments to a new site. During the past year the scientific and research side of the business had been reorganised. The services had been secured of Dr. Pyman, hitherto Professor of Technological Chemistry in the University of Manchester and in the College of Technology, who will have control of the research laboratories. They had also persuaded Prof. Robinson, one of the most brilliant organic chemists of the day, to act as consultant to this department. Feeling the need for correlation of the purely chemical side of their work in the preparation of therapeutic substances with biochemical research and its application to clinical medicine, the company thought it of great importance to obtain some link with an up-to-date biochemical institute. In this they had been most successful, and acknowledged the valuable assistance afforded to their research department by the Middlesex Hospital, London, and, in particular, by the biochemical department of the Bland-Sutton Institute of that hospital. In recognition of this assistance they had endowed a scholarship in this institute. Total sales last year were the largest in the company's history. They had now over 800 shops open in Great Britain, and looked forward with every confidence to the future.

COURTAULDS, LTD.

A dividend has been announced on the 5% cumulative preference shares, payable on July 1 to shareholders registered on June 9.

MIRRELES BICKERTON AND DAY, LTD.

A dividend of 6% has been declared on the ordinary shares for the year.

NEUCHATEL ASPHALTE CO., LTD.

A dividend has been recommended of 9d. per ordinary share, less tax, making 1s. 3d. per share for 1926, being the same as for 1925.

ASBESTOS CORPORATION

The report for the eleven months ended December 31, 1926, shows operating profits of \$1,237,008, compared with \$781,979 by the old company for 1925, the net profits being \$596,673. Preference dividends absorbed \$391,445, leaving a balance of \$205,228 applicable to the common stock.

CROSFIELD'S OIL AND CAKE CO., LTD.

A final dividend has been declared of 5%, making 15%. The net profits amounted to £27,000.

ALEXANDER, FERGUSSON AND CO., LTD.

The profit made by this firm of lead smelters for 1926 was £18,318, plus £3535 brought forward, making £21,853. The sum of £4000 has been allocated to depreciation, and £4000 to reserve. Dividends have been declared on A and B ordinary shares at the rate of 12½%, plus a bonus of 2½%, carrying forward £2653.

TARAPACA AND TOCOPILLA NITRATE CO., LTD.

The twentieth ordinary annual general meeting, held on April 28, was presided over by the chairman, Mr. Edward Eyre. The gross profit for 1926 amounted to £37,927, the net profit being £3963, which has been carried forward. The total quantity of nitrate sold for shipment during 1926 was 13,473,848 metric quintals, against 24,926,009 metric quintals for 1925. The new oficina, "San Andres," was completed on February 14 last, and working operations were commenced on February 15. The old "Santa Fé" plant was closed on the previous day. The oficina was entitled to a monthly quota of 112,000 metric quintals, and this the company expected to get. A provisional iodine quota of 738·20 m.q. had been granted, and as this only represented 70% of the quantity that would be given when the Iodine House was completed, the company's effective quota should be 1054·6 m.q. The shareholders were to be congratulated upon possessing one of the best maquinas on the Pampa, and as the grounds were excellent, the cost of production should easily place them among the cheapest producers. It was thought that the average price for nitrate for the year July, 1927, to June, 1928, would probably be about 16s. f.o.b. Chile. Referring to the burden of the Chilean Government duty, the chairman said no trade could be maintained under such conditions. The company would continue working operations, although the returns would not, at any rate for the time being, yield the profits the investment of so large a sum of money was entitled to expect.

INTERNATIONAL PAPER CO., LTD.

The report of this company and its subsidiaries for 1926 shows total revenue amounting to \$9,834,543. Depreciation absorbs \$3,756,277, and interest on funded debt \$2,802,981, leaving a net revenue balance of \$3,275,283. Dividends on the preferred stock absorb \$2,198,471 and on the common stock \$750,000, leaving \$326,812, which with \$74,050 paid in surplus, makes a balance of \$400,862.

SWEDISH MATCH COMPANY

The final dividend for 1926 of 10 Swedish crowns per share has been paid at exchange 18·16 Swedish crowns to £ (11s. 0·158d.) per share, less British tax.

ALIANZA NITRATE CO., LTD.

The gross profit for 1926 was £29,900, the net result being a loss of £34,200. It has been decided not to recommend the payment of a dividend, but to carry forward £171,700 to 1927.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 4d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 2d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 8d.—2s. per gal. Pure, 1s. 10d.—2s. 3d. per gal.
 Xylol.—1s. 11d.—2s. 3d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—9d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/160, 1s. 3d.—1s. 9d. per gal. Solvent 95/160, 1s. 5d.—1s. 6d. per gal. Solvent 90/190, 1s. 1½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—70s.—80s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Naphthanic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d. 1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. £40—£43 per ton. Powder £44—£47 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s. 21s. per lb.
 Acid, Citric.—1s. 7½d.—1s. 8d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. 1s. 3½d.—1s. 5d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal £24—£27 per ton, Powder £26—£29 per ton, according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium.—1s. 10d.—1s. 11d. per lb. Sodium.—2s. 1d.—2s. 2d. per lb. All spot.
 Calcium Lactate.—1s. 2d.—1s. 4d. per lb.
 Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ¼ lb., 9s. 6d. per doz.; ½ lb., 6s. 6d. per doz.
 Hydroquinone.—4s. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perochloride.—4d. per lb., 22s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 3d. per lb. net. Synthetic, 10s. 6d.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonol.—11s. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—3s. per lb.
 Phenazone.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanoide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—7s. 6d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.
 Thymol, Puriss.—10s. 3d.—10s. 9d. per lb., according to quantity. Natural.—12s. 6d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.
 Aubepine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—14s. 6d. per lb.
 Citral.—8s. 9d. per lb.
 Ethyl Cinnamate.—7s. 6d. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol.—9s. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. 6d. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—3s. 9d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanilin.—17s.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—30s. per lb. Bourbon Geranium.—14s. 9d. per lb.
 Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure—6s. per lb.
 Eucalyptus, 75/80%.—2s. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—8s. 3d. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz., Palma Rosa.—9s. 9d. per lb. Peppermint.—Wayne County, 17s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 6d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Aug. 6th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on June 23rd. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Andrews. Classification of powdered materials by elutriation. 14,547—9. May 30.

Boving. Apparatus for rarefying gases. 14,646. May 31.

Garland. Filters. 14,509. May 30.

Luck and Wood. Apparatus for supplying liquids in predetermined quantities. 14,845. June 2.

Mabag Maschinen u. Apparatebau A.-G., and Neuroth. Apparatus for degasification etc. of liquids. 14,754. June 1.
 Raw. Chemical etc. treatment of solid materials. 14,544. May 30.

Zahn & Co. Ges. Calcining-furnaces. 14,880. June 2.

I.—Complete Specifications

5383 (1926). Johnson (I.-G. Farbenind.). Manufacture of adsorbents. (271,564.)

5499 (1926). English and Hannan. Stills etc. (271,567.)

5615 (1926). Besta. Annealing metals, ceramic and other materials. (248,394.)

12,684 (1926). Berlin. Absorption refrigerating-apparatus. (271,634.)

24,434 (1926). Trocknungs-Verschmelzungs-u. Vergasungs Ges., Honigmann, and Bartling. Annular ovens or furnaces with rotating hearths for the treatment of pulverulent, granular, or like materials. (271,707.)

3820 (1927). Hänel. Grinding-mills. (271,780.)

7074 (1927). Pyrene Co., Ltd. Low freezing-point solutions. (267,561.)

8611 (1927). Roseoe. Machines for crushing ores, stone, rock, etc. (271,799.)

9349 (1927). Akt. Separator. Centrifugal separator installations. (269,883.)

*13,777 (1927). Akt. Elektrisk Malmletning. Discovering the position, configuration, and nature of ores, solutions of salts, etc. (271,871.)

*14,492 (1927). Ver. Stahlwerke A.-G. Grinding and milling machines. (271,904.)

II.—Applications

Chilovsky. Manufacture of gas from heavy oils. 14,536. May 30. (Belg., 16.7.25.)

Coley. Apparatus for activating carbon etc. 14,733. June 1.

Dupuy. Heating gases etc. 14,620. May 31. (Fr., 18.6.26.)

Générateur Rex Soc. Anon. Gas-producing apparatus. 14,505. May 30. (Fr., 31.5.26.)

Hellmann. Ovens for treating fuels etc. 14,767. June 1. Ger., 8.6.26.) Ovens for treating fuels. 14,881. June 2.

Johnson (I.-G. Farbenind.). Catalytic production of hydrocarbons. 14,503. May 30.

Soc. Anon. Charbons Actifs E. Urbain. Analysis of mixture of gases etc. 14,873. June 2. (Fr., 24.7.26.)

Soc. Anon. des Fours à Coke Semet, Solvay, et Piette. Apparatus for dry-cooling of coke. 14,535. May 30. (Belg., 5.5.27.)

Turner. Carbonising etc. retorts. 14,640. May 31.

II.—Complete Specifications

4558 (1926). Portham, and Tangential Dryers, Ltd. Removal or separation from gaseous fluid of material suspended therein. (271,545.)

8089 (1926). Perelis. Treatment of mineral oils by heat to obtain lower-boiling oils. (271,601.)

11,992 (1926). Berrisford. Separating coal from dirt and like foreign substances. (271,633.)

13,762 (1926). Hodgson and Jones. Apparatus for generating oil-gas. (271,649.)

21,266 (1926). Heylandt. Obtaining and storing gases under pressure. (271,692.)

28,563 (1926). Trumble. Distilling solid carbonaceous material. (271,740.)

28,768 (1926). Raytheon Manuf. Co. Gaseous electric conduction apparatus. (263,108.)

33,077 (1926). Tully and Yeo. Manufacture of gas for heating and lighting purposes. (271,765.)

70 (1927). *Pétrole Synthétique* and Folliet. Converting methane gas into hydrocarbons of higher carbon content. (271,767.)

*19,303 (1926). Still. Eliminating sulphuretted hydrogen from gases. (271,805.)

*8300 (1927). *Holzverkohlungs-Ind. A.-G.* See VII.

*12,404 (1927). I.-G. Farbenind. A.-G. Means for the extraction of carbon dioxide from gaseous mixtures. (271,852.)

*12,771 (1927). *Rhenania-Kunheim Ver. Chem. Fabr. A.-G.* Roasting gas-purifying substances. (271,854.)

*14,147 (1927). Novelli. Combustion of pit-coal, lignite, etc. (271,889.)

*14,334 and 14,536 (1927). Chilovsky. Manufacture of gas from heavy oils (271,899 and 271,907.)

*14,442 (1927). *Prep. Industrielle des Combustibles (Soc. Anon.)*. Apparatus for crushing and mixing pitch. (271,903.)

IV.—Applications

L.-G. Farbenind. Manufacture of dyestuffs. 14,534. May 30. (Ger., 29.5.26.) Manufacture of α -anthraquinonyl ketones. 14,851. June 2. (Ger., 7.6.26.)

Imray (I.-G. Farbenind.). Manufacture of azo dyestuffs. 14,746. June 1.

Johnson (I.-G. Farbenind.). Production of dyestuffs. 14,504. May 30. Manufacture of azo dyestuffs. 14,828. June 2.

Scottish Dyes, Ltd., Hooley, and Thomas. Production of dyestuffs. 14,748. June 1.

IV.—Complete Specifications

1789 (1926). Wylam, Harris, Thomas, and Scottish Dyes Ltd. Dyes and dyeing. (271,533.)

2291 (1926). Smith, Thomas, and Scottish Dyes, Ltd. Dyes and dyeing. (271,537.)

5048 (1926). Johnson (I.-G. Farbenind.). See VI.

5522 (1926). Marschalk. Reducing vat dyestuffs to their leuco-derivatives. (271,569.)

5892 (1926). Marks (Du Pont de Nemours & Co.) Water-insoluble colours or dyes. (271,580.)

6615 (1926). I.-G. Farbenind. A.-G. Manufacture of α -keto- β -naphthols and of condensation products of the benzanthrone series. (248,791.)

8397 (1926). Brit. Dyestuffs Corp., Ltd., and Shepherdson. Manufacture of anthraquinone derivatives. (271,602.)

10,081 (1926). I.-G. Farbenind. Manufacture of azo dyestuffs. (253,488.)

*14,332 (1927). Soc. Chem. Ind. in Basle. See VI.

*14,333 (1927). Soc. Chem. Ind. in Basle. Manufacture of products applicable for making dyestuff preparations and of dyestuffs therefrom (271,898.)

*14,534 (1927). I.-G. Farbenind. A.-G. Manufacture of vat dyestuffs. (271,906.)

V.—Applications

Hägglund. Treatment of black liquor obtained in manufacture of wood fibre. 14,667. May 31. (Ger., 23.6.26.)

Moes. Manufacture of paper. 14,550. May 30. (Holland, 24.12.26.)

V.—Complete Specifications

29,917 (1925). Langwell, Ricard, and Burton. See XVIII.

4429 (1926). Imray (I.-G. Farbenind.). Grounding or padding of textile material. (271,543.)

5119 (1926). Kaye. See XIV.

9029 (1926). Phipps. Surface decoration of textiles. (271,008.)

10,025 (1927). Roura. Manufacture of product for treating the hair. (271,802.)

*13,123 (1927). Heberlein & Co. A.-G. Producing pattern effects on textiles. (271,859.)

VI.—Application

Huessy. Bleaching textile fabrics etc. 14,455. May 30.

VI.—Complete Specifications

1789 (1926). Wylam, Harris, Thomas, and Scottish Dyes, Ltd. See IV.

2291 (1926). Smith, Thomas, and Scottish Dyes, Ltd. See IV.

5048 (1926). Johnson (I.-G. Farbenind.). Dyeing cellulose esters and preparations for use therein. (271,550.)

*14,332 (1927). Soc. Chem. Ind. in Basle. Producing fast tints on vegetable fibres and manufacture of dyestuffs therefor. (271,897.)

VII.—Applications

Cerini. Apparatus for purification of solutions of caustic soda etc. 14,500. May 31. (Italy, 1.6.26.)

Coley. Manufacture of zinc oxide. 14,734. June 1.

Still and Still. Recovering sulphuric acid. 14,641. May 31. (Ger., 22.12.26.)

VII.—Complete Specifications

26,401 (1926). Metallbank u. Metallurgische Ges. A.-G. Production of sulphuric acid. (262,397.)

26,465 and 26,525 (1926). Reymerholms Gamla Ind. Akt. Utilising the liquors from chloridising roasting pyrites cinder etc. (260,294 and 260,297.)

*2202 (1927). Rütgerswerke-A.-G. Working-up fluorides containing silicic acid. (271,816.)

*8300 (1927). *Holzverkohlungs-Ind. A.-G.* Concentrating raw pyrolygneous acid. (271,828.)

*13,626 (1927). Weitz. Separation of alkali salts. (271,869.)

*13,777 (1927). Akt. Elektrisk Malmletning. See I.

*13,808 (1927). Titanium Alloy Manuf. Co. Obtaining zirconium compounds. (271,873.)

4881 (1927). Collin A.-G. zur Verwertung von Brennstoffen u. Metallen. Discharging ammonium sulphate from saturating-tanks. (268,309.)

VIII.—Applications

Holophane, Ltd., and English. Manufacture of glass for transmitting ultra-violet light. 14,542. May 30.

United Glass Bottle Manuf., Ltd., and Moorshead. Glass furnaces. 14,743. June 1.

VIII.—Complete Specifications

5615 (1926). Besta. See I.

32,847 (1926). Bicheroux. Manufacture of raw plate-glass. (263,846.)

*12,149 (1927). U.S. Metals Refining Co. Magnesite refractories. (271,847.)

IX.—Complete Specifications

1791 (1926). Hauts-Fourneaux & Acieries de Differdange-St. Ingbert-Rumelange Soc. Anon., and Lavandier. Calcining limestone and the like in vertical kilns fired with lean gas. (246,485.)

20,775 (1926). Cohen. Toughening and hardening artificial or natural stone. (271,722.)

6740 (1927). Michelsen. Conversion of slags into cement. (267,539.)

X.—Applications

Boës and Kröning. Steel-hardening baths. 14,500. May 30.

Cholevinski. Bearing-metals. 14,725. June 1. (Poland, 18.6.26.)

Greenway Bros., Ltd., and Greenway. Galvanising etc. metals. 14,562. May 31.

Harris. Mechanical ore-roasting furnaces. 14,784. June 2.

Pirovarsky. Cupola furnaces. 14,655. May 31. (Ger., 31.5.26.)

Siemens Elektrowarme-Ges. Annealing-furnaces. 14,645. May 31. (Ger., 3.6.26.)

Weichel. Cupola furnaces. 14,709. June 1. (Ger., 2.6.26.)

X.—Complete Specifications

- 5190 (1926). K&h. Furnaces for smelting and refining iron, steel, etc. (248,012.)
 5815 (1926). Besta. See I.
 7431 (1926). Clausson & Co. Akt. See XI.
 7637 (1926). Hybinte. Manufacture of a light aluminium alloy. (271,597.)
 8922 (1926). Chopra and Bullen. Heat-treatment of steel. (271,606.)
 16,377 (1926). Marks (Vergo Aluminium Metallverwertungs-Ges.). Solders for aluminium and aluminium alloys. (271,662.)
 27,449 (1926). Maschinenfabr. Esslingen. Making grey-iron castings of any desired structure. (260,990.)
 8502 (1927). Aluminium Co. of America. Production of corrosion-resistant articles. (271,798.)
 *20,269 (1926). Industrias Reunidas "Alba" Soc. Anon. Manufacturing metallic articles from molten metal. (271,806.)
 *12,435 (1927). Copper De-oxidation Corp. Pyrometallurgically refining and casting copper. (271,853.)
 *13,777 (1927). Akt. Elektrisk Malmletning. See I.
 *13,863 (1927). Soc. Gén. Métallurgique de Hoboken. Roasting of zinc sulphide ores. (271,877.)
 *14,655 (1927). Pivovarsky. Cupola furnace. (271,910.)

XI.—Applications

- A.-G. Brown, Boveri, et Cie. Electric furnaces. 14,861. June 2. (Ger., 7.6.26.)
 British Thomson-Houston Co., Ltd. Electric incandescence lamps. 14,629. May 31. (U.S., 2.6.26.)
 Jordan. Plating iron etc. 14,750. June 1.
 Northrup. Electric induction furnaces. 14,554. May 30.

XI.—Complete Specifications

- 7431 (1926). Clausson & Co. Akt. Electrodeposition of chromium and its alloys. (264,442.)
 8450 (1926). M.-O. Valve Co., Ltd., and Cosgrove. Electric discharge tubes. (271,603.)
 19,265 (1926). Allan. Electrolytic apparatus and electrodes therefor. (271,685.)
 26,646 (1926). Salles. See XXIII.
 26,895 (1926). Scott. Electrolytic apparatus and electrodes therefor. (271,726.)
 28,557 (1926). Armstrong, Whitworth, & Co., Ltd., and Windle. Electric furnaces. (271,739.)
 28,768 (1926). Raytheon Manuf. Co. See II.
 30,336 (1926). Gumlich. Magnetisable material. (262,153.)
 1701 (1927). A.-G. Brown, Boveri & Cie. Electric furnaces for heating gases at high temperatures. (264,849.)
 *31,418 (1926). Goltstein. Mercury-vapour lamp. (271,812.)

XII.—Application

- Pansky. Apparatus for extracting fats at low temperatures. 14,793. June 2.

XIII.—Complete Specifications

- 5746 (1926). Soc. Chem. Ind. in Basle. Manufacture of condensation products from carbamide or its derivatives and formaldehyde. (249,101.)
 6458 (1926). I.-G. Farbenind. A.-G. Manufacture of water-soluble condensation products. (248,782.)
 24,554 (1926). Palasseau. Manufacture of sticks, canes, etc. having a nacreous or metallic appearance. (259,249.)

XIV.—Complete Specifications

- 5119 (1926). Kaye. Vulcanised products for use in the manufacture of rubber goods, paper, or coated fabrics, etc. (271,553.)

- *13,366 (1927). I.-G. Farbenind. A.-G. Preserving rubber latex. (271,863.)

XVI.—Application

- Comp. de Prod. Chim. et Electrometallurgiques Alais, Froges, et Camargue. Herbicidal products. 14,825. June 2. (Fr., 25.6.26.)

XVIII.—Application

- Fox. Acetification of vinegar. 14,447. May 30.

XVIII.—Complete Specifications

- 20,917 (1925). Langwell, Picard, and Burton. Fermentation of cellulosic materials. (271,254.)
 3356 (1927). Hansena and Nathan. Treatment of yeast for use in the brewing of beer. (271,777.)
 *14,075 (1927). Levin. Preparing a preservable yeast preparation. (271,883.)

XIX.—Complete Specification

- 11,565 (1926). Haddan (Collins). Preservation of fresh fruit, vegetables, and like food materials. (271,626.)

XX.—Application

- Grasso. Treating organic fluids. 14,789. June 2.

XX.—Complete Specifications

- 2768 (1926). Audibert. Production of substantially pure methyl alcohol. (271,538.)
 5193 (1926). Danischevsky. Manufacture of pine extract. (271,555.)
 6615 (1926). I.-G. Farbenind. A.-G. See IV.
 6976 (1926). Synthetic Ammonia & Nitrates, Ltd., Smith, and Smith. Manufacture of acetic acid and acetates. (271,589.)
 19,031 (1926). Soc. Chem. Ind. in Basle. Manufacture of new compounds of gall acids. (257,900.)
 25,301 (1926). Deutsche Gold- u. Silber-Scheidanstalt vorm. Roessler. Production of β -pyridylhydrazine and its derivatives. (259,961.)
 26,806 (1926). McKee. Making peroxides of organic acids. (271,725.)
 70 (1927). Pétrole Synthétique, and Folliet. See II.
 *3022 (1927). Bots, and Soc. Anon. Prod. Chim. Coverlin. Manufacture of vanillin. (271,818.)
 *3023 (1927). Bots, and Soc. Anon. Prod. Chim. Coverlin. Manufacture of isoeugenol. (271,819.)
 *10,322 (1927). Etabl. Poulenc Frères. Manufacture of readily soluble organic salts of CC-dialkyl- and arylalkyl-barbituric acids. (271,837.)
 *10,647 (1927). Commercial Solvents Corp. Catalysts for synthetic methyl alcohol production. (271,840.)
 *14,056 (1927). Frischer. Producing volatile acids. (271,881.)
 *14,091 (1927). I.-G. Farbenind. A.-G. Manufacture of α -anthraquinonyl ketones. (271,884.)

XXI.—Application

- Martinez. Colour photography. 14,476. May 30.

XXI.—Complete Specification

- 5605 (1926). Wheeler. Colouring the image on photographic plates, films, etc. (271,578.)

XXIII.—Complete Specification

- 26,646 (1926). Salles. Electrolytically sterilising waters. (271,721.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference

number:—*British India*: Steel tubes, cast steel, malleable cast iron (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1.). *Canada*: Centrifugal electric pumping set (A.X. 4781). *Egypt*: Hides, leather (Egyptian Government, 41, Tothill Street, Westminster, S.W.1); Iron and steel, metals (A.X. 4723). *Holland*: Newsprint, printing papers (596). *Italy*: Leather (597). *Norway*: Copra, coconut and linseed oil, syrup (600). *Panama*: Paint, varnish, oils, corrugated galvanised iron (606). *Rumania*: Industrial chemicals, paper, leather (601). *Spain*: Cast iron piping (26964/27). *Switzerland*: Pharmaceutical products (603).

Gas-making Plant

The Gas Light & Coke Co., London, has placed an order with the Woodall-Duckham Vertical Retort & Oven Construction Co. (1920), Ltd., for an installation of continuous vertical retorts capable of making approximately 10 million cu. ft. of gas per day under ordinary working conditions, when carbonising unscreened Durham coals. The installation will comprise two benches, each of thirty-six 103-in. retorts. The contract includes coal and coke-handling machinery, and four waste-heat boilers, three of which will normally be working, leaving the fourth acting as a standby.

National Benzole Mixture

In view of the recent propaganda appertaining to Soviet petrol, the National Benzole Co., Ltd., wishes to make the position quite clear as far as its products are concerned. National Benzole Mixture is composed of benzole produced from British coal and petrol refined within the Empire. It is produced and distributed entirely by British labour, and exploited by British enterprise and capital. In short, it is completely British.

Sulphate of Ammonia

Nitram, Ltd., announces it has decided to continue selling sulphate of ammonia for home agricultural use until further notice, at the current prices of £12 6s. per ton for neutral quality and £11 16s. per ton for ordinary quality, delivered carriage paid in 4-ton lots and upwards to buyer's nearest station or ex works in 1-ton lots and upwards.

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during May, has been furnished to the Board of Trade by the Dyestuffs' Advisory Licensing Committee. The total number of applications received during the month was 656, of which 542 were from merchants or importers. To these should be added 29 as set out tanding on April 30, making a total for the month of 685. These were dealt with as follows:—Granted - 582 (of which 555 were dealt with within 7 days of receipt); referred to British makers of similar products - 77 (of which 58 were dealt with within 7 days of receipt); referred to Reparation Supplies available - 3 (all dealt with within 2 days of receipt); outstanding on May 31, 1927 - 23. Of the total of 685 applications received, 616, or 90%, were dealt with within 7 days of receipt.

News from Advertisements

1. The City of Cardiff Education Committee announce a vacancy for a full-time assistant lecturer in pharmaceutical chemistry (p. ix).
2. A metallurgical chemist is required (p. ix).
3. Applications for appointment in the research laboratories of a manufacturing company will be considered from physicists or physical chemists (p. ix).
4. The Manchester Municipal College of Technology announce particulars of various courses (p. ix).
5. The University of Leeds announce courses in connexion with the Department of Coal Gas and Fuel Industries (with Metallurgy) (p. ix).
6. B.Sc. (Hons. Chem.) A.I.C. seeks position in laboratory of food factory (p. ix).
7. Chemist experienced in the manufacture of heavy chemicals, dyestuffs, and pharmaceutical products requires position (p. ix).

PUBLICATIONS RECEIVED

- DEFECTS IN GLASS.** By C. J. Peddle. Pp. 205. London: Glass Publications, Ltd., 1927. Price 8s. 6d.
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EDITORIAL

The Annual Meeting at Edinburgh

THE Scots have been clever enough to envelope Edinburgh and other Anglo-Saxon cities and towns with a romantic haze of Highland glory. The hostility which prevailed for so many centuries between the townsmen who wore tweeds, and the clansmen who wore the tartan, has been followed by a successful effort to create a national pride in a number of heroes who detested and despised each other. The southern Scots have taken to themselves all the Highland virtues and now feel a superiority over the English north countrymen from whom they hardly differ in race, language or history. The City of Edinburgh is singularly fortunate in this romantic glory; founded by marauders from Schleswig and occupied by their descendants to this day, it has become a capital in which the kilt, the pipes and the claymore possess an air of respectability if not aristocracy. Edinburgh is sufficiently close to the wonderful Highland country to be familiar with the glories of Loch Tay and Loch Rannoch, of Schiehallion and Ben More; it is a city which is crowded with memories of Scott and Burns, and also with those of Mackenzie, Campbell and MacGregor. Edinburgh has its own volcanic hills to give an air of verisimilitude to its claim to relationship with the Highlands; it has in addition every charm necessary for a great capital, and the only disadvantage it possesses is that there is so much to see in Edinburgh that the lazy ones amongst us may not pay due regard to the improvement of our chemical knowledge. We have ourselves visited Edinburgh several times; the last time we saw it was after a rough voyage across the North Sea, a few weeks after the outbreak of war. There are still three chemical pilgrimages we have to make in Edinburgh, one to the home of Simpson, who discovered chloroform, one to the home of Gregory, the inventor of the famous powders, and one to the home of Napier, the mathematician, whose logarithms saved us so many hours nearly forty years

ago, when we used to perform with the retort and the balance. We are not sure which are the best things to see in Edinburgh; the natural scenery is undoubtedly striking; to literary or to legal folk the place is crammed with memories and anecdotes; any one can rejoice to see the fine paintings by Raeburn, and then we have ourselves to admire, and what for no? Conscious as we are of our own merits and each other's infirmities, we can demonstrate to Scotland and even to so cultured people as the academic society of the modern Athens, how much modern civilisation owes to the chemical industry. A few of the really earnest ones, biochemists and chemical engineers, will improve their minds; the President and members of Council have duties to perform; the editorial staff, having practically no duties to perform, and having improved their minds for a considerable period of time, now intend to relax them. We can hardly think of a pleasanter place for relaxation than Edinburgh; in its richness in historical and romantic associations it may be ranked with the most famous cities; in its proximity to a romantically beautiful country it excels, we think, all the capitals we have visited.

The Hydrogenation Pendulum

In the course of a few rare moments of delightful abstraction our thoughts strayed without restraint until the dignified tick-tock of an old grandfather clock fastened them upon the swing of the pendulum. By more or less inconsequential sequences, we passed to the recollection of a child's flight through the air from an improvised garden swing, to aeronautics, to Captain Lindbergh and Messrs. Chamberlin and Levine, to airships, helium and hydrogen. At hydrogenation, a reversion to the swing of the pendulum occurred, and we commenced to consider in earnest the changes which have taken place in hydrogenation practice and the latest suggestions for relatively low temperature processes.

The pendulum has swung many times since Sabatier, thirty years ago, first discovered the catalytic power of nickel in hydrogenation processes. Sabatier declared that the catalyst must not be wetted by condensation of the vapours undergoing treatment, but a few years later Norman demonstrated that oils could be hydrogenated in the liquid condition in the presence of Sabatier's nickel. Views as to the nature of the catalyst changed, and the original conception that metallic nickel was the active catalyst came back into favour after the Bedford and Erdmann school had pressed strongly for nickel suboxide. Ideas on the mechanism of the hydrogenation reactions have changed, too, since the classical work of Sabatier and his associates pointed to the intermediate formation of a hydride of nickel, and the Armstrong-Hilditch theory appears definitely to hold the field.

Right from the early days of oil hydrogenation, however, two facts have been known, namely, that the addition of hydrogen is a selective process, and that iso-oleic acid is produced during hydrogenation.

Iso-oleic acid is a solid unsaturated acid, and possesses undesirable properties considered from the point of view of the soap maker or the edible oil producer, the two most important consumers of hardened oils. In the hydrogenated oils required by the makers of compound lards, margarine and general edible fats the presence of acids more unsaturated than oleic—for example, linolic acid—is undesirable for well-established reasons, but as the selective hydrogenation of such acids is accompanied by the formation of large amounts of solid iso-oleic acid or acids, the melting point and texture of the fat obtained are unsatisfactory. Similarly, the presence of iso-oleic acids in soap makers' hardened oils involves the production of a soap with diminished lathering and detergent properties, especially in the absence of a highly intricate technique of blending. It is therefore unfortunate that up to the present it has been technically almost impossible to hydrogenate oils rapidly and economically without the formation of relatively large amounts of the solid unsaturated acids. Certainly the process of Bolton and Lush aims at establishing conditions such that iso-oleic acid formation is avoided to a large degree, and in view of its simple and continuous nature, it has an interesting future.

It might seem invidious at first sight to select from the hundreds of hydrogenation patents a single one for editorial notice, but the value of a catalyst which will facilitate hydrogenation at a low temperature and a high velocity can scarcely be over-estimated, for, as the ordinary temperature of hydrogenation is lowered, it is well known that iso-oleic acid formation is repressed. Thus it is that a recent specification of the I.-G. Farbenindustrie Aktiengesellschaft has attracted our special consideration. In this specification it is stated that many hydrogenation reactions can be conducted at a relatively low temperature and at a rapid rate, if a suitably prepared nickel catalyst be employed. Acetone is converted into iso-propyl alcohol in 95% yield at a temperature of 40°–70° C. Similarly, from pyridine at 110° C., piperidine is produced in almost quantitative yield, and it is quite within the bounds of possibility

that liquid vegetable oils may be capable of hydrogenation or hardening sufficiently rapidly for economic technical purposes without the formation of substantial amounts of iso-oleic acid by reason of the relatively low temperatures of reaction which it may be feasible to employ.

In the ordinary method of making nickel catalysts, the nickel compound to be reduced is precipitated upon a carrier in a more or less colloidal form. If, it is stated by the I.-G., the nickel compound is precipitated in a crystalline form, the catalyst subsequently produced is very active, even at relatively low temperatures. The nickel compound is precipitated upon the carrier at a raised temperature, and so slowly as to allow of a crystalline form being assumed by the nickel hydroxide or carbonate. For example, the carrier—powdered silicic acid gel—is suspended in a dilute solution of nickel nitrate, and a very dilute solution of sodium carbonate is added drop by drop during a period of 8 hrs., the temperature being maintained at 70° C. After filtration, washing and drying, the mass is heated slowly in hydrogen up to about 420° C., and after a suitable reduction time, a supported nickel catalyst is formed which is claimed to be highly efficient in hydrogenation operations conducted at temperatures much lower than those commonly employed in present practice. The swing of the pendulum in hydrogenation technique has shown much of interest. From operations conducted at ordinary temperatures and pressures, with the aid of the noble metals, sometimes in colloidal form, we passed with Sabatier to processes using reduced nickel at such temperatures as were sufficient to maintain organic compounds in the vapour state. Ipatiev employed metallic oxides at higher temperatures and raised pressures, whilst Norman showed how to hydrogenate liquid oils at 180° C. Brochet then applied liquid phase hydrogenation to phenol and other organic compounds, reduced nickel again being used. The noble metals came back in the technical application of supported palladium for oil hydrogenation, and later we saw the development of such processes as synthetic ammonia production, the manufacture of methyl alcohol from carbon monoxide and hydrogen, coal hydrogenation and the conversion of naphthalene into tetrahydro and decahydro derivatives, all of which demanded the employment of very high temperatures and pressures, and the creation of plant by modern metallurgists and chemical engineers which would stand up to pressures of a thousand atmospheres and temperatures of 500° C. simultaneously doing their worst. Finally, we have come back with the work of Fischer to the hydrogenation of carbon monoxide to paraffins at ordinary pressures with the aid of special catalysts and the hydrogenation of oils at such temperatures as repress iso-oleic acid formation by the process of Bolton and Lush, and, if the claims of the I.-G. are substantiated, by the use of specially prepared highly active nickel catalysts.

Tick-tock, tick-tock—the pendulum is still swinging, and if we read the signs of the times aright, the old clock is destined to turn his face upon more discoveries in a decade than he did in a century of his earlier life.

THE COMMERCIAL SYNTHETIC RESINS AND THEIR PRODUCTS

By HERBERT W. ROWELL

The manufacture of synthetic resins has become a chemical industry of such commercial importance that the volume of its demand for raw materials affects their market price. One firm in America is working a large synthetic plant to supply part of its requirements of pure phenol. In this country at least 30 well-qualified chemists are directly engaged in controlling plant and sales, or in research connected with the manufacture of synthetic resins, and probably over 300 chemists, together with a number of assistants, are so exclusively engaged throughout the world.

As a chemical industry it virtually ends with the manufacture of soluble resins, solutions or lacquers, and mouldable masses or powders. A second industry, now called the moulding industry, converts these raw materials into the finished article. It is not always good business policy to combine the two industries in one organisation, although no technical objection can be raised if the output of resin is sufficiently large.

The output of synthetic resins can only be very roughly approximated. A French authority in 1924-5 gave America as making 6000 tons per annum, Germany 3600 tons, France 1200 tons, and Great Britain was not mentioned, but these figures probably mean synthetic resin products, and they may be halved to arrive at the pure resin output. A report of the United States Tariff Commission mentions three firms producing a total of over 2000 long tons of pure resin in 1920. The present figures for pure resin output are in the region of: America, 6000 tons; Germany, 4000 tons; France, 600 tons; and Britain, 500 to 700 tons per annum. This means about 200 million moulded articles and hundreds of tons of resin-paper material, as well as other fancy goods, as the annual world output.

Synthetic resin products include many articles such as cups and saucers which are not easily broken, teapot handles which do not become hot, transparent fountain pens, clock cases, cigarette tubes, ash trays, telephone ear-cups, laboratory apparatus and toilet requisites, as well as a large variety of engineering and electrical components. They are made in all colours, either transparent, translucent or opaque. Synthetic resin of one kind or other is the essential ingredient in all of them, and it is not a mere substitute for other materials. Its peculiar properties enable articles of simple or complicated shape to be made rapidly by new and cheaper methods which give results unattainable by the use of the older materials.

By combination of suitable resin with suitable reinforcing and filling materials it is possible to make goods which do not soften on heating or decompose at temperatures below 350° C., do not swell or distort when boiled in water, are not attacked by tar, petroleum or vegetable oils, alcohol or the common organic solvents, 50% sulphuric, strong hydrochloric, hydrofluoric or organic acids, zinc chloride, copper sulphate and most salt solutions. Strong sodium carbonate and weak caustic solutions are without effect, but the resins are

soluble in strong caustic solutions, and are charred or oxidised by strong sulphuric and nitric acids.

Although modern types of hard rubber may be a more practical proposition in many cases, it is of interest to chemical manufacturers that tank linings, stirrers, pump casings and impellers, cocks, pipes, and the like can be made of light and strong synthetic resin compositions and stoneware parts or pipe joints can be cemented with them. Synthetic resin products should not be confused with articles moulded from mixtures of fillers bonded with shellac, bitumen, pitch, drying oils and the like, which soften when heated and which may be identified by their characteristic smell when held in a flame. Some hard rubber goods like ebonite, casein goods like erinoid, and nitrocellulose goods like celluloid have a similar appearance to the synthetic resin goods, but have not the same desirable properties. The term "synthetic resin" is a misnomer, for these compounds have no chemical relation to the natural resins and few physical properties in common with them, but we continue to use the term until a better generic name is discovered. Many names, such as Bakelite, have been invented as trade marks and add to the confusion. The same name is used indiscriminately by a maker to describe not only a particular make of synthetic resin, but also his semi-manufactured material and finished article containing the resin and having widely different composition and appearance. A number of different makers' names are also applied to substantially the same material.

Hundreds of resin-like materials have been prepared, and most of them have formed the subject matter of patents, but very few have found practical application. Academic and industrial research has been carried out from about 1890 onwards, when formaldehyde became a commercial product, and it has resulted in a most appalling mass of patent literature. Many of these specifications seem to overlap and conflict quite considerably, and it is doubtful if more than a few of them would have survived a serious legal fight.

Bayer (Ber., 1872, 5, 25, 280 and 1094) showed the possibility of producing resin-like substance from aldehydes and phenolic bodies, and Emil Fisher and Kleeberg carried this work into more hopeful channels in 1891, but brought to view nothing having commercial value. Various workers then published a variety of reactions around similar materials, using various condensing agents and, in 1899, Smith patented (E.P. 1899, 16,247) a method of making an electrical insulating material of historic interest, but of no practical importance.

The first patents of importance and the key to the possibility of commercial success are those of Blumer (E.P., 1902, 12,880) and Luft (E.P., 1902, 10,218), who both heat phenol and formaldehyde solution in presence of an acid catalyst.

Story patented (E.P. 1904, 8875), a simple and workable process using no catalyst and excess of phenol, which produced lacquers and transparent or translucent blocks for further machining.

De Laire (E.P. 1905, 15,517) produced resin-like substances from cresols, whilst the following three years saw a series of patents, involving the use of alkaline

catalysts or condensing agents and a large number of variations in material and methods, in which the names of Knoll & Co., Lebach & Stephan are prominent.

The credit for the foundation and development of the synthetic resin industry belongs to Leo. H. Baekeland, who turned laboratory experiment into controllable works processes which produced saleable articles in large quantity. (Baekeland, E.P., 1908, 1921; 1908, 1922; 1908, 21,566; 1911, 26,614; 1912, 6293; 1912, 6294; 1915, 7284.) Baekeland also eventually founded what is now the Bakelite Corporation and its subsidiary firms, which are the largest producers of phenol-aldehyde resins and their products.

Following Baekeland in America, came Redman and his associates with further modification in process, and J. W. Aylesworth with elaborate chemical explanation in his patent specifications and a distinctly new process. Patent litigation of a protracted and ruinous nature appeared to be inevitable, but these American firms eventually settled their differences by commercial combination.

The earliest manufacture of synthetic resins in Britain follows the patent of Story, but no serious commercial development occurred until 1913-1914. The growth of the industry here has been lamentably slow, although there is a potential market for at least five times the present output. The Bakelite Corporation of Great Britain, which is an American concern, has now obtained control of some English companies, and proposes to develop increased output in Britain.

Up to the year 1914 all the research of commercial value centred on phenol-aldehyde resins. Many other avenues have been searched, but only two or three promise to be of industrial use, and are mentioned later.

PHENOL-ALDEHYDE RESINS

These resins are of much the greatest commercial importance. The type is characterised by a primary or intermediate stage in which it is soluble and fusible, and can be mixed with filling, colouring or other ingredients, and a final stage in which it is substantially hard, infusible and insoluble.

A resin may be prepared by heating under a reflux condenser one molecular equivalent of crystal carbohydric acid with one molecular equivalent of 40% formaldehyde solution. After several hours the condensation is complete and the mixture separates into an upper watery layer and a lower resinous layer. Acids, alkalis and salts which act as electrolytes, catalysts, or condensing agents may be added to the mixture. They considerably shorten the time of reaction, and may produce resins having different practical use or final properties. Paraformaldehyde, hexamethylenetetramine, and other substances producing formaldehyde and catalysts may be used, while cresols sometimes replace phenol. In these cases the characteristics of the intermediate and final resins may differ considerably. In practice, synthetic resins are actually made from synthetic phenol and synthetic formaldehyde, thus making the product truly synthetic. The "treacle," "primary" or "A" resin thus produced is separated from the watery layer and dried by heating under vacuum. It is a sticky, viscous mass, either clear or

translucent, soluble in alcohol and acetone, but not in benzene or petrol. If this "treacle" is further heated under controlled conditions, it polymerises to the "resin" or "B" stage, when it has the appearance of common rosin, melts to an extremely viscous mass at temperatures below 80° C., and is still soluble in alcohol and acetone. The "treacle" and "resin" are intermediate stages which make possible the commercial production of the final and only useful stage having the shapes, colours and general properties desired.

The "final," "baked" or "C" stage is produced by still further heating and polymerisation, when it is now insoluble in alcohol and acetone and does not soften when heated. The "final" state of the various phenol-aldehyde resins may exhibit some difference in physical properties, but, generally speaking, they do not soften on heating, are not decomposed at temperatures lower than 350° C., are insoluble in all the usual organic solvents, acids, alkalis and chemical solutions, except concentrated nitric and sulphuric acids and caustic solutions. Strong caustic soda will dissolve them, and they may be reprecipitated on the addition of acid. This was proposed as a method of purification by Potter (E.P. 1919, 131,112).

When cresols are used to replace phenol the resulting final product is generally softer and more flexible. *o*-Cresol alone combines more slowly with formaldehyde, and by incomplete combination produces this softness and flexibility. Conflicting statements are made with regard to the speed of reaction and degree of combination of the three cresols with formaldehyde, due most probably to the variable composition of the commercial cresols used by the experimenters and the unobserved catalysts present.

A most important variation in method of manufacture is the two-stage Aylesworth process (E.P. 1911, 3496), in which phenol is heated with only about two thirds of the required quantity of formaldehyde and a resin formed which does not give a hard, final product on heating. This molten resin is usually dissolved in alcohol, together with a sufficient quantity of hexamethylenetetramine to supply the remainder of the formaldehyde necessary for producing a resin which hardens quickly on heating. This method is said to give a more easily controlled works process of making moulding powders.

Many variations in plant and method are in use as the result of technical experience, but the general procedure follows the outline given above.

Much has been written about the chemical constitution of the phenol-aldehyde resins and the mechanism of the reaction, but proper investigation of molecular weight and other characteristics is practically impossible with such insoluble, infusible and chemically inert final products. The simplest condensation product of phenol and formaldehyde would be *o*-oxybenzyl alcohol or saligenin, a crystalline substance which, on dehydration by heat, assisted or not by a catalyst, gives a resinous substance. The *para*-alcohol may also be formed, and combination may take place between phenol and alcohol or between the two alcohols. Condensation on these lines theoretically takes place first, followed by polymerisation, but the two processes may be proceeding at the same time in practice.

When mixed cresols are used together with phenol, the reaction is even more difficult to follow, but technical observation of the properties of the variety of resin-like bodies it is possible to make from phenol and formaldehyde leads to the conclusion that a number of reactions go on side by side. The speed of reaction is controlled by temperature, catalyst, and the proportion of free formaldehyde present, and this determines the proportion of the various compounds, or polymers, which form the final mixture. Excess of phenol in the reacting mixture apparently produces a solution of normal final product resin in the excess of phenol, and uncombined phenol is generally found in the commercial resins.

Baekeland and others have prepared crystalline compounds of phenol and cresol with hexamethylene-tetramine in excess of the mono-formaldehyde requirements. Lebach and Redman prepared hexamethylenetetramine-triphenol, which gives off ammonia and methylamine when heated, leaving an infusible final resin.

It seems safe to assume that each of the commercial phenol-aldehyde resins is a mixture of compounds, their polymers and uncombined reagents, the complexity of which depends upon the methods used by the maker. In order to reproduce batches of resin having the same physical properties, it is necessary to repeat exactly the technical details of the process used, and this involves chemical control.

PURE RESIN PRODUCTS

Final products containing over 95% of resin come into this class, the remaining ingredients being colours or other additions which produce opaque or cloudy effects. Artificial amber, which very closely resembles the natural product, is made by adding to the initial reacting mass or to the "treacle" a dye, such as auramine, and oil or wax, which emulsifies and produces the cloudy appearance. The viscous material is then heated carefully for several days at 50° to 85° C., in moulds to form blocks, rods, or other rough shapes. Excess of phenol or cresol is generally used, catalysts are absent, and the polymerisation is done slowly to avoid bubbles and obtain transparency. Phenols in excess reduce brittleness and improve machining properties. A pale straw colour is the lightest natural colour so far produced, but this can be coloured with a small amount of bright dye or pigment. These goods are not moulded by pressure, but are finished by machining the rough-cast blocks.

MOULDING COMPOSITIONS

Probably over 75% of the phenol-aldehyde resins are made into moulding powders, consisting of resin, colouring matter, and the so-called "fillers," which give strength and mechanical properties to the moulded piece. Mineral powders could be intimately ground and mixed with the synthetic resin in its "resin" or "B" state, but the moulding made from this dry mixing would lack strength, be uneven in texture, and have a high specific gravity. All kinds of filling materials have been proposed, but the only one of industrial importance is wood meal, because it is light, fibrous, absorbs the resin, and produces easily machinable mouldings.

Some moulding powders are made by masticating the "resin" or "treacle" with the dried wood meal and

colouring matters, but the best qualities are made with an alcoholic solution of the "treacle" or "resin" which, having a lower viscosity, gives better impregnation of the wood particles. Accelerators such as hexamethylenetetramine are frequently added to reduce the subsequent hardening period.

A sticky mixture is heated under very carefully regulated conditions with the object of polymerising the resin as far as is technically safe, and thus reducing the time required for hardening in the mould. It is then dry and not sticky when cooled, and is ground and packed in moisture-proof containers. The moulder requires a powder which softens thoroughly when put into the hot mould and flows easily under pressure, but at the same time bakes to its final hard state in a few minutes at a temperature of 175° C. to 190° C. To meet these requirements and reproduce the same characteristics at will, requires exact technical control in manufacture. In addition, a good powder moulded under standard conditions in a properly designed and well-polished mould should not shrink unduly, should leave the mould cleanly, and produce an article having an even colour and texture with a perfect surface finish.

MOULDED ARTICLES AND THEIR MANUFACTURE

Almost anything can be moulded with these synthetic resin compositions, and light articles of intricate shape with engraved or embossed decoration are in daily production. Metal insertions are regularly moulded solidly into magneto bodies, distributors, radio valve bases, commutators and terminal boards at the one operation, which simplifies design and assembly, improves the electrical insulation value, and reduces cost of production.

Every moulded article requires a mould which may cost from £4 for a small single-impression of simple design, to £150 for a complicated multiple mould. As a mould can only turn out a definite number per day, the number of moulds is multiplied to meet the rate of delivery required. A hard steel mould can produce many thousands of pieces before it is worn out.

The largest market is for moulded articles of a few inches in diameter required in fairly large numbers, but articles up to 2 sq. ft. are regularly made from these moulding compositions. It is technically possible to mould large tanks and other shapes, but the cost of the moulds and the size of press required to develop two or three thousand tons pressure would make the cost prohibitive unless large numbers of the same article were required.

Moulded articles can be purchased from specialist firms which provide moulds to suit their customers' requirements. Moulding powders are purchased by some large manufacturers of motor accessories and electrical apparatus who mould their own components. If tool-making facilities or press plant are available, it may pay to mould rather than purchase finished mouldings required in very large quantities.

Process.—The quality of the moulding powder is important, but correct mould design, temperature, time and pressure are equally important in the production of sound goods. The operation of moulding consists of assembling the hot mould, adding the correct

weight of moulding powder, replacing the piston, placing in the heated press and applying a pressure of 1000 to 3000 lb. per sq. in. of moulded piece and heating for a suitable time at a temperature of 175° to 190° C., and then removing from the press and ejecting the hard moulding from the mould. The range of temperature when moulding carbamide resins is much narrower and lower.

For small moulds and thin goods, the whole operation is complete within 5 min., but heavy moulds and

circulation before removing the pressure, or to cool under pressure in a second press.

Moulds.—The volume of the powders is two or three times the volume of the finished article, and allowance

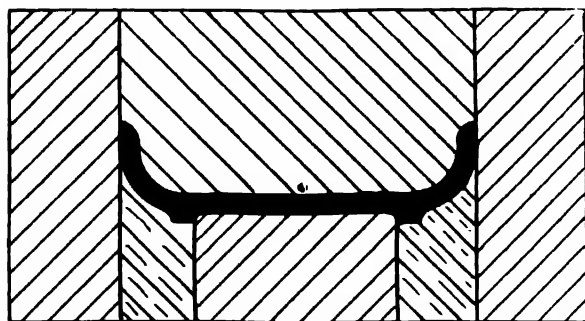


FIG. 1
Positive Mould

thick mouldings require longer time to attain the necessary temperature. Excessive temperature and time cost money, but are not generally harmful. They may cause pre-hardening and flow marks if they occur before the pressure is applied, or undue shrinkage of the piece or damage to a fugitive colouring matter. The appropriate pressure is determined by the plasticity, speed of hardening and adhesiveness of the moulding

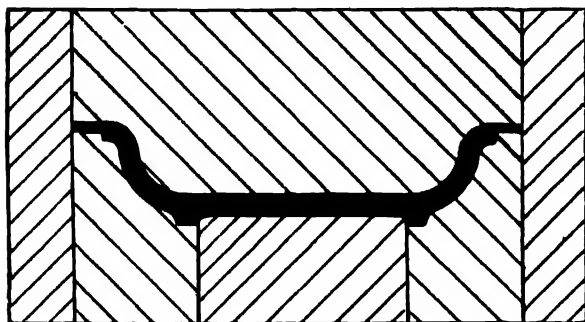


FIG. 2
Positive Flash Mould

powder, and the intricacy of the mould or presence of delicate metal insertions.

Powders which have been exposed to the air and become damp, or powders containing excess of "hexa" or similar additions, give off vapour or gas when heated. If the pressure is removed from such powders at a high temperature, especially with an under-baked and slightly soft moulding, the vapour will produce blisters in the goods. To remedy this, it is the practice in some works partly to cool the press and moulds by a water

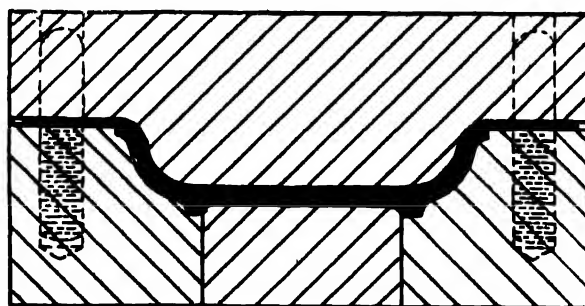


FIG. 3
Open Flash Mould

for this has to be made in designing the moulds, which are of three main types: (a) the positive or piston mould, where the powder is compressed in a closed vessel with the full applied pressure resting on the article (Fig. 1); (b) the positive flash type, in which any excess powder forms a fin or flash on which the piston also presses, but which is retained within the closed mould

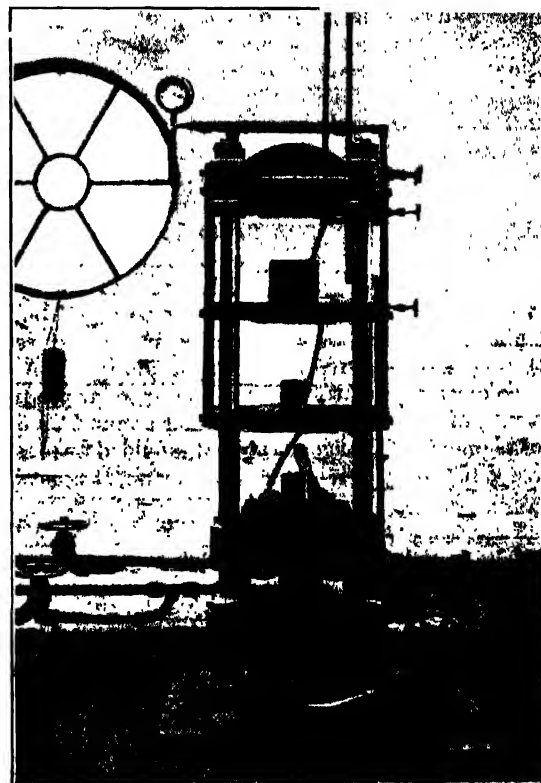


FIG. 4
Three-platen press with moulds in position. The press has one single action valve fitted with high- and low-pressure hydraulic supply. Platens fitted for steam heating and water cooling.

(Fig. 2); and (c) "open flash" or "spew" moulds out of which the excess material has free escape until the upper half rests on the lower (Fig. 3). This last type is only used when the powder is first compressed cold to a hard tablet or briquette which slightly more than fills the mould. It is obvious that the moulding cannot be so thoroughly compressed as in a positive mould, and this type has limited applications.

A large number of small articles may be moulded in one operation on a multiple-mould, and if this is used in a semi-automatic press the two halves of the mould would be fixed to the press and may contain their own heating arrangements. Multiple ejector pins are attached to an independent ejector ram of the press. The moulds may be made of any material which will withstand the temperature and pressure and take a very high polish. We are practically limited to close-grained hard steels or case-hardened steels which will take a mirror finish on those parts in contact with the moulding powder. As an accuracy of size to 0.002 in. is frequently called for in engineering component moulding, after allowing for contraction, it is obvious that the mould has to be made by a skilled tool maker and finally polished by special methods.

Presses.—Quickly acting hydraulic presses are necessary for economic production and they are generally fitted with steam-heated platens. A simple single-ram press is illustrated which takes three moulds and develops 20 tons pressure. It is fitted with high and low-pressure hydraulic service, steam heating and water cooling service to the four platens by flexible pipe connexions behind, and has unusually large space between platens to accommodate specially deep moulds. A battery of single deck presses of the same type operated by quick-acting valves, arranged so that the hot moulds can be pushed along metal benches to another cold press which ejects piston and moulded piece, is often more convenient for quick production from hand-assembled moulds. While one mould is discharging and re-charging, a second mould is under the press.

(To be continued.)

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING, 1927

July 4 to 9

EXTENSION OF PERIOD FOR REDUCED RAILWAY FARES

Since the programme for the Annual Meeting was printed, the Railway Companies of Great Britain which agreed to issue tickets at the ordinary single fare and one third for the double journey to persons travelling to Edinburgh to attend the meeting have extended the validity of these tickets, and they will be available from Saturday, July 2, to Monday, July 11. These tickets will be obtainable at the time of booking on production of vouchers which will be supplied on application to Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

If the holder of a return ticket at the reduced fare wishes to make use of it after the period for which it is available has expired, the excess payable will be the difference between the fare paid and the fare payable for an ordinary return or a tourist ticket, where such is available. This excess would have to be paid at an Edinburgh booking-office before commencing the return journey.

PROPOSED EXCURSION TO ST. ANDREWS ON SATURDAY, JULY 9

The train will leave the Waverley Station, Edinburgh, at 9.30 a.m., arriving at St. Andrews at 11.22 a.m.

A visit to the University, including the Chemical Laboratories, will be arranged for the afternoon, and the St. Andrews University Court has kindly offered to entertain the members to tea in the University Buildings.

The return train will leave St. Andrews at 5.35 p.m., arriving in Edinburgh at 7.26 p.m.

Members will also have an opportunity of visiting other places of historic interest in St. Andrews or of playing golf.

CHEMICAL ENGINEERING GROUP

A lunch for Members of the Chemical Engineering Group and their guests is being arranged for Wednesday, July 6, at 12.30 p.m., immediately after the meeting of the Group. The lunch will be held in the University Union, Park Place, Edinburgh. Price of tickets 5s., exclusive of wine and gratuities.

Members of the Society who are not Members of the Group are welcome to attend the lunch.

Charabancs will call at the University Union at 1.55 p.m. for those going to the Gasworks, and at 2.5 p.m. for those proceeding to King's Buildings.

Application for tickets should be made immediately to the Secretary of the Group, Abbey House, Victoria Street, London, S.W.1. After July 1 communications regarding the lunch should be addressed to Dr. W. T. H. Williamson at the North British Station Hotel, Edinburgh.

BUREAU OF CHEMICAL ABSTRACTS

The following are the prices at which copies of the Index to British Chemical Abstracts, 1926, can be purchased:—

By members of the Chemical Society or the Society of Chemical Industry—5s. post free; by subscribers—10s. post free.

DEATHS

Clark, John (elected 1900), of Broadway Works, Millwall Docks, London, E.14, Manufacturing Chemist. On June 5, 1927.

Kerr, Samuel T. (elected 1890), of Delaware Avenue, and Spring Garden Street, Philadelphia, Pa., U.S.A., Salt Manufacturer. On January 31, 1927.

Van Laer, Norbert (elected 1896), of 18, Laurence Pountney Hill, Cannon Street, London, E.C.4, Brewer and Chemist. On May 28, 1927.

Wesener, Dr. John A. (elected 1903), of 31, North State Street, Chicago, Ill., U.S.A., Consulting Chemist. On November 17, 1926.

Williams, W. Carleton (elected 1884), of Broomsgrove, Goring-on-Thames, Professor of Chemistry. On May 25, 1927.

AMERICAN SECTION

The May meeting of the American Section of the Society of Chemical Industry was held on Friday evening, May 6, 1927, in Rumford Hall of the Chemists' Club, Dr. Redman in the chair. The secretary announced the meeting of the Canadian Convention of Chemists at Quebec from June 6-9, and the Society's annual general meeting at Edinburgh from July 4-9. The election of officers was announced as follows:—

Chairman, Dr. L. V. Redman; *Secretary*, Dr. F. D. Snell; *Treasurer*, Mr. F. C. R. Hemingway; *Members of the Executive Committee*, Dr. James Kendall, Mr. Irving Hochstetter, Dr. Herbert R. Moody, and Dr. D. D. Jackson.

Mr. Paul Mahler, after defining a consultant, discussed the problems of the activated carbon industry in a very interesting manner. He classified the subject into manufacture, evaluation, uses and methods of application, and revivification.

Manufacture was covered hurriedly in a few words. Evaluation was taken up in detail and discussed in terms of absorption as measured by the Hess-Ives tintophotometer. Every problem of decolorisation must be studied individually, and careful data kept in order to make the proper recommendations. Application was discussed with, in particular, a case of decolorising and cleaning dry cleaners solvent. Time did not permit an extensive discussion of revivification. The paper will appear in CHEMISTRY AND INDUSTRY at an early date.

Mr. Lewis, of the L. Martin Company, described the production of carbon black and lamp black. He gave details of various methods of manufacture and reasons for the migratory nature of the industry. Interesting slides were shown of the agglomeration and dispersion of short and long blacks ground in oil. Explanations were given of the apparently different colour of dispersions of carbon black and lamp black and of their varied applications.

Seventy-five members and guests attended the dinner in the Club dining-room at 7 p.m. preceding the meeting. About 200 attended the meeting, which closed at 10.30 p.m.

CALENDAR OF FORTHCOMING EVENTS

- June 29. ROYAL SOCIETY OF ARTS, John Street, Adelphi, W.C.2., at 4 p.m. Annual General Meeting.
- July 4 to 9. SOCIETY OF CHEMICAL INDUSTRY. Forty-sixth Annual Meeting in Edinburgh. (See CHEM. AND IND., May 20, 1927, p. 404.)
- July 4 to 8. SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group*. Annual Meeting in Edinburgh. "Some aspects of the manufacture of fibrous cellulose," by Dr. J. L. A. Macdonald. A discussion will follow.
- July 15 & 16. INSTITUTION OF SANITARY ENGINEERS. Annual General Meeting and visits in Birmingham.
- Aug. 20. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, Newcastle-upon-Tyne. Annual Meeting at 2.30 p.m.
- Aug. 31 to Sept. 7. BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Annual Meeting (97th year) at Leeds.

INTERNATIONAL OIL, CHEMICAL AND COLOUR TRADES EXHIBITION

We are informed that a meeting of the exhibitors of this exhibition was held at the Royal Agricultural Hall on Friday, June 17, at the request of the organisers; that the speeches were eulogistic as regards the success of the exhibition, and it was unanimously decided that the exhibition should be repeated in the spring of 1929, and that the following gentlemen from those present were elected by the exhibitors to serve as an Honorary Advisory Committee for the next exhibition:—Mr. S. J. C. Mason (Messrs. Bush, Beach & Gent), Mr. F. Burrell (J. W. & T. A. Smith, Ltd.), Major J. H. Foster (Joseph Foster & Sons), Mr. J. R. Torrance (Torrance & Sons), Mr. W. Gundry (Morris Ashby, Ltd.), Mr. S. W. Whiffen (Whiffen & Sons), Mr. L. H. Hill ("Chemical Engineering Catalogue"), Col. A. E. G. MacCallum (Sidney Smith & Blyth, Ltd.), Mr. F. Gunn (W. T. Nicholson & Clipper), Mr. F. J. Ryland (M. Lummerzheim et Cie), and Mr. K. L. Cobb (The Building and Metal Export Co.). The hope was expressed that a representative from Messrs. Howards & Sons, Ltd., would join.

CANADIAN METALLURGICAL NEWS

A decision of considerable interest was recently rendered by Justice Audette, of the Exchequer Court of Canada, in an action brought by the Electrolytic Zinc Process Co. (a Montana corporation and subsidiary of the Consolidated Mining and Smelting Co., Ltd.) for a declaration that the alleged patent of the French Electrolytic Zinc Process Co. was invalid, because of prior art and other grounds. Judgment was given cancelling the alleged French patent. The originator of the alleged patent was Andrew G. French, metallurgist, reputed to have made important discoveries in connexion with ore reduction which were said to have been put to use in Swansea, Wales, and later with experience at Broken Hill, in Australia. A company was formed at Nelson, B.C., about 1911 or 1912. Both Dominion and British Columbia Governments made grants to the French company. The latter had a plant at Fairview, B.C., and the Consolidated Company also lent facilities at Trail, which were occupied for several months. The inventor died, and was succeeded by his son, Thomas French. The Consolidated Company took an option on the French process, but did not purchase it, as it developed its own process, which is used on the Sullivan and Slocan ores. After the war the French plant was closed down. In 1924 the French company instituted proceedings against the Consolidated Company in the Quebec courts (Montreal head office of the Consolidated) for alleged infringement of a Canadian patent covering the production of electrolytic zinc, and maintaining that the process was the financial salvation of the defendant company. The claim was for \$8,000,000. The defendant company immediately brought suit for declaration of the invalidity of French's patent. After a hearing of over two months the decision, already mentioned, was given.

The old lead and zinc mines in Dorion township, 35 miles east of Port Arthur, Ont., are being re-opened, while the old Omega mine, in the same district, is shipping high-grade lead ore.

[To supplement the notice of Col. Pollitt, which appeared in our columns last week¹, we here publish his portrait



COL. G. P. POLLITT, D.S.O., Ph.D., Etc.

Awarded the Society of Chemical Industry's Medal, 1927

CHEMICAL SOCIETY

Twenty-two new Fellows were elected by ballot at the last meeting of the session, held on June 16, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., occupying the chair. The President announced that Prof. Willstätter's lecture, entitled "Problems and methods in enzyme research," would shortly be issued in separate form, price 1s., obtainable from the Assistant Secretary. Fellows applying before Christmas Day, 1927, could obtain the Annual Reports for 1927 for 5s. 6d., post free; by applying (with remittance) before that date they could also obtain copies of the A abstracts, 1927, printed on one side of the paper only, gummed or ungummed, for £1.

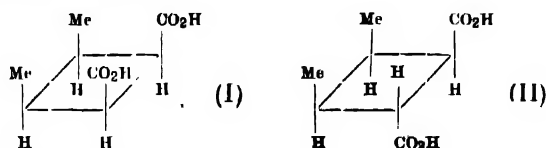
The President, announcing that the Council and Fellows desired to convey, in a tangible form, an expression of their appreciation of the services of the Assistant Secretary, Mr. S. E. Carr, during the past 25 years, said that Mr. Carr's unvarying and unfailing courtesy was a great asset to the Society. Dr. Alexander Scott, who was Honorary Secretary at the time of Mr. Carr's appointment, testified to his valuable and unstinted services over a period during which so many changes in the Honorary Officers had taken place. The President then handed Mr. Carr cheques, being gifts from the Society and from the Fellows, who also presented him with a "grandmother" clock and an illuminated album containing the signatures of the subscribers.

Mr. Carr, who expressed his astonishment, as well as his appreciation of, and gratitude for the gifts, thanked the Council and Fellows for the goodwill which had prompted their action. He had been fortunate in the happy relationship which had always subsisted between the Honorary Officers and himself.

Mr. I. Vogel then read the following paper:—

Syntheses of cyclic compounds. Part I. Ethyl $\beta\gamma$ -dimethylbutane- $\alpha\alpha\delta\delta$ -tetracarboxylate and some cyclobutane compounds derived therefrom.

REDUCTION of ethyl ethyldenemalonate with moist aluminium amalgam yields ethyl $\beta\gamma$ -dimethylbutane- $\alpha\alpha\delta\delta$ -tetracarboxylate, which on hydrolysis with alcoholic potash gives the two corresponding stereo-isomeric tetracarboxylic acids. When heated at 200°, this yields the $\beta\beta'$ -dimethyladipic acids. Treatment of ethyl $\beta\gamma$ -dimethylbutane- $\alpha\alpha\delta\delta$ -tetracarboxylate with sodium methoxide and bromine gives the cyclobutane compound, which on hydrolysis and heating to 180° affords the two stereo-isomeric $\beta\gamma$ -dimethylcyclobutane- $\alpha\delta$ -dicarboxylic acids (I) and (II).



The *cis* acid (I) yielded an anhydride with acetyl chloride, while the *trans* acid (II) yielded the *cis* anhydride with acetic anhydride.

The bearing of these results on the modified strain theory of Profs. Thorpe and Ingold is discussed.

Prof. J. F. Thorpe referred to the bearing of investigations on the four-membered ring on the elucidation of the structure of pinene.

In reply to Prof. C. S. Gibson, who asked whether the stereoisomerism of the four-carbon acids had been considered, Mr. Vogel said that the matter would be investigated when a series of the compounds had been prepared.

Mr. B. Cavanagh described:—

A new method of (absolute) potentiometric titration.

A NEW and very simple method of "absolute" potentiometric titration, based on an application of Helmholtz's "concentration cell without liquid junction" is described. The requisite procedure in the titration of a strong acid, chloride, bromide, and iodide, is indicated. The sensitivity and accuracy are the highest attainable by electrometric methods.

A silver halide electrode and a platinum electrode dipping into a solution containing the corresponding halide ion, hydrogen ion, and a trace of quinhydrone, develop an *E.M.F.* given by $E = E_0 + (RT/F) \log_e C_H \cdot C_X$, depending therefore at a given temperature on the product of the concentrations of hydrogen and halide ion. The whole procedure follows from this, the values (and temperature coefficients) of E_0 for chloride, bromide, and iodide having been determined.

Mr. M. P. Applebey asked how the silver halide electrode was prepared, how permanent it is, and exactly what degree of accuracy was attainable in the titration of a weak acid.

Dr. E. K. Rideal asked whether the process was intended to be an instrument of precision or a routine method: what, for instance, was the accuracy in the titration of cupric chloride and hydrochloric acid with sodium hydroxide. He had found that with a mixture of acids and salts and small quantities of quinhydrone the errors are large.

The author replied that the electrode was prepared by electrolysis of silver wire in dilute halide solutions for 1 hr. at 4–5 milliamperes; it could be kept in boiled-out distilled water for a week. In the presence of sodium or potassium chloride (or iodide) a very high degree of accuracy was attainable, the *E.M.F.* being within 0.5 (or 2–3) millivolts of that calculated. The method depended on the attainment of a particular potential, and not on the rate of change of the potential.

Dr. G. M. Bennett discussed the two following investigations:—

Cis-trans Isomerism of Disulphoxides. [With E. V. Bell.]

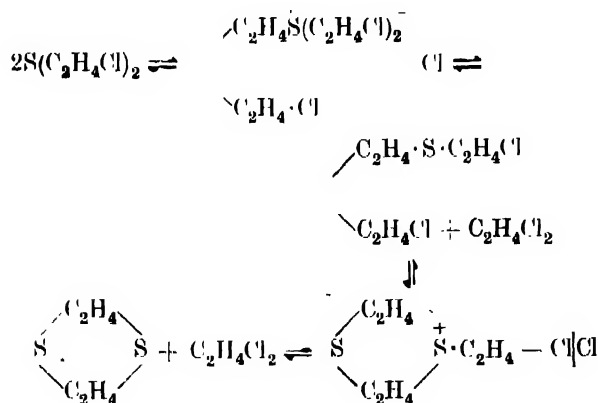
THE existence of optically active compounds of the type $RR'S \cdot O$ proves that in these compounds the oxygen atom is not in the same plane with the group $RR'S$, and implies the possibility of *cis-trans* isomerism in substances containing this group twice in the same molecule. A re-examination of the disulphoxide of 1:4-dithian (Crafts, *Annalen*, 1862, 124, 110) has revealed that 11% of an isomeride is present with it in the crude oxidation product.

Dithiandisulphoxide (described by Crafts), decomp. 263° , is monoclinic. The *disulphoxide*, decomp. $235-250^{\circ}$, is anorthic, and is 5 times as soluble in 90% alcohol as its isomeride. A complete crystallographic description of each is given.

The disulphide, $\text{CH}_3(\text{SMe})\cdot\text{CH}_2\cdot\text{SMe}$, also yields two isomeric disulphoxides on oxidation, *dimethylethylene-disulphoxide*, m.p. $163-164^{\circ}$, and the *disulphoxide*, m.p. $128-130^{\circ}$, which is the more soluble in various solvents.

Decomposition of some Halogenated Sulphides, and the Nature of the "Polymeric" Ethylene Sulphides.
[With E. V. Bell and A. L. Hock.]

$\gamma\gamma'$ -DI-IODODIPROPYL sulphide decomposes when kept with liberation of trimethylene di-iodide. $\beta\beta'$ -Dichlorodiethyl sulphide is reversibly decomposed at 180° into dithian and ethylene dichloride, and the same reaction occurs more slowly at the ordinary temperature. These observations, the decomposition of a δ -bromo-sulphide recently described (J., 1927, 477) and certain anomalies recorded in the literature are explained as similar processes involving the formation of sulphonium salts and their dissociation into other components. The changes for dichlorodiethyl sulphide, for instance, are as follows:—



The "depolymerisation" of some of the "polymeric" ethylene sulphides is to be attributed to the same type of change, and depends on the presence of a small proportion of halogen in these substances. "Polymerides" free from halogen will not yield dithian when heated, but it is now found that they yield dithian when heated in presence of hydrogen bromide. This supports the views previously expressed as to the nature of these "polymerides" (Nature, 1926, 118, 555).

Dr. H. Phillips asked whether the author was satisfied regarding the chemical nature of the disulphoxides, the tendency being for both oxygen atoms to become attached to the same sulphur atom.

Dr. Bennett replied that the behaviour of the compounds with hydrochloric acid at 100° , and with zinc dust and hydrochloric acid, was convincing evidence that they were disulphoxides, but he would also examine their reaction with bromine.

ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY

The 18th ordinary meeting of the Society was held on Wednesday, June 15, at the Northampton Polytechnic Institute, when Mr. E. Downs, M.Sc., read a paper on "Electrolytic refining." Mr. W. A. C. Newman occupied the Chair.

Mr. Downs said that of the three methods available for refining silver, viz., the metallurgical, chemical and electrolytic, the last was finding increasing favour on account of the relative ease with which it was possible to obtain a high purity product. The purity could be as high as 99.98%.

The earliest attempts at silver refining were made by Wohlwill in 1873, using an acid sulphate solution. This was abandoned in favour of the Moebius process introduced in 1884, which with only slight modifications is used at the present time. The electrolyte consists of copper and silver nitrates and nitric acid. The material usually refined consisted of *dore* silver, having a very high silver content; gold and silver alloys from various sources, e.g., jeweller's residue and scrap composed of 2-30% gold, 60-90% silver and 15-20% copper and base metals; and silver and copper alloys used for coinage and in the jewellery trade containing 70-92½% silver. The main impurities comprised lead bismuth, platinum metals, tellurium, selenium and zinc. The impurities which are insoluble remain in the anode slimes or may be precipitated at the anode as basic compounds, e.g., lead peroxide; silver occurs as the oxy-nitrate compound and to a lesser extent copper. To prevent the solution of bismuth and tellurium, the solution must be kept neutral.

Copper being nearest to silver in the electrochemical series has the greatest tendency to co-deposit with the silver. To ensure that this shall not occur, the solution is kept rich in silver ions, and the copper ion concentration kept within limits by periodic withdrawal of the electrolyte addition of silver solution and efficient circulation of the electrolyte is ensured to prevent polarisation.

The two cells in general use, the Moebius or vertical cell and the Balbach or horizontal cell were then described and compared. The current efficiency in both types reaches 95%. The voltage required in the Balbach is twice as great as in the Moebius owing to the greater distance between the electrodes in the former case and also the added resistance of the anode slimes.

There is, however, very little difference in the cost of working.

Mr. D. McDonald, in opening the discussion, said that electrolysis was undoubtedly the best method for silver refining not only on account of the purity of the product, but also because of the completeness of the recovery. The chief source of refinable material was not now the ore but the by-products of the electrolytic industries, e.g., those producing lead and zinc. The physical nature of the product presented an interesting field for research—it varied so. Nitrites possibly have a similar effect to selenium. Again, the anode slimes would be worth investigation—their constitution was little known. How was it, too, that finely divided silver found its way into the deposit?

Mr. McNaughton referred to the hardness of the deposit, and wished to know whether the hardness number had been determined. It would be interesting if this could be linked up with the hardness of electro-deposited nickel and chromium. An increase of temperature would be expected to give a soft deposit. He also wished to know what type of pump had been used, and whether there was any trouble with the anode slimes in pumping.

Mr. Perring asked whether the cells were arranged in parallel or series, and what was the maximum voltage used?

Mr. Ollard wished to know whether an arrangement for incorporating a moving cathode could not be utilised. He gave details of a revolving disc cathode from which the deposit could be scraped off.

Mr. Hothersall gave his experience in dealing with anode slimes, and wished to know if filtration had been used.

Mr. Gardam asked if mercury present as an amalgam would not be troublesome. He said that the electrolytic process had completely replaced smelting in some cases, and that in one case the chain from the ore to the finished product was entirely electrochemical.

Mr. Wernick said it was somewhat surprising to find that colloids had not been used until latterly in order to reduce the crystal size of the deposit. He asked for the relative purity of the product and the costs in the three processes available.

The Chairman then gave some very interesting information of the Cleave Refining Process which he had carried out at Ottawa, where a very high output had been achieved.

Mr. Downs then replied to the discussion, and was accorded a hearty vote of thanks.

Copies of the paper may be obtained from the acting Hon. Sec., 3, Bridge Street, London, E.3, and also particulars of membership of the Society.

The next meeting of the Society will open the new Session in October next.

CORRESPONDENCE

VERBIAGE?

SIR,—The remarks made by Prof. Armstrong in his letter to you regarding his prophecy bespeak a great deal in keeping with the theories of Einstein and Relativity. The old idea of fixed bodies or characteristics like that of fixed stars is in the light of modern reason untenable. If a list of compounds be drawn up showing increase in acidity and decrease in basicity there is no middle to that list. There is no absolutely neutral compound thereon. A compound is only more acid than another according to its behaviour with an indicator, and water is only neutral as far as such can make manifest to our eyes. I have in the *Chemical News* taken water as an acid, and called it Hydric Acid, for it makes more hydrates in its reactions with salts than hydrochloric acid makes chlorides. There is a great list of metals which I have christened the "Milky Way" from the ease with which their chlorides hydrolyse with water, especially in Group III including the rare earths, and produce the hydrate. I have represented water as

$\text{H}:\text{OH}$, the hydrogen salt of hydroxyl. In electrolysis I have found it acting like any other acid, practically always producing the hydrate. No acid will act as an acid without it, and there is overwhelmingly more reason to consider it as an acid than such bodies as sulphuretted hydrogen, or say carbonic or silicic acid, which it fights successfully even with insoluble salts like those of lead, producing basic salts.

Yours faithfully,

ROBERT SAXON

Baldon, Yorks

PERSONAL AND OTHER ITEMS

Among the distinguished foreign visitors to the Society's Annual Meeting at Edinburgh will be M. Agache, the president of the Société de Chimie Industrielle, and Prof. Dr. K. M. Meyer, vice-president of the German Chemical Society and a director of the I.-G. Farb. Gesellschaft.

Dr. Leonard James Spencer, F.R.S., has been appointed a deputy keeper in the Department of Mineralogy of the British Museum.

The University of Manchester has appointed Mr. G. G. Hepburn, B.Sc., Ph.D., special lecturer in chemical technology.

Dr. George Harker has resigned from his post as Lecturer in Organic Chemistry at the University of Sydney, and has become a partner in the firm of Messrs. Campbell & Harker, Consulting and Analytical Chemists, of 35-43, William Street, Melbourne.

Institute of Chemistry

The following have passed the examination for the Associateship in General Chemistry of the Institute of Chemistry:—(1. Brown, A.H.-W.C., D. M. Freeland, G. Harding, E. C. Keeley, B.Sc., C. D. Lawrence, B.Sc., D. T. Lucke, B.Sc., E. F. Natrass, B.Sc., A. W. Thompson, S. L. Tompsett, B.Sc. The following have passed the examination for the Fellowship in Branch A:—Inorganic Chemistry, Section II, Metallurgy:—H. N. Blyth, B.A., and J. Sandilands. In Branch D: Agricultural Chemistry:—E. R. Ling, B.Sc., A.R.C.S. In Branch E: The Chemistry (including Microscopy) of Food and Drugs, and of Water:—H. Childs, B.Sc., C. Chilvers, B.Sc., R. Crosbie-Oates, B.Sc., F. P. Hornby, B.Sc., A. S. Houghton, M.Sc., T. Mann, H. E. Monk, B.Sc., J. G. Sherratt, B.Sc.Tech., R. W. Sutton, B.Sc. Tech., and R. W. Watridge, B.Sc. In Branch F: Biochemistry, with special reference to Chemical Pathology:—F. D. M. Hocking, M.B., B.S., M.R.C.S., L.R.C.P., A.C., G.F.C. In Branch G: Industrial Chemistry, with special reference to Coal Tar and Ammonia:—R. G. W. Eadie, B.Sc. In a Special Examination in the Chemistry of Foods, with special reference to Milk and Milk Products:—M. Bogod, A.R.C.S. In a Special Examination in Oils and Fats:—W. Rhys-Davies.

Dye Industry in Japan

There is very little business to be done in dyestuffs in Japan at present, and no improvement in the textile industry is yet in sight.

The Japanese Department of Commerce has issued

regulations to prohibit the falsification of the dye labels and packages, and thus prevent the sale of Japanese dyes under foreign labels.

Artificial Silk in Germany

A new artificial silk company, with a capital of £600,000, has been established at Breslau to take over and extend the artificial silk factory at Cawallen, near Breslau, belonging to the Giesche Mining Co., of Breslau. The founders are the Giesche Mining Co., the Vereinigte Glanzstoff Fabriken Co., of Elberfeld, and the N.V. Dutch Art-silk Co., of Arnheim, the Board of the Disconto Bank of Berlin, and the J. Frank and Co. banking house of Crefeld. The Vereinigte Glanzstoff and the Dutch Art-silk Co. will place at the disposal of the new company all patents, procedure and experience, and will support it in all technical and commercial matters. The products of the new undertaking will be sold through the sales organisation of the Vereinigte Glanzstoff Fabriken, which, together with the Dutch firm, will receive some £200,000 shares out of a future capital increase.

Belgian and Czechoslovak Uranium Pigments

An agreement has been made by the Belgian company which produces radium and uranium colours at Oomen and the State factory at Joachimsthal in Czechoslovakia for a joint sales organisation for uranium pigments with headquarters at Cologne. As the United States production is said to be falling off, this announcement is of particular interest.

The Norwegian Carbide Industry

Of the various branches of the Norwegian electrochemical industry, the carbide industry is one of the oldest, having been established nearly half a century ago. Its rapid development is largely attributable to the abundant cheap supply of hydro-electric power and the close proximity to England, the chief market for carbide. At present there are about a half-dozen carbide works in Norway, with an approximate yearly capacity of 100,000 tons. The most important are the plants at Odda, Meraker and Hafsland, which have a joint management. Approximately one third of the carbide production of the Norwegian industry is exported. The bulk goes to England, but Norwegian carbide during late years has also found its way into practically all the important world markets. The remaining two thirds of the domestic production is consumed mainly in the manufacture of fertilisers, of which large quantities are exported. The exports of calcium carbide during 1925 declined to 29,478 metric tons from 33,491 tons in 1924.

Sodium and Boron Compounds in the U.S. in 1926

The production of sodium compounds, not including common salt, from natural salines and brines in the United States in 1926, as indicated by sales or shipments by producers, amounted to 93,480 short tons, valued at \$2,326,750, according to the U.S. Bureau of Mines. These figures show an increase of 28% in quantity and 11% in value as compared with 1925. They cover the output of sodium carbonate, sodium bicarbonate, sodium sulphate, trona and sodium borate (borax). The total sales of sodium carbonates in 1926 amounted to 56,750 tons (\$1,154,840), an increase of 24% in

quantity and 25% in value. The sales of sodium sulphate in 1926, comprising natural salt cake and Glauber's salt, were 19,620 tons (\$166,800), about double the output of 1925. The boron minerals shipped in 1926 amounted to 115,970 tons, an increase of 2%. The value was \$3,128,110. The boron minerals included borax and calcium borate (colemanite).

Winter Oilseeds Crop of British India, 1926-27

From information received from reports of provinces and states which contain 94% of the total area in India under rape and mustard and 93% of the total area under linseed, the total area under rape and mustard amounts to 5,491,000 acres, or 1% below that of last year, and the total area returned for linseed is 3,348,000 acres, or 7% below the last year's figure. The total estimated yield of rape and mustard is 983,000 tons, as against 909,000 tons, or an increase of 8%. The total estimated yield of linseed is 407,000 tons, compared with 402,000 tons last year, an increase of 1%. The condition of the crops is, on the whole, fair.

Sesamum Crop of British India

The total area reported to be under sesamum crop in provinces and states which contain, on the average, 89% of the total area sown in India, is estimated at 4,533,000 acres, as against 4,684,000 acres last year, a decrease of 3%. The total yield is estimated at 358,000 tons (excluding Hyderabad, for which no quantitative estimate of outturn is made at present), as against 364,000 tons last year, showing a decrease of 2%. The weather is not very favourable, but the condition of the crop, on the whole, is reported to be fair.

Groundnut Crop of British India, 1926-27

From information based on reports from provinces which contain 93% of the total area under groundnut in India, the estimated acreage is 4,163,000 as compared with 3,973,000 acres in 1925-26, an increase of 5%. The total yield is estimated at 1,931,000 tons of nuts in shell, as against 1,999,000 tons last year, a decrease of 3%. The condition of the crop is reported to be fairly good.

Sugarcane Crop of British India, 1926-27.

From provinces and states containing on the average 95% of the total area under sugarcane cultivation in India, it is reported that the estimated area sown is 2,920,000 acres, as against 2,679,000 acres last year, an increase of 9%. The total yield of raw sugar is estimated at 3,208,000 tons, as compared with 2,977,000 tons last year, an increase of 8%. The weather was generally favourable, and the condition of the crop on the whole is reported to be good.

Brown-coal Products in Germany

Some 110,000 to 140,000 metric tons of brown-coal tar is produced annually in Germany, the output of brown coal being 135,000,000 metric tons, compared with 87,000,000 tons in 1913. About 50,000-60,000 of the output of tar is produced in Central German lignite distillation plants, mainly by the Deutsche Erdoel A.-G. Certain amounts of gasoline substitutes are recovered from the treatment of lignite, the total output of "petroliferous products" in 1924 being 14,000 tons from shale and gas, 60,000 tons from lignite tar, and 310,000 tons from black-coal tar, exclusive of benzol.

REVIEWS

ANCIENT EGYPTIAN MATERIALS. By A. LUCAS, O.B.E.
Pp. viii + 242. London: Edward Arnold & Co.,
1926. Price 7s. 6d.

Mr. Lucas, who is the chemist to the Egyptian Department of Antiquities, has made a valuable addition to our knowledge of ancient materials in his new work. It is not generally recognised that such materials have been often daringly identified after insufficient examination and not a few misconceptions will be cleared away by the author's judicious presentation of the evidence, to which he himself has largely contributed.

The story is set in perspective by the opening outline of Egyptian history and then, in separate chapters, the origin, preparation, uses, identification, and so on, of ancient Egyptian materials are discussed. The subjects dealt with are:—building materials; faience, glass and pottery; metals; mummification materials; oils, fats and waxes; pigments and varnishes; precious stones, monumental stones; textile fabrics, leather and dyes; writing and various other materials.

Such a book appeals, not only to the archaeologist, but to all who are interested in the origins of industrial products or of art. The book is interestingly written, and invites quotation and discussion. But the space available is limited and the best thing to do is to send all who are interested in the origins of materials to the book itself; they will not be disappointed. The book is well produced and reasonably priced.

PYROXYLIN ENAMELS AND LACQUERS: THEIR RAW MATERIALS, MANUFACTURE AND APPLICATION. By S. P. WILSON, M.A., Ph.D. Second printing. Pp. x + 212. London: Constable & Co., Ltd., 1926. Price 18s.

The author of this book has had considerable experience in the manufacture of pyroxylin enamels and lacquers and writes with authority on his subject. An interesting account of the history of the cellulose varnish industry opens the first part of the book, followed by chapters in which the manufacture and properties of pyroxylin, and the various solvents (alcohols, esters, ketones), non-solvents, plasticisers, gums and resins, pigments and dyes which are employed as raw material, are discussed.

The second part of the book deals with the manufacture of pyroxylin products such as bronzing liquids, dopes for leather and aeroplanes, cements, collodion, metal and wood lacquers, lacquer enamels, passing on to discuss methods of application and miscellaneous methods of analysis, concluding with a short bibliography and a condensed index.

The point throughout is that of the manufacturer, and the author continually treads on the solid ground of experience. Numerous recipes are given to illustrate the many varieties of pyroxylin varnishes and there are illustrations of American plant used in the industry. The book will be read with interest by all those concerned with these at-times-disconcerting products of cellulose.

PARLIAMENTARY NEWS

Raw Copper Supplies

In reply to various questions, Sir P. Cunliffe-Lister said he was aware that a large proportion of the producers of copper in the United States had formed a company to regulate the sale of raw copper outside that country, and that important European interests were also parties to the arrangement. Since the formation of the company, the prices quoted to British consumers had frequently been higher than the equivalents of the prices quoted to American consumers. It was of great importance that British users of copper should be able to obtain supplies on terms as favourable as those given to their competitors, and he should welcome the development of copper production and refining within the Empire.—June 14.

Packing and Wrapping Paper (Imports)

In a written answer to Mr. Livingstone, Mr. A. M. Samuel stated that the following figures showed the total quantities of packing and wrapping paper imported into Great Britain and Northern Ireland in each of the last three years: In 1924, 4,145,463 cwt.; in 1925, 4,392,981 cwt.; and in 1926, 3,823,084 cwt.—June 15.

Iron and Steel Trade

Mr. A. M. Samuel informed Mr. Couper that he knew pig-iron was at present being sold and delivered at steel works in Lanarkshire and Glasgow district from the Continent at 72s. 6d. per ton, while the same class of pig-iron at the blast furnaces in Scotland was 76s. to 77s. 6d. per ton, exclusive of railway carriage to steel works. Continental steel plates were also being delivered at the shipyards and works on the Clyde at 145s. to 152s. 6d. per ton, as against 162s. 6d. to 167s. 6d. per ton from Scottish steel works, and steel bars were being delivered at 103s. 6d. per ton from the Continent as against 150s. per ton from the local works. These figures were substantially correct, but might not relate to identical classes of material. He was not aware of any direct subsidies by Governments on the Continent to the industries concerned. As regarded exports and imports, in May, 1927, this country imported 356,000 tons of iron and steel, and exported 422,000 tons. He considered that one of the big factors in the difference in cost in England was lower wages and longer hours on the Continent; also indirect subsidies which could not be traced in the form of low rates of interest granted to the industry; the fluctuations of the franc, rebates to producers of pig-iron for export houses, and possibly a certain amount of rebate advantage given by foreign railways for export iron and steel.—June 20.

COMPANY NEWS

BLEACHERS' ASSOCIATION, LTD.

The twenty-eighth ordinary general meeting was held on June 17, Sir Alan J. Sykes, Bart., presiding. Reference was made to the great loss incurred during the year by the death of two of the oldest directors, Mr. Warburton and Mr. Fred Whowell, and also of Mr. J. J. Kirkpatrick, who managed the Belfast branch of Kirkpatrick Bros. After briefly reviewing the accounts (cf. *CHEM. AND IND.*, June 10, 1927, p. 536), the chairman said the drop in the profits was attributed largely to the coal stoppage. It

was estimated that the total extra amount paid for coal over and above the ordinary contract price was £230,000, and, in addition, there was a loss of £200,000 due to the shortage of cloth arising from this and other causes. During 1926 there was a continual drop in the price of raw cotton; so far this year, this process had been reversed, and buyers all over the world for the first time were experiencing the benefit of rising values. Referring to the rapid growth of artificial silk production and its influence on the Lancashire trade, the chairman said the directors, alive to these developments from the outset, had maintained a keen interest throughout, and by the carrying out of countless experiments, the introduction of new plant, and the modification of existing machinery, the Association was in an extremely favourable position to process, with the highest degree of technical efficiency, all classes of fabric of whatever type of yarn they were made. The new fibre did not replace cotton, but lent itself to the decoration of cotton fabrics. He believed that the increased use of the synthetic fibres, the development of which was mainly due to British skill and enterprise, would be a factor in restoring, in part at any rate, our great textile industries to prosperity, which would in time beneficially affect their own particular industry. The Association manufactured pure cotton cellulose—one of the basic materials of artificial silk—of a quality equal, if not superior, to anything produced. The finishing of cotton goods—one of the main activities of the Association—was also receiving close attention. A final dividend was declared of 1s. 2d. per share, making 1s. 6d. per share for the year.

CELANESE CORPORATION OF AMERICA

It is announced that Messrs. Morgan & Co., the American financiers, have undertaken an issue of £5,000,000 preference shares on behalf of this company. The proceeds of the issue, together with £1,200,000 to be raised by the offer to existing holders of the common shares, are to be utilised in increasing the company's plant, and it is estimated that production will thereby be trebled and quadrupled.

SCOTTISH ARTIFICIAL SILKS LIMITED

This company has been formed with a capital of £250,000, divided into 760,000 preferred ordinary shares of 5s. each, and 1,200,000 deferred shares of 1s. each, and will manufacture artificial silk by the viscose process. The Tongland Works, near Kirkcudbright, Scotland, have been acquired, with very valuable water rights. The company has also taken over the Providence Mill, Hyde, Cheshire, well known for its manufacture of special yarns for the Nottingham, Leicester and foreign trade, and the directors propose to continue this trade, and in addition to make the yarn suitable for artificial silk fabrics. The company has secured the services of Mr. H. Kindermann as consulting engineer and technical adviser, and also proposes to engage Dr. Otto Ruff, Professor and Director of the Technical College, Breslau, as consulting chemist. The following are the directors: J. Morison, chairman; J. T. Rostern (late with Messrs. Courtaulds, Ltd.), managing director; A. Morris, Lieut.-Colonel A. F. Inglis, O.B.E., N. H. Macalister, J.P., C. P. Williams, M.Sc., J.P., M.P., and R. C. Hannay. The registered address of the company will be 145, St. Vincent Street, Glasgow.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£8 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 *Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Black.—£35 per ton, barrels free.
 Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 8d.—9d. per lb. Crude 60's, 2s. 4d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 2d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 8d.—2s. 0½d. per gal. Pure, 1s. 10d.—2s. 3½d. per gal.
 Xylol.—1s. 11d.—2s. 4d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—8½d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/160, 1s. 3d.—1s. 11d. per gal. Solvent 95/160, 1s. 5d.—1s. 6d. per gal. Solvent 90/190, 1s. 1½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—72s. 6d.—82s. 6d. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzdine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylylene Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. £40—£41 per ton. Powder £44—£45 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 3½d.—1s. 10d. per lb. Crystals 1s. 10d.—1s. 11d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal £24—£27 per ton, Powder £26—£29 per ton, according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d.—2s. 5d. per lb. Potassium.—1s. 11d.—2s. per lb. Sodium.—2s. 2d.—2s. 3d. per lb. All spot.

Calcium Lactate.—1s. 3½d.—1s. 5d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiaicol Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ½ lb., 9s. 6d. per doz.; ¼ lb., 6s. 6d. per doz.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—4d. per lb., 22s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 3d. per lb. net. Synthetic detached crystals, 11s.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonal.—11s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. per lb.

Phenazone.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar 100s. per cwt., less 2½% for ton lots).

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—7s. 6d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.

Thymol, Puriss.—10s. 6d.—11s. 6d. per lb., according to quantity. Natural.—12s. 6d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (ex Anethole).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—8s. 9d. per lb.

Ethyl Cinnamate.—7s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—9s. per lb. Geraniol (Palmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. per lb.—(ex Shui Oil) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—17s.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—28s. 6d. per lb. Bourbon Geranium.—14s. 6d. per lb. Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure—6s. per lb.

Eucalyptus, 75/80%.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 18s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 6d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Aug. 18th.

The remainder are those accepted.

I.—Applications

Boyd. Furnace walls. 15,556. June 10.
British Dyestuffs Corp., Hailwood, and Shepherdson. Manufacture of finely-divided substances. 15,171. June 7.
Comp. Gén. de Construction de Fours. Tunnel kilns. 15,006. June 7. (Fr. 5,626.)
Geigy A.-G. Preparation convertible into dispersions. 15,311. June 8. (Ger., 18,626.)

Filters etc. 15,003. June 7. (U.S., 7.6.26.)
 Farbenind. Recovery of reaction products from
 res. 15,170. June 7. Production of cleansing etc.
 agents. 15,615. June 11.
 Machin and Ringrose. Furnaces. 15,059. June 7.
 Paterson. Filtering-apparatus. 15,214. June 7.
 Sacchi. Apparatus for effecting reactions between fluids.
 15,178. June 7.
 Soc. Ind. de Briqueterie et Céramique. Drying apparatus.
 14,033. June 7. (Fr., 30.7.26.)
 Steam Production Corp. Furnaces. 15,622. June 11.
 (U.S., 31.7.26.)
 White. Separation of liquids of different specific gravities.
 15,213. June 7.
 Wood. Grinding, mixing, etc. machinery. 15,063.
 June 7.
 Wright. Apparatus for effecting intimate contact of
 gases and liquids. 15,353. June 9.

I.—Complete Specifications

17,128 (1926). Lityen. Tumbling-mills. (266,664.)
 32,346 (1926). Kreutzberg. Pulverisers. (272,111.)
 3099 (1927). Marx. See XXIII.
 6810 (1927). Ludwig. Improving the utilisation of heat
 in drying drums. (267,543.)
 13,192 (1927). Fowler & Co. (Leeds), Ltd., and Fowler.
 Mixing-machines. (272,151.)
 *8303 (1927). I.-G. Farbenind. Drying-agent for gases.
 (272,173.)
 *14,527 (1927). Scheidt. Bag filter. (272,209.)
 *14,560 (1927). Cerini. See VII.
 *15,006 (1927). Comp. Gén. de Construction de Four.
 Tunnel kilns. (272,238.)

II.—Applications

Akt. Separator-Nobel, and Malm. Removal of paraffins
 from fluid hydrocarbons. 15,183. June 7.
 Betts and Pearson. Pulverised fuel for steam-raising
 furnaces etc. 15,573. June 11.
 Comp. des Mines de Bruay. Distillation of mineral fuels.
 15,376 and 15,379. June 9. (Fr., 14.6.26 and 18.12.26.)
 Delplan and Quairiaux. Washing coal etc. 14,983. June
 7. (Belg., 4.6.26.)
 Hodeige. Washing coal etc. 15,398. June 9.
 I.-G. Farbenind. Bleaching mineral oils etc. 15,205.
 June 7. (Ger., 21.7.26.) 15,262. See III. Destructive hydro-
 genation of carbonaceous materials. 15,525. June 10. (Ger.
 11.6.26.) Treatment of coal tars etc. 15,526. June 10.
 (Ger., 11.6.26.)
 Johnson (I.-G. Farbenind.). Treatment of montan wax.
 15,414. June 9.
 Linnmann. 15,255 and 15,359. See III.
 Paucy. Calorimeter. 15,086. June 7.
 Trautmann. Extraction of hydrocarbon oils from coal.
 15,386. June 9. (Ger., 11.6.26.) Extracting benzene.
 15,642. June 11. (Ger., 16.6.26.)

II.—Complete Specifications

3454 (1926). I.-G. Farbenind. Method of working with
 carbon monoxide under pressure. (247,217.)
 12,705 (1926). Humphreys & Glasgow, Ltd., and Stelfox.
 Manufacture of water-gas. (272,026.)
 20,884 (1926). Soc. pour l'Exploit des Proc. Urbain.
 See VII.
 27,029 (1926). Levinsohn. Gas-analysis apparatus.
 (272,092.)
 *13,601 and 13,820 (1927). I.-G. Farbenind. Manufacture
 of products from coal, tars, mineral oils, and the like. (272,190
 and 272,194.)
 *14,983 (1927). Delplan and Quairiaux. Washing coal
 schlamms etc. (272,235.)

III.—Applications

Fairweather (Selden Co.). Purification of aromatic hydro-
 carbons. 15,169. June 7.
 I.-G. Farbenind. Manufacture of hydrocarbons. 15,262.
 June 8. 15,526. See II.
 Johnson (I.-G. Farbenind.). Manufacture of hydrocarbons.
 15,411 3. June 9.
 Linnmann. Benzol separators. 15,255 and 15,359. June
 8 and 9. (Ger., 8.6.26.)
 Wessel. Distillation of coal tar. 15,252. June 8. (Ger.,
 29.6.26.)

III.—Complete Specification

*13,601 (1927). I.-G. Farbenind. See II.

IV.—Applications

British Dyestuffs Corp., and Silvester. Manufacture of
 dyes. 15,005. June 7.
 Carpmæl (I.-G. Farbenind.). Manufacture of sulphonic
 acids. 14,990. June 7. Manufacture of benzanthrone
 condensation products. 15,425. June 9. Manufacture of
 condensation products of anthraquinone. 15,562. June 10.
 Manufacture of vat dyestuffs of anthraquinone series.
 15,631. June 11.
 I.-G. Farbenind. Manufacture of perylene compounds.
 15,422. June 9. (Ger., 9.6.26.)
 Johnson (I.-G. Farbenind.). Anthraquinone dyestuffs.
 15,163. June 7. Manufacture of dyestuffs. 15,416 and
 15,528. June 9 and 10.

IV.—Complete Specifications

30,990 (1925). Badische Anilin & Soda Fabrik. Manu-
 facture of anthraquinone derivatives. (244,463.)
 5891 (1926). Marks (Du Pont de Nemours & Co.). Pro-
 duction of N-dihydro-1 : 2 : 1' : 2'-anthraquinone azine.
 (271,942.)
 7577 (1926). I.-G. Farbenind. See VI.
 8312 (1926). Soc. Chem. Ind. in Basle. Manufacture of
 azo-dyestuffs containing metal. (249,884.)
 12,260 (1926). Dyestuffs Corp., and Mendoza. Pyrazolone
 dyestuffs. (272,024.)
 13,023 (1926). I.-G. Farbenind. Manufacture of dyestuffs.
 (252,300.)
 16,012 (1926). Soc. Chem. Ind. in Basle. Manufacture of
 azo-dyestuffs and chromium derivatives thereof. (254,708.)
 28,907 (1926). I.-G. Farbenind. Manufacture of amines
 of the cyclohexano series. (261,747.)
 *14,851 (1927). I.-G. Farbenind. Manufacture of
 α -anthraquinonyl ketones. (272,225.)

V.—Applications

Calvert. Treating fibres etc. 15,228 and 15,230. June 8.
 Manufacturing artificial silk etc. 15,229. June 8.
 Carpmæl (I.-G. Farbenind.). Protecting wool from insects
 etc. 15,569. June 10.
 Micklethwaite. Treating wool fibres etc. 15,929. June 7.
 Plastic, Inc. Making paper etc. 15,287. June 8. (U.S.,
 25.3.27.)

V.—Complete Specifications

2441—2 (1926). I.-G. Farbenind. Production of celluloid-
 like masses. (247,174 and 263,076.)
 6114 (1926). Standard Telephones and Cables, Ltd.
 (Western Electric Co., Inc.) See XI.
 29,489 (1926). Heberlein & Co. See VI.
 2413 (1927). Syntheta A.-G. Manufacture of artificial
 silk. (265,577.)
 11,989 (1927). Bonnard. Treating crêpe waste. (270,727.)
 *30,160 (1926). Heberlein & Co. See VI.

VI.—Applications

British Dyestuffs Corp., Baddiley, Brightman, and Chorley.
 Dyeing. 15,180. June 7.

Chem. Fabr. vorm. Sandoz. Treating cellulose fibres with alkali. 15,544. June 10. (Ger., 29.10.26.)

Marks (Du Pont de Nemours & Co.). Printing with vat dyes. 15,280. June 8.

Mond (I.-G. Farbenind.). Bleaching linen, hemp, etc. 14,989. June 7.

VI.—Complete Specifications

7577 (1926). I.-G. Farbenind. Production of azo-dyestuffs on silk. (253,865.)

18,215 (1926). I.-G. Farbenind. Production by dyeing of fast mixed shades on silk. (263,088.)

29,489 (1926). Heberlein & Co. Chemically varying artificial fibres. (261,794.)

*30,160 (1926). Heberlein & Co. Chemically varying vegetable fibres or artificial fibres. (272,165.)

VII.—Applications

Dicker (Chemical Products Co.). Production of ammonium phosphate. 15,566. June 10.

I.-G. Farbenind. Manufacture of active silica. 15,415. June 9. Method of storing dibasic calcium hypochlorite. 15,515. June 10. (Ger., 18.8.26.) Manufacture of active silica gels. 15,527. June 10.

Kolbert. Manufacture of a solid alcoholic solution of iodine. 15,265. June 8.

Mond (Metallbank und Metallurgische Ges.). Disintegrating liquid alumina. 15,011. June 7.

Petersen. Manufacture of sulphuric acid. 15,115. June 7.

Sacchi. Production of hydrogen-nitrogen mixtures. 15,179. June 7.

VII.—Complete Specifications

299 (1926). I.-G. Farbenind. Production of phosphoric acid. (246,128.)

3470 (1926). I.-G. Farbenind. Production of phosphorus. (247,219.)

5767 (1926). Carpmael (I.-G. Farbenind.). Manufacture of new complex antimony compounds. (271,940.)

13,086 (1926). Akt. Norsk Aluminium Co. Manufacture of aluminium oxide. (252,399.)

16,365 (1926). Smith. Conversion of lead sulphide into lead carbonate. (272,053.)

20,884 (1926). Soc. pour l'Exploit. des Proc. Urbain. Manufacture of phosphorous or phosphoric acid and activated charcoal. (257,917.)

25,659 (1926). California Cyanide Co., Inc. Making cyanides of alkali-forming metals. (261,722.)

28,321 (1926). Müller. Purifying gases for the synthesis of ammonia. (261,388.)

30,646 (1926). I.-G. Farbenind. Purification of hydrogen obtained by the interaction of phosphorus and steam. (262,455.)

*14,560 (1927). Cerini. Apparatus for osmotic purification of solutions of caustic soda etc. (272,211.)

VIII.—Application

Quartz et Silice. Manufacture of glazed silica articles. 14,966. June 7. (Fr., 15.7.26.)

VIII.—Complete Specifications

580 (1926). I.-G. Farbenind. Production of potash glass. (245,785.)

4837 (1927). Quartz et Silice. Manufacture of silica glass articles. (266,711.)

IX.—Application

Doughty. Producing coloured cement etc. 14,901. June 7.

IX.—Complete Specifications

10,848 (1926). Schumacher'sche Fabr. Ges. Manufacture of porous artificial stone. (251,964.)

10,849 (1926). Schumacher'sche Fabr. Ges. Manufacture of artificial filter stones. (251,965.)

*29,295 (1926). Forssen. Manufacture of hydraulic cements. (272,163.)

X.—Applications

Aluminium-Ind. A.-G. Electrolytic extraction of aluminium from aluminium alloys etc. 15,154. June 7. (Ger., 7.6.26.)

Berger. Manufacture of zinc etc. 15,304. June 8. (Fr., 11.6.26.)

Carpmael (I.-G. Farbenind.). Precipitation of copper. 15,426. June 9.

Coley. Manufacture of zinc. 15,041 and 15,444. June 9.

Treatment of ores etc. 15,443. June 9.

Cornish Tin Smelting Co., Ltd., and Davey. Refining tin. 15,297. June 8.

Ellis (Anaconda Copper Mining Co.). Production of copper cakes. 15,172. June 7.

Moulin (Pierron). Manufacture of zinc etc. 15,304. June 8. (Fr., 11.6.26.)

Potts (Electro Metallurgical Co.). Wrought articles of chromium alloy. 15,333. June 9.

Rogers. Coating iron or steel plates with brass. 15,051. June 7.

Smith. Treatment of ores etc. 15,150. June 7.

Verein. Stahlwerke. Treating drawn steel wire. 15,009. June 7. (Ger., 4.6.26.)

X.—Complete Specifications

19,285 (1926). Sempell. Bearing-metal. (272,065.)

32,876 (1926). Krupp Grusonwerk. Treatment of zinciferous flue dust. (265,558.)

33,070 (1926). A.-G. Brown, Boveri, & Cie. Electric smelting-furnaces. (263,872.)

*15,009 (1927). Verein. Stahlwerke. Improving the tensile qualities of drawn steel wire. (272,240.)

*15,154 (1927). Aluminium-Ind. A.-G. Electrolytic extraction of pure aluminium from crude aluminium alloys, etc. (272,246.)

XI.—Applications

Aluminium-Ind. A.-G. 15,154. See X.

British Thomson-Houston Co., Ltd. Treating filaments. 15,121. June 7. (U.S., 9.6.26.)

XI.—Complete Specifications

6114 (1926). Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). Treatment of fibrous material for electric insulating. (271,948.)

7884 (1926). Scanes and Metropolitan-Vickers Electrical Co., Ltd. Electrical insulating compounds. (271,979.)

11,514 (1926). Harrison and Campbell. Electric batteries. (272,013.)

19,186 (1926). Norske Akt. for Elektrokem. Ind. Electrodes for electric furnaces. (262,722.)

33,070 (1926). A.-G. Brown, Boveri, & Cie. See X.

*13,781 (1927). British Thomson-Houston Co. Electric furnaces. (272,192.)

*14,861 (1927). Brown, Boveri, & Cie. Electric furnaces. (272,227.)

*15,154 (1927). Aluminium-Ind. A.-G. See X.

XII.—Application

Harvel Corp. Treating cashew-nut shell oil etc. 15,203—4. June 7. (U.S., 8.6.26.)

XIII.—Applications

Edser and Fowler. Paints. 15,318. June 8.

Holzverkohlungs-Ind. A.-G., and Seib. Manufacture of white lead. 15,432. June 9.

XIII.—Complete Specifications

16,365 (1926). Smith. See VII.

6381 (1927). Turner. Paints or protective compositions. (272,142.)

*13,038 (1927). Rubber Latex Research Corp. Rubber compositions. (272,187.)

XV.—Application

Manfred. Preparations of albumen-containing plastic masses. 14,889. June 7. (Czecho-Slovakia, 26.11.26.)

XV.—Complete Specifications

10,083 (1926). L.-G. Farbenind. Manufacture of tanning-agents. (260,543.)

*13,945 (1927). Botson. Treatment of hides and skins preliminary to tanning. (272,195.)

*14,198 (1927). Guillemin. Impermeabilising and protecting leather. (272,197.)

XIX.—Applications

Clark (Dry Milk Co.). Irradiating milk solids with ultra-violet rays. 15,639. June 11.

Fisher and Jones. Manufacture of flour. 15,542. June 10.

Günther. Conserving animal foodstuffs. 15,000. June 7.

Oram and Oram. Compound for making bread etc. 15,138. June 7.

XX.—Applications

Blugden, and Howards & Sons. Manufacture of crystalline menthol. 15,294. June 8.

Etabl. Poulenc Frères, and Fourneau. Manufacture of formyl derivatives of 2-oxy-4-amino-phenyl-arsinic acid etc. 15,197. June 7. (Fr., 29,10,26.)

Hoffmann-La Roche & Co. Product for internal disinfection. 14,935. June 7. (Ger., 4,6,26.)

Kolbert. 15,265. See VII.

XX.—Complete Specifications

5767 (1926). Carpmal (L.-G. Farbenind.). See VII.

6977 (1926). Synthetic Ammonia & Nitrates, Ltd., Smith, and Smith. Production of acid amides and salts. (271,969.)

11,816 (1926). L.-G. Farbenind. Manufacture of compounds containing carbocyclic or heterocyclic rings. (251,997.)

26,777 (1926). Chem. Fabr. vorm. Schering. Obtaining the active constituents of germ glands. (261,356.)

32,725 (1926). Grouhkin. Preparation of diiodotrimethylamine. (272,113.)

979 (1927). Chem. Fabr. vorm. Schering. Manufacture of chloriodo compounds of alphaaminopyridine and its derivatives. (264,508.)

7460 (1927). Rupe. Manufacture of unsaturated aldehydes. (267,954.)

*22,052 (1926). Soc. Chim. de la Grande-Paroisse. Manufacture of formaldehyde. (272,155.)

*14,337 (1927). Stiepel. Manufacture of hydroxy acids. (272,198.)

*14,935 (1927). Hoffmann-La Roche & Co. Product for internal disinfection. (272,232.)

XXI.—Complete Specification

26,797 (1926). Bausch, Bausch, Bausch, and Bausch. Making unsensitised films for photographic and cinematographic purposes. (260,306.)

XXIII.—Applications

Boehringer, and Boehringer Sohn. Production of disinfecting agents. 15,572. June 10. (Ger., 8,3,26.)

Keleti. Production of disinfectants etc. 15,550. June 10. (Hungary, 12,6,26.)

XXIII.—Complete Specification

3099 (1927). Marx. Clarification of liquids and recovery of the solid matter. (272,130.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Cod liver oil (607); cod oil (608); crockery, glassware (Commercial Bureau, Australia House, Strand, W.C.2. Ref. No. 457). *Austria*:

Paper, stationery, Indian ink (617). *British India*: Belting, lubricating oils, ferro-manganese, steel tyres and axles (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1); steel and cast-iron pipes (A. 4791). *Canada*: Zinc sheets (611). *Chile*: Leather (629). *Germany*: Leather, ox-leathers, grained and split chrome leathers (622). *Hungary*: Leather (623). *Italy*: Chemicals (624). *Japan*: Metals (626). *South Africa*: Tyres (616); aluminium paint (B.X. 3568).

British Industries Fair

According to an official announcement made on June 17, the holding of the British Industries Fair is definitely assured for the next three years, the British Government having leased the White City, Shepherd's Bush, for the London section of the Fair for the necessary periods in 1928, 1929, and 1930.

The next Fair, which will be held simultaneously in London and Birmingham from February 20 to March 2, will be by far the largest British Industries Fair on record. The available exhibiting area in London exceeds the space provided there last year by 100,000 sq. ft. Extensions amounting to 80,000 sq. ft. are to be made at Castle Bromwich, Birmingham, and additional space up to 100,000 sq. ft. is in readiness.

Application forms for space in London are being sent out this week by the Department of Overseas Trade to approximately 10,000 British manufacturers. The space already applied for in the Birmingham section amounts to double the figure for the corresponding day last year.

Safeguarding of Key Industries

The Board of Trade give notice that representations have been made to them under Section 10 (5) of the Finance Act, 1926, regarding the following articles:—Ethylene bromide, lead tetra-ethyl, monochlor-naphthalene, and R potassium hydroxide.

Communications regarding the applications should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, within two months from the date of this notice (June 15, 1927).

News from Advertisements

1. The Department of Scientific and Industrial Research announce various vacancies for research chemists (p. x).

2. A qualified chemist is wanted immediately for a mine on the Eastern Mediterranean coast (p. x).

3. The Egyptian University, Cairo, require a glass blower (p. x).

4. An expert in micro-chemical methods and photomicrography seeks appointment (p. x).

5. A technical and analytical chemist seeks partnership (p. x).

PUBLICATIONS RECEIVED

ADVERTISING, PRINTING AND ART IN COMMERCE. By J. F. Preston and E. Arch. With a foreword by Sir Robert A. Hadfield, Bart., D.Sc., F.R.S. Pp. xvi + 301. London: Chapman & Hall, Ltd., 1927. Price 16s.

CLINICAL PATHOLOGY AND THE USE OF STAINS, WITH PRICE LIST OF STANDARD MICROSCOPIC STAINS. Pp. 15. London: The British Drug Houses Ltd., 1927.

THE SOCIETY OF CHEMICAL INDUSTRY.

INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 31st DECEMBER, 1926.

Corresponding Figures for 1925.		EXPENDITURE.		INCOME.	
£	s. d.	£	s. d.	£	s. d.
100	0 0	To Journal—Editorial and Sundry Expenses—		By Members' Annual Subscriptions for 1926	
16	1 8	Editor's Salary (Transferred only)	100 0 0	Amount paid during year	10,347 0 0
23	10 0	Editor's Expenses	17 18 6	Life Composition Fees	79 17 2
5	18 2	Editor's Sundry Journals	10 4 0	Advertisements	10,456 17 2
		Insurance of Stock	3 18 2	Office furniture	127 8 9
				Less: Depreciation	
					9,144 7 4
					171 15 0
					100 0 0
					£17,628 0 11

"MESSEL FUND."

INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 31st DECEMBER, 1926.

EXPENDITURE.		INCOME.	
£	s. d.	£	s. d.
To Sundry Grants—		By Dividends	
Federal Council	100 0 0	Income Tax Refund (1925-26)	1,102 11 8
Chemical Society's Library	100 0 0	Bank Interest	64 18 6
Nottingham & District Technical Society's Library	15 0 0		45 9 8
Newcastle Chemical Industry Club	12 3 0		
British Chemical Plant Manufacturers Association (Exhibition)	282 3 0		
Messel Medal and Memorial Lecture	108 0 0		
Audit Fee	5 0 0		
Balance, being excess of Income over Expenditure for the year	867 16 10		
	£1,212 19 10		£1,212 19 10

BALANCE SHEET AS AT 31st DECEMBER, 1926.

LIABILITIES.		ASSETS.	
£	s. d.	£	s. d.
To Capital Account—		By Investments—	
As at 31st December, 1925	18,157 12 9	(a) Original Fund at Value at date of Transfer—	
Less: Bank Interest	2 4 0	400 0 0 Birkenhead Corporation 5 per cent. 1924-34	350 0 0
Sundry Creditors	18,157 8 9	Exchequer Bonds, 3 per cent. due 28th January, 1930	972 0 0
Income and Expenditure Account	4,029 10 4	Metropolitan Water Board, Staines Reservoir Guaranteed Debenture Stock	786 0 0
Add: Transfer from Capital Account	2 4 0	1,000 0 0 Metropolitan Water Board, Grand Junction Waterworks, 3½ per cent. Preference Stock	535 0 0
	4,031 14 4	720 0 0 London Electric Railway 4 per cent. Debenture Stock	435 12 0
	867 16 10	600 0 0 London & North Eastern Railway 4 per cent. Guaranteed Stock	381 0 0
Add: Excess of Income over Expenditure for the year 1926	4,809 11 2	15,734 5 5 War Loan, 5 per cent., 1929-47	13,748 8 7
		1,577 13 0 Conversion Loan 3½ per cent.	969 2 2
		(b) Purchased out of Income at cost—	
		686 18 11 Conversion Loan 3½ per cent.	480 17 10
		1,026 17 1 Conversion Loan 4½ per cent., 1940-44	1,000 0 0
		3,239 8 10 War Loan 5 per cent., 1929-47	3,200 0 0
			4,680 17 10
		(Market Value at 31st December, 1926, £25,770 10s. 9d.)	
		By Cash on Deposit at Midland Bank	22,838 6 7
			229 3 4
			£23,067 9 11

To the Members of the Society of Chemical Industry.
We have audited the above Balance Sheet, dated the 31st December, 1926, as also that of the Messel Fund, with the books and vouchers of the Society, and have verified the Investments, and we are of the opinion that such Balance Sheets correctly set forth the financial position of the Society and of the Fund at the 31st December, 1926.

3, FREDERICK'S PLACE, OLD JEWRY, LONDON, E.C. 2.

26th May, 1927.

PRICE, WATERHOUSE & CO.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW
SERIES

LONDON, JULY 1, 1927

No. 26

EDITORIAL

The Chemist and Druggist

THESE two nouns not only are the title of a well-known journal, the last number of which we have read with great interest and pleasure, but they form the description of many thousand people who are interested in the preparation and the sale of drugs. The circumstances are such that we must be particularly careful how we allude to a matter with such potentialities of discord as the relationship between the chemist and the chemist and druggist. That a sharp and rigid line, perhaps even more than a line, can and should be drawn between these two occupations is obvious. When we have attended meetings of the Society of Chemical Industry in provincial cities we have more than once been courteously greeted by an entire stranger, who has made some complimentary remark about the Society, and then asked our candid opinion about Yadil or some equally valuable fluid. We have usually explained that we had no chemical pretensions ourselves, and that our chemical friends who allowed us to attend their meeting belonged to an entirely different and much superior branch of mankind, and hardly were aware of the existence of the other and much lower beings who had no moral right to use the term chemist. We ourselves make a point of invariably using the term "pharmacy" instead of "chemist's shop" except when we ask a maid, or a child, or the gardener to buy something for us in that establishment. But as we never have occasion to mention the establishment unless we are conversing with persons of inferior mental equipment, we fear that it is only on very rare occasions that our invariable practice comes into operation. Moreover, we find there is a danger that some of the potent grave and reverend signiors of our profession do not hold themselves duly aloof. We concealed, so far as possible, from our neighbours the fact that our last president was a pharmaceutical chemist; we cannot

conceal the fact that our reigning president spends his time in pharmacy and drugs, because his own presidential address is, we are informed, abundant evidence of his interest in these matters; a predecessor in the presidential chair, Sir William Pope, also has studied drugs, and, in conjunction with pharmacologists, has prepared drugs which in his and their opinion are even more meritorious than Yadil itself. Pharmacologists differ from pharmacists, just as presbyters differ from priests. The past Honorary Treasurer of the Society, Mr. D. Lloyd Howard, is this year's chairman of the British Pharmaceutical Conference, and from his portrait, which adorns the last number of the *Chemist and Druggist*, he does not seem to have altered his appearance much since he carried the Society's purse and pass-book. We could give other instances of this sort, but we refrain: it is obvious that our nomenclature requires revision. The chemotherapeutical practitioners, the pharmacologists and the biochemists are not to be confounded with mere pharmaceutical people; their methods are different, and the subjects they study are different: and yet we find in the pharmaceutical conference reference to a paper on the adjustment of p_H for the stability of ammonium acetate, to another paper on the presence of vitamins A and B in orange juice, and to another paper by the Burroughs scholar in the Pharmaceutical Society's Research Laboratory. The last number of the *Chemist and Druggist* contains an article on the Beginnings of Pharmacy, with pictures from an early MS. of Dioscorides, photographs of Egyptian and Assyrian vases and inscriptions, Greek and Roman relics, extracts from a XV Century MS. of Galen, and pictures of many men of science, some of whom were both chemists and chemists and druggists. This historical sketch of the evolution of the art of compounding medicines is well written, well printed, and beautifully illustrated, and contains many pictures and

statements which we should have been glad to have seen in CHEMISTRY AND INDUSTRY. We think that if the last four presidents of the Society of Chemical Industry, the president of the Chemical Society, and the Chief Government Chemist would only meet and draw up logical definitions of the various classes mentioned in this short editorial note, we should all get accustomed to the accurate use of the various terms, and, having become fluent in these, we could then commence a vigorous campaign for the education, first of the public, and then of the House of Commons, the House of Lords we regard as hopeless in this respect. There is a grave danger that chaos may prevail in that great department of learning which adjoins chemistry, pharmacy, physiology, biology and medicine. This chaos may be avoided by exact definitions, a few weeks ago we thought of a good definition of the word "chemist" ourselves; unfortunately it escaped us, and we have not been able to recall it; it is not forgotten; it is in the sub-conscious part of our mind, and we shall probably think of it immediately after going to press. It should be as easy to define chemist, as lawyer or engineer, and as profitable. While the chaos we have mentioned continues to exist, it is comforting to think that the bio-chemists in this country will continue the excellent work they are now engaged in, and that the pharmaceutical chemists, of the type of Mr. Carr and Mr. Lloyd Howard, will continue their excellent work, and that the chemo-therapeutical chemists will invent drugs which will rival salvarsan and quinine. The trouble is that chemistry has already invaded most of the professions, industries and arts, and will invade the residue very speedily, and unless we prune our words in due course the luxuriant growth will bewilder the journalists and the newspaper-reading public, and the words will be so distorted from their true meaning that all nicety of expression will be lost, even though everybody will understand perfectly well what is meant. We are all in favour of nicety of expression, and shall be grateful for a little guidance. It is a pity that the general public is not more interested in exact and scientific methods; we visited our old haunt, the Law Courts, the other day, and listened to certain learned gentlemen discussing the condensation of fatty acids and phenols with a view to a decision by a judge already profoundly learned in equity and absorbing chemistry with great rapidity. The case, they told us, was of extraordinary interest, would last a fortnight or three weeks, and cost an appalling lot of money, and yet the court was nearly empty: the general public, unfamiliar with the technical terms, tired of the first witness after he had been in the witness-box only a day; his subsequent evidence, though equally interesting, attracted no gallery, and we have, so far, seen no report of the proceedings in the morning papers. We did not intend our editorial to wander in this way; our intention was to describe Mr. Chaston Chapman's address on the Profession of Chemistry, and to bring in somehow a reference to the Alembic Club, which is domiciled in Edinburgh, and was omitted from our recent account of that city. We cannot think how we have gone astray. "*Amphora coepti institui, currente rota curvaceus exit!*" It was a wine jar that was to be moulded: as the wheel runs round why does it come out a pitcher?

THE COMMERCIAL SYNTHETIC RESINS AND THEIR PRODUCTS*

By HERBERT W. ROWELL

(Concluded)

Presses.—A semi-automatic press is used for rapid output from a multiple mould for small articles or the more convenient handling of a large single impression mould.

The piston portion of the mould is attached to the double-action ram, which alternately presses upon and withdraws the piston, while the other half of the mould is attached to the bed frame. Ejector pins, attached to a small ram below the mould, work in the lower half of the mould and push out the articles. The mould contains its own heating arrangements.

Telephone earcaps are moulded with the screw thread and hole complete. If it were not for the projecting rim at the cord end of the post office telephone earpiece the trumpet-shaped portion could be moulded in and ejected from an ordinary type piston mould. A special angle press used for such articles carries the core and piston portion of the mould on the overhead ram, one half of the cavity portion of the mould attached to the horizontal ram and the other half to the press frame. The horizontal ram closes the two halves of the cavity portion, the powder is added and the piston brought down, and when both rams are withdrawn the article with its projecting rim falls out of the split cavity portion.

Finishing.—Thin fins or flashes found on many mouldings as they come from the mould are removed by filing, grinding or turning with the help of ingenious jigs and tools to reduce labour costs. Holes which are inconvenient to mould have to be drilled and sometimes tapped or slots sawn or milled out. A highly polished mould gives a corresponding finish to the goods, but machined spots and goods from dull moulds can be brought to a good finish by mopping and buffing. The depressed moulding, as in radio dial scales, trade or other markings, can be filled with coloured composition.

LAMINATED RESIN-PAPER PRODUCTS

In the form of sheets, blocks, tubes, rods and trough-moulded shapes, the makers of modern electrical plant require this material for insulation purposes. It has many other uses in other industries, as it is stronger than the powder mouldings, and large sheets and tubes can be obtained.

There are two distinct qualities. The lower grade, which is called "laminated" or "rolled," consists of sheets of paper cemented together with, and containing 25% to 35% of, resin. The higher grade contains 45% to 55% of resin, and is usually called "moulded sheet" or "rolled and moulded tube," and is made by a more expensive process involving complete impregnation of the paper and baking under heavy pressure. The lower grade is a good insulator, is practically non-inflammable, can be sawn, punched and machined, but will absorb several per cent. of its weight of water when immersed

* Read before the Birmingham Section on March 8, and illustrated by an exhibition of numerous products, moulds, and materials.

and is liable to split along the laminations. It is quite satisfactory for many electrical purposes, and has the larger sale. In the higher grades, as the paper is impregnated with resin the mass loses nearly all its laminated structure. It absorbs practically no water, it can be drilled, tapped and screwed without splitting, its tensile and shearing strength is 5 to 7 tons per sq. in., it can be engraved like metal, and the surface and cut edges can be highly polished. It will withstand a temperature of 150° C. continuously, and is resistant to solvent and

required a solution of the "treacle" in methylated spirit may be used, which, however, adds to the cost.

To make sheets or boards, the paper is cut into suitable pieces, made into a pack with coated side against plain side, placed between polished metal sheets and compressed between the hot plates of a large press. The resin first melts and partly impregnates the paper, then hardens and forms the cement which binds the mass together.

To form tubes, the coated paper is fed from the rolls

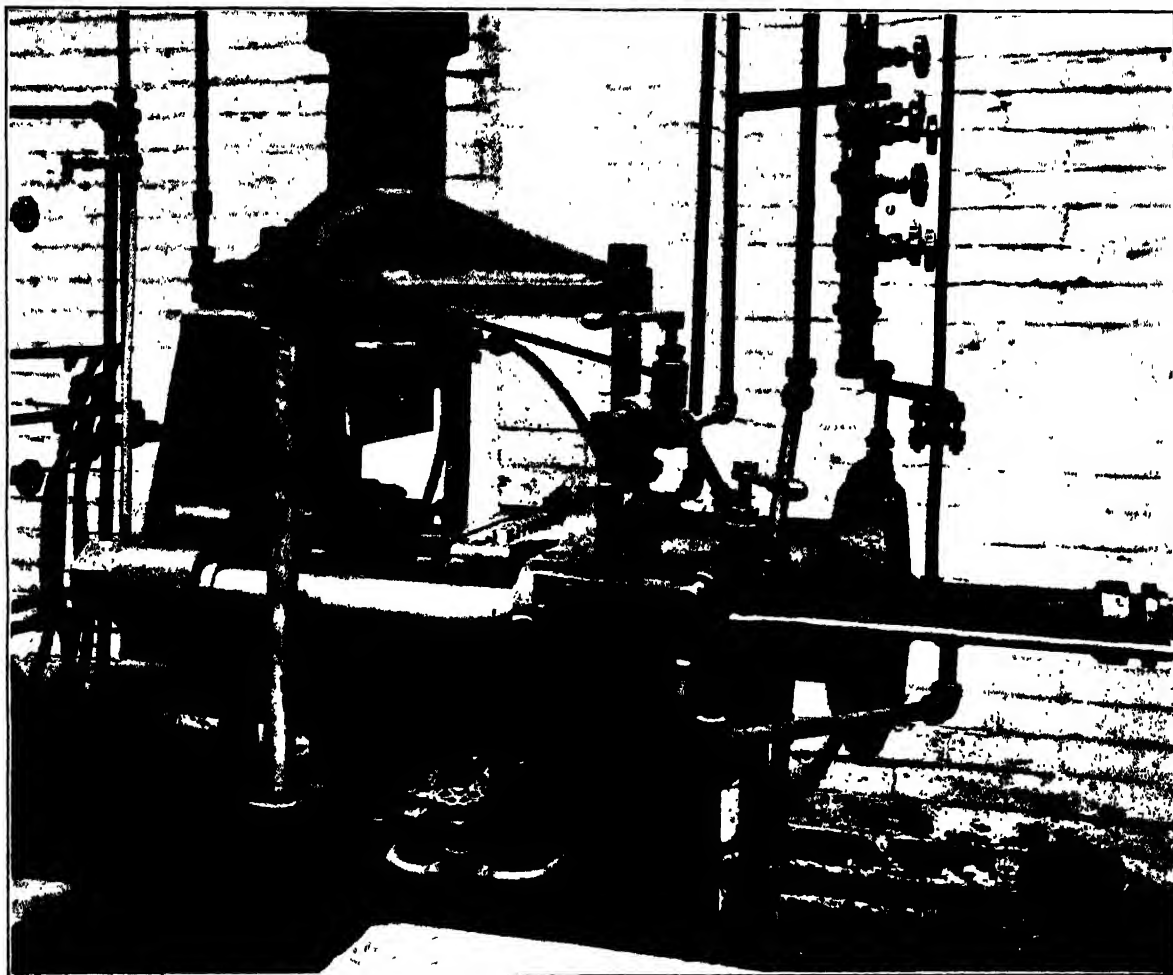


FIG. 5

Angle or two-direction press, showing moulds fixed for making telephone handles

chemical attack as in the case of powder mouldings. In the manufacture of the lower grade of laminated goods, a suitable grade of paper is coated on one side with resin in its "treacle" stage in a machine such as is used for spreading rubber solution on to cloth. In its passage over the hot plates the paper is dried and the treacle polymerises to a resin state in which it is not sticky when cold. This enables the coated paper to be again made into convenient rolls without sticking. Owing to the high viscosity of the "treacle" there is no serious penetration of the paper, but if better impregnation is

to a machine which wraps it tightly around a steel mandrel and at the same time heats the resin rapidly to above its melting point. Square and round tubes from $\frac{1}{8}$ -in. to 3 in. bore and up to 6 ft. long, or cylinders from 3 in. to 3 or 4 ft. diam. by 6 ft. or longer, are manufactured with wall thickness up to an inch or more.

The tube while still on its mandrel is baked at a temperature below 100° C. for a day or more and finally at a higher temperature according to the practice of the maker. He has to dry the paper thoroughly and bake his resin to its final stage without blistering or reducing

... of the tube. The mandrel is then withdrawn and any wax paper or other preparation used to prevent sticking to the mandrel is removed from the bore.

Moulded paper-resin products.—A better grade of paper is used for this type, and after drying it is passed through a machine which impregnates and leaves an even coat of resin solution in alcohol on both sides of the paper. The impregnated paper passes continuously through a heated oven in the larger factories and is re-rolled when cold. Sheets of thickness from $\frac{1}{8}$ -in. to $\frac{1}{2}$ -in. and blocks up to 3 in. or 4 in. thick are made in a similar way to the laminated sheet by baking in large hydraulic presses.*

The rolling of tubes is much more difficult than in the case of the lower quality, as the paper is sticky when hot on both sides. After rolling on to the round, square or hexagonal mandrel, the tube and its mandrel are placed in a mould and heavily compressed and baked in the hydraulic press.

In this manner tubes and rods having mechanical strength, moisture-proof, machining and electrical properties equal to the best grade sheet can be made up to 4 in. diam. or more and 4 ft. long, as well as angles, troughs and other shapes. The tubes can be screw-jointed or cemented to form longer lengths, and are supplied accurate in internal and external diameter to within 0.002 in. Only one firm in this country manufactures this kind of tube under the name of "Tufnol," and two firms in the United States manufacture a similar moulded type using Bakelite resins. Asbestos is used in place of paper to obtain satisfactory resistance to 350° C. in the "Asbestos-Tufnol" sheets and tubes.

Fibrous mouldings.—To obtain greater tensile strength and shock resistance than is obtainable in wood meal powder mouldings, a proportion of asbestos or vegetable fibre is sometimes added as filler. This gives a more bulky powder, the fins are not so clean, and the surface finish is often rather poor. Flanged bushings, trays, cup washers and other shapes with a high finish are moulded from paper pulp and phenol-aldehyde resins. They are practically unbreakable, and can be drilled or machined in any direction without splitting.

Another important application is the manufacture of small and large spur wheels and pinions which wear better than raw hide, and are noiseless. The smaller wheels of this type are now largely used in timing gear and magneto drives in motor-cars. Cotton duck cloths are impregnated and moulded into laminated blocks, which are then machined to form the toothed wheels or worm drives of usual type. Very small wheels can be punched from paper-resin sheet or may be moulded from fibrous powders.

Cements.—The "treacle" stage resin or a solution of the "resin" stage forms a transparent cement with practical applications. Fillers and colours may also be included. Mouldings, paper-resin sheet and tube, broken china, rough metal and unglazed porcelain can be joined, and after baking carefully to avoid bubbles, give heat-resistant and perfectly waterproof

and oilproof joints. Flanged steam pipe joints can be packed with asbestos washers soaked in the resin which bake to hard joints automatically. Paint brushes have their bristles cemented in place with Bakelite resin, and no solvent will remove them.

After proper baking, these resins do not stick to any highly-polished surface, and, generally speaking, such cements or any other phenol-aldehyde product is of no practical value until baked to its final stage. Abrasives such as carborundum and emery are mixed with this cement and moulded into grinding wheels. In place of the usual emery cloth disc glued to a face plate, the emery grains can be cemented directly to the plate to form a disc grinder. Heating to nearly red heat will detach the coating, which can be renewed, and gives more satisfactory service than cloth discs. Another interesting application is the formation of steam pipe insulation sections from long fibre asbestos cemented together with a solution of the resin and baked to a robust, permanent shape.

Chemical-proof linings for vats and large pipes have been made by mixing silica or other inert powder or grains with phenol-aldehyde resins. Tiles or other shapes of earthenware cemented into place with similar mixtures are regularly used in pumps and tanks.

MODIFIED RESINS

Methods of producing flexible or elastic final products of phenol-aldehyde resin have been suggested which are based on the addition of substances which either dissolve or are dissolved in the hard-baked final resin. The use of an excess of phenol or *o*-cresol has already been noted, and a number of substances like naphthalene, ricinoleic acid, chloro-naphthalenes, and di-phenylamin[•] have been mentioned in patent and other literature. No really flexible product has been produced commercially, because whilst these added substances produce flexibility they reduce melting or softening point, reduce tensile strength, or otherwise damage the good properties of the resin.*

Oil-soluble resins of the phenol-aldehyde type have been sought for varnish work; in fact, this was the main object of the original investigators, but the only commercial types are those known as "Albertols" patented by Albert and Berend (E.P., 1914, 15,875). These are apparently a phenol-aldehyde resin containing excess phenol or cresol heated with 30—50% of common rosin for some time. The resins may need to be "run" still further by the varnish maker to render them entirely soluble in linseed oils and the usual solvents.

Aylesworth, Robinson and others have patented the use of *o*- and *p*-cresols with formaldehyde and other agents to produce oil-soluble resins without rosin addition, but these do not appear to be on the market.

Furfural has been produced at a low price from oat hulls, and has been condensed with phenols of various kinds to produce resins. The resins are black or practically so, and have therefore only been used in limited quantity for commercial purposes.

* Some highly polished natural wood grain boards of Bakelite-paper were exhibited in which the top layer of paper is printed with a photographic reproduction of the timber grain in natural colour. Such panels do not warp, and are practically indestructible.

* Among the large assortment of synthetic-resin products exhibited were some samples of quite flexible cloth and paper which are intended to replace oiled silk and varnished cloth, and which may develop commercially for electrical insulation.

A French resin, "Thiolite," has sulphur incorporated with it by digesting the treacle stage phenol-aldehyde resin with sulphur chloride, and removing the hydrochloric acid formed. Its physical properties are much like the normal resins, but claim is made for superior electrical resistance.

There might also be mentioned here some small French production of resins from acrolein. The cheap production of this by dehydration of glycerin and distillation enables a commercial product to be made either by simple polymerisation with a basic catalyst or condensation with phenol.

Lacquers.—Large amounts of air-drying or "cold" lacquer and stove drying or "hot" lacquer are used in the light metal trades. Ordinary phenol-aldehyde resins when baked do not adhere well to polished metal, are not flexible, and generally are too dark in colour and further darken in colour with exposure to light. They are not suitable for metal lacquering, but are suitable for papier maché and similar work. One of the Albertol modifications is said to produce a good lacquer. A new phenol-urea-formaldehyde lacquer removes entirely the faults of the phenol-aldehyde type, and seems to be a decided advance in protective lacquer work generally.

Pottery glazes.—Ordinary biscuit pottery can be glazed with phenol-aldehyde coloured enamels or glazes. They are baked at a low temperature compared with ordinary pottery glazes, but the goods resist water and heat sufficiently well for every ordinary purpose. Effects in colour and pattern can be obtained which are not possible by the usual pottery methods.

Insulating varnishes.—A solution of phenol-aldehyde resins in alcohol and acetone is largely used for treating taped or cotton-covered wires in electrical apparatus. After thorough drying, the formed coils are dipped in the varnish, air dried and then baked, and this process may be repeated to give a heavy coating.

The main advantage of this varnish is the perfect saturation which may be obtained, the high insulating value of the covering, and the fact that a mass of winding may be made into a strong, rigid, heatproof and waterproof mass which is not attacked by vermin or tropical insects.

THE COUMARONE RESINS

These are not synthetic compounds, but are mixed polymers consisting in the main of paracoumarone and paraindene. They are of interest as oil soluble varnish-making resins.

The commercial resins vary in softness, melting point and colour depending upon the proportion of coumarone indene and adventitious substances contained in the naphtha used as raw material and the care in manufacture. The supply of these resins was so variable and inferior at times that they earned a bad name amongst potential users of large quantities. The German qualities were generally inferior to the American, while a British product does not seem to exist. Light coloured, hard resins of consistent quality have been obtainable for some years. The tar distiller is only too well aware of the acid sludges obtained in washing light oils, and has tried to extract resins or other usable products from them

without success and without hope, for his beginnings are bad.

Good coumarone resins are made from the carefully fractionated distillate boiling between 160° and 185° C., free from benzene, toluene, xylenes, bases, tar acids and naphthalene. This fraction from various tar sources should be blended to obtain fairly uniform proportions of coumarone and indene with an average content around 30% of polymerisable substances. The washed distillate is dried with a wash of 1% of 76% sulphuric acid and then 3–5° of 96% sulphuric acid is added with violent circulation and efficient cooling. The reaction is exothermic, and special plant is necessary to keep the temperature down to 15° C. while maintaining reasonable speed of working. The tarry acid is separated, the polymerised oil is washed with soda and water, and the clean material is distilled until any naphthalene is cleared and a small amount of viscous polymerised oil distils. High vacuum is necessary, to keep the B.P. below 270° C. and maintain the pale colour of the resin which remains in the still.

The commercial coumarone resins are also made from less well-refined naphtha boiling between 150° and 190° C. A weaker acid is also used with a proportionately higher temperature, and other polymerising agents than sulphuric acid have been suggested by various patentees and are possibly used.

With the greatest care in manufacture, using the best quality materials, a certain amount of lower grade dark or soft resin is made, and it does not seem wise to use methods which cannot produce the pale, hard resins that are in greatest demand at the best price.

The commercial resins are graded according to colour and softening or melting point into five or six qualities. The hardest quality has a softening point of about 50° C. and a melting point of 135–150° C. by an agreed method, while the medium to soft grades soften at 25–40° C. and melt at 90–130° C. Some dark odorous resins, liquid to viscous at 15° C., are also sold.

Their solubility varies, but generally they are soluble in benzene, carbon tetrachloride and turpentine, not completely soluble in petroleum spirit, but soluble in mixture of this with coal tar naphthas or turpentine. In absolute alcohol they are generally soluble, but not in the weaker industrial spirit, although claims are made that alcohol soluble resins of this type are on the market.

The paint and varnish industry is probably the largest field for their use, and the harder qualities have been extensively used in America and Germany to replace, in whole or part, the more expensive natural resins and rosin esters in varnish and varnish paints. Coumarone resins are said to be more waterproof than many of the natural gums, and have been used in admixture with pitches in so-called "bituminous" paints. As an ingredient in rubber mixings, the medium to soft grades have been successful as softeners, promoting easy mixing. For overshoes, hose, mechanical goods and friction tapes the addition is said to be useful. For diluting gutta percha and balata there seems to be an opening as their dielectric constant is high, and they are waterproof and adhesive. Backeland suggested adding coumarone resins to the phenol-aldehyde type, but a

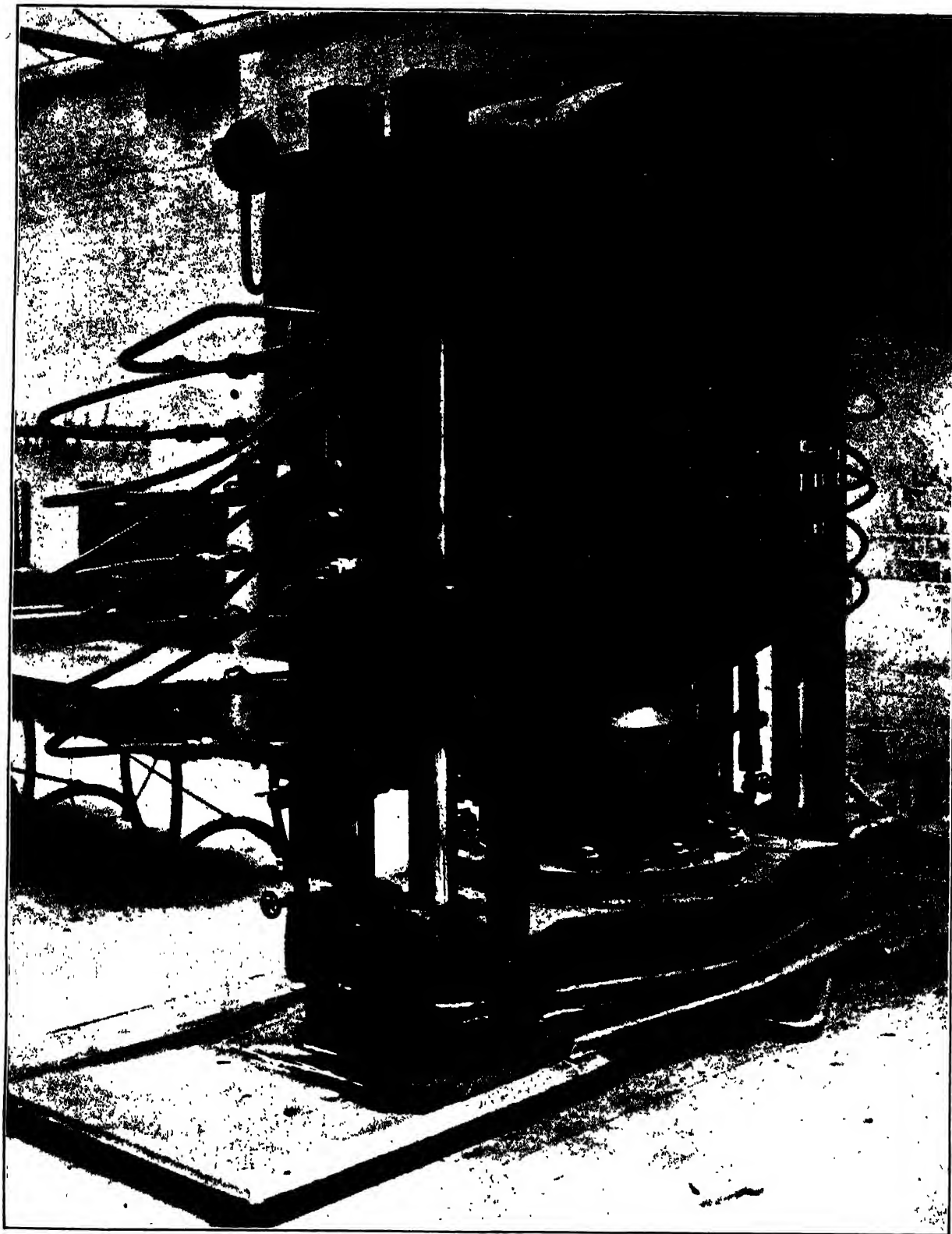


FIG. 6

Large six-platen press with synthetic resin paper sheets and moulded tubes under pressure.

better use seems to lie in their incorporation in "cold moulded" articles consisting of pitch, drying oils and fillers. In view of the increasing demand and failing supply of natural gums these coumarone resins are worth much more attention by chemists in the tar, paint, varnish, linoleum and mechanical rubber trades.

CARBAMIDE RESINS

Urea or carbamide is famous in chemical history as the first organic compound to be synthesised by Wöhler in 1828. It is now in the ranks of heavy chemicals made from atmospheric nitrogen, and is used as a manure. In 1889, Lüdy, and in 1896, Goldsmith, published data on the manufacture of resin-like bodies from carbamide and formaldehyde, noting that varying proportions and acid, neutral or alkaline conditions produced different products. Dixon and others also studied these reactions, but the first patent of commercial importance is that of H. John (E.P., 1920, 151,016), who used excess of formaldehyde with no catalyst. He obtained an adhesive substance as an intermediate product which became a transparent glass-like substance on heating, and he covers the use of thio-urea, benzoyl and acetyl ureas in place of carbamide. Pollak and Ripper have patented a series of methods of manufacturing such resins. A factory exists in Austria, and a British company is now formed with a capital of over £250,000 to work the patents, but at the moment the manufacture of these "Pollopas" resins does not amount to any large tonnage.

Some idea of the work done by Pollak and Ripper may be gathered from *Chemiker Zeitung*, Aug. 14 and 28, 1924, and it would seem, from what information is available, that the difficulties in producing large sheets of a clear glass-like product have not yet been overcome on the commercial scale. (Coloured glass and artificial amber rods which are machined to form useful articles, and a piece of plate glass 1 ft. square, were exhibited.)

The actual methods of manufacturing commercial products are very vaguely stated, but it is sufficient to know that on heating carbamide and formaldehyde in the presence of a basic salt, but in a solution about neutral to litmus, a condensation takes place and a watery or albumen-like solution may be obtained as a first stage. This solution is then polymerised by heat, and the hydrogen ion content may be varied to produce different types of colloid, as a second stage. When the water or salt solution is removed from this jelly-like mass considerable shrinkage takes place, and some ingenious methods have been proposed which are said to avoid cracks, bubbles and distortion, and so produce large pieces of perfect glass or moulded shapes for further machining. The cloudy and coloured resin material is more easily manufactured, and is worked up into fancy articles by turning and machining. (Some dress fabrics were exhibited which are decorated by a very ingenious method consisting of printing small beads of this clear glass or coloured resin in patterns. The beads are firmly attached to the silk, and cannot be washed off as they are baked in position, and the effect is pleasing and novel.)

Moulding powders are also made on similar lines to the phenol-aldehyde resin powders; but with the carbamide

resins very light or white mouldings may be obtained. The primary resin solution can be used in other ways, and auto-gelatinisation may be prevented by the addition of alkali salts of weak acids like borax or sodium acetate. Such a solution can be used for finishing textile materials by impregnating and drying out in dry steam and calendaring to form buckrams and similar stiff products. By varying the degree of such treatment, fabrics may be sized, glazed or linenised with a finish which does not wash out, and which produces a more desirable appearance.

According to Pollak, his resin is decomposed at 150° C., which is much below the charring point of the phenol-aldehyde resins. It is not quite waterproof, its specific gravity is given as 1.44, which is heavier than the phenol-aldehyde resins, and it apparently machines easily. Pollak states about Pollopas that "The new material also possesses special suitability for motor screens on account of the fact that it does not splinter." The material is very little more flexible than ordinary glass or the phenol-aldehyde resins according to figures given, but examination of the broken edges of specimens exhibited shows that these are not sharp, nor do they cut flesh like broken glass. Early samples of Pollopas were uneven in degree of refractive index and permeability to ultra-violet light, and in spite of the fact that it scratches fairly easily, hopes are entertained of making useful lenses and glass sheets permeable to ultra-violet rays. It is stated that the present production in Austria is of improved quality, and that it will find its place on the market.

THIOCARBAMIDE RESIN

A method of preparing this type of resin is described in E.P. 1926, 248,477, which, briefly stated, is to heat formaldehyde and thiocarbamide below 100° C., while passing a current of inert gas through the solution. Formic acid is thus removed, and a neutral watery solution of the resin provided suitable for polymerisation in commercial practice by the further application of heat. Moulding compositions have been made commercially by treating paper pulp, powders and colours with this solution. These mouldings can be produced in very light colours, and by using white pigments a fairly good white has been obtained. In this respect they excel the phenol-aldehyde resins. Their electrical insulating properties are not exceptionally good, and although quite sufficiently waterproof and resistant to soap and soda for domestic use, they do not compare favourably in such respects with the phenol-aldehyde resins. At 150° C. the thiocarbamide resins decompose with a very unpleasant smell. The watery resin solution can be used for stiffening and finishing textile fabrics without materially affecting their colour. Cotton goods can be given a linen finish, and filling materials made resistant to washing. Printed paper may be treated with the resin solution, and baked to form signs or glazed wall tiles having weatherproof properties, but they would not, of course, resist high temperature. A transparent product has not been put on the market, and the light colour of the resin seems to be the only advantage which it has over the phenol-aldehyde type of moulding powder.

GLYCEROL-PHTHALIC ANHYDRIDE RESINS

Watson Smith (J.S.C.I., 1901, 1075) gives the earliest practical data for the production of resins from glycerol and phthalic anhydride. Citric, tartaric, succinic and benzoic acids also form resin-like products with glycerol, while mixtures of these acids with phthalic anhydride have also been used. The research staff of the General Electric Co., of Schenectady, has developed this type of resin to the commercial stage. A large number of patents dating from 1914 in the names of Callahan, Arsem, Dawson and others cover various reactions and uses. The synthetic production of phthalic anhydride at a reasonable price now makes its use possible in industry.

The main use of this resin is as a substitute for shellac etc. for bonding mica flakes in the manufacture of micanite sheets and tubes for electrical insulation. Its special property is that it sticks firmly to a polished surface in both intermediate and final stages. Micanite thus bonded has a higher surface and volume resistance than shellac bonded mica, and the resin does not carbonise easily under an arc, like shellac or the phenol-aldehyde resins. Although it is light in colour, it is not of commercial interest in the making of moulding powder on account of the higher cost and long-baking time necessary to harden it compared with the phenol-aldehyde types. In fact, some types do not become infusible and insoluble on baking.

A typical resin is made by heating one part of glycerin with two parts of phthalic anhydride slowly up to 185° C., at which temperature it is held until distillation ceases.

The heating is continued at about 210° until samples show hardness without being sticky. This resin is soluble in acetone and other solvents, and may be made into lacquers.

To make it hard and insoluble the resin is further heated at 85-100° C. for several hours, and the temperature may then be raised for a further several hours. Rapid heating promotes considerable vesiculation, and the result is a useless pumice-like mass, instead of a transparent, machinable piece.

The sample of commercial Glyptol resin shown is easily soluble in acetone or mixture of acetone and alcohol, softens when heated to about 75° C., melts at 95°, and bubbles at 120°. Phthalic anhydride and acetic vapours are evolved on further heating and the residue is not easily carbonised. The solution in acetone and alcohol attacks copper slightly when applied as a lacquer and baked at 100° C. Two days' baking of this lacquer at 130° C. did not render it insoluble in acetone, and it still softened on heating to 100° C. This particular sample compares with a bleached shellac in physical properties and possible uses, and it does not quite agree in properties with published data for glycerol-phthalic anhydride resins.

Conclusions

The original search for synthetic varnish resins has resulted so far only in the modified phenol-aldehyde type called Albertols, the coumarone resins, and an insignificant supply of shellac substitutes of various composition and special application. The production of these

resins compared with consumption of the natural resins is quite small, and there is room for the discovery of something more satisfactory for varnish manufacture.

The side lines of research often result in discovery of more importance than the main object, and the commercial development of the phenol-aldehyde resins has provided new material and methods of production and new industries of considerable importance.

Over 90% of the synthetic resin manufactured is of the phenol-aldehyde type, and new application, modification, and increased output are frequently registered. Any successful competitive resin must show either cheaper material, more convenient application, cheaper method of manufacturing its products, greater resistance to heat or other destructive agents, or more pleasing appearance. Except for the light colour of the thio-carbamide resins, no competition is in sight. There is still a demand for a new synthetic material which will provide an electrical insulation whose electric strength is invariable under varying temperature, which is not damaged by an electric arc, which is easily worked and has all the other desirable properties demanded by the electrical engineer, and also for a transparent, colourless, synthetic material which will remove the danger of plate-glass windows on vehicles in a really satisfactory manner.

This mentions only two of the many demands for better material which follow the constant advance in quality of industrial products which, in turn, follows the rising standards of what we call civilisation. Such demands can only be met by continued scientific research on a more extended scale.

The author wishes to record his thanks to a number of individuals for help in the gathering of information, photographs and specimens, including the Danard Lacquer Co., Ltd., for specimens of Bukelite resins, moulding powders, finished products and lantern slides; Messrs. Birkbys, Ltd., for photographs, moulded products, moulding powders, and information; Mr. G. Ellison for samples of Tufnol products, resins, photographs, etc.; the British Thomson-Houston Co., Ltd., for sample of Glyptol resin; and Rubber Industries, Ltd., for samples of coumarone resins.

HYDRO-ELECTRIC DEVELOPMENT IN CANADA

The recent survey of the Pagan Falls, Gatineau river, indicates the possibility of a 135 ft. head; and 95 billion cb. ft. of storage at Bitobe dam. The power plant at Pagan Falls will be capable of developing 600,000 h.p. The Gatineau Power Co. (subsidiary of International Paper Co.) will commence delivery of power to the Ontario Provincial Hydro-Electric Commission on October 1, and reach a fixed maximum of 260,000 h.p. in 1931. The surplus power will be utilised by the Gatineau Mills of the Paper Corporation and Canada Cement Co., Hull, Quebec.

The West Kootenay Power & Light Co., Ltd., B.C. (subsidiary of Consolidated Smelting) showed a gross earning, for 1926, of \$1,660,668 as compared with \$1,041,125 in 1925, and \$683,516 in 1924. The surplus for 1926 amounted to \$449,733, as against only \$5238 in the preceding year.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

ANNUAL GENERAL MEETING, 1927

July 4 to 9

EXTENSION OF PERIOD FOR REDUCED RAILWAY FARES

Since the programme for the Annual Meeting was printed, the Railway Companies of Great Britain which agreed to issue tickets at the ordinary single fare and one third for the double journey to persons travelling to Edinburgh to attend the meeting have extended the validity of these tickets, and they will be available from Saturday, July 2, to Monday, July 11. These tickets will be obtainable at the time of booking on production of vouchers which will be supplied on application to Dr. W. T. H. Williamson, 13, George Square, Edinburgh.

It is urgently requested that all persons going by rail to Edinburgh for the meeting will take advantage of this concession.

If the holder of a return ticket at the reduced fare wishes to make use of it after the period for which it is available has expired, the excess payable will be the difference between the fare paid and the fare payable for an ordinary return or a tourist ticket, where such is available. This excess would have to be paid at an Edinburgh booking-office before commencing the return journey.

PROPOSED EXCURSION TO ST. ANDREWS ON SATURDAY, JULY 9

The train will leave the Waverley Station, Edinburgh, at 9.30 a.m., arriving at St. Andrews at 11.22 a.m.

A visit to the University, including the Chemical Laboratories, will be arranged for the afternoon, and the St. Andrews University Court has kindly offered to entertain the members to tea in the University Buildings.

The return train will leave St. Andrews at 5.35 p.m., arriving in Edinburgh at 7.26 p.m.

Members will also have an opportunity of visiting other places of historic interest in St. Andrews or of playing golf.

CHEMICAL ENGINEERING GROUP

A lunch for Members of the Chemical Engineering Group and their guests is being arranged for Wednesday, July 6, at 12.30 p.m., immediately after the meeting of the Group. The lunch will be held in the University Union, Park Place, Edinburgh. Price of tickets 5s., exclusive of wine and gratuities.

Members of the Society who are not Members of the Group are welcome to attend the lunch.

Charabancs will call at the University Union at 1.55 p.m. for those going to the Gasworks, and at 2.5 p.m. for those proceeding to King's Buildings. Application for tickets should be made immediately to Dr. W. T. H. Williamson at 13, George Square, Edinburgh.

BUREAU OF CHEMICAL ABSTRACTS

The following are the prices at which copies of the Index to British Chemical Abstracts, 1926, can be purchased:—

By members of the Chemical Society or the Society of Chemical Industry—5s. post free; by subscribers—10s. post free.

CALENDAR OF FORTHCOMING EVENTS

July 4 to 9. SOCIETY of CHEMICAL INDUSTRY. Forty-sixth Annual Meeting in Edinburgh. (See CHEM. AND IND., May 20, 1927, p. 464.)

July 4 to 8. SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group*. Annual Meeting in Edinburgh. "Some aspects of the manufacture of fibrous cellulose," by Dr. J. L. A. Macdonald. A discussion will follow.

NATIONAL PHYSICAL LABORATORY

The annual visitation and inspection by the General Board of the National Physical Laboratory took place on June 24. Visitors were received by Sir Ernest Rutherford, Sir Richard Glazebrook and Sir Joseph Petavel. All the different departments of the Laboratory—*aerodynamics, engineering, metallurgy, the William Froude national tank, metrology, physics, optics and electricity*—were thrown open for the occasion, and about 200 exhibits representative of researches and investigations, completed or in course of completion at the Laboratory, were made available for inspection by visitors. In the Engineering Department the results of fatigue tests on single-metallic crystals were shown. An ordinary piece of metal consists of a multitude of small crystals (about 1,000,000,000 to a cubic inch). In each single crystal the atoms are arranged throughout according to a perfectly regular geometrical pattern, but the effect of this regularity is lost in an ordinary piece of metal owing to the different orientations of the small crystals making up the sample. In recent years methods for producing single crystals of certain metals, several inches long, have been developed. Such crystals are made in the Laboratory, and by submitting these to stresses applied in various ways and studying the resulting slip bands and changes of shape, considerable advance has been made in correlating the manner of fracture of metals with the planes of atoms in the crystals. Until quite recently the strength of engineering materials at high temperatures was obtained by breaking a test piece at the specified temperature, the test lasting a few minutes only. Recent investigations have shown that metals and alloys under a constant tensile load at high temperatures gradually increase in length and finally fail after a period often extending over some months. With newly-designed methods of testing, an endeavour is made to find the maximum loads at different temperatures; such materials will stand for many years when the loads are continuously applied. Such maximum load is, for any temperature, termed the "limiting creep load." Thus a nickel-chromium alloy having a breaking strength, as usually determined, of 18 tons per square inch at 800° C. broke in 37 days at that temperature under a *continuously applied* load of 2 tons per square inch. Investigations of this nature dealing with "Armco" iron, carbon steels and cast steel have been completed at the Laboratory, and the results are now in the press. Similar investigations dealing with boiler tube steels, normalised and heat-treated carbon steel, 3% nickel steel, cast and forged steels, special high-temperature steels, and new alloys containing nickel and chromium as a base, were shown in progress.

All the resources of modern science, from high-frequency induction furnaces to X-ray analysis and the ultra-violet spectrograph are employed in investigations relating to the production of metals and alloys shown in the Metallurgy Department. Progress in the design of gas, oil and petrol engines depends upon the use of increasingly higher temperatures and pressures, and new materials to withstand the imposed increasingly severer conditions are called for. Alloys are melted experimentally in a high-frequency induction electric furnace either in a vacuum or a controlled atmosphere, and are then cast, forged and rolled. Materials available commercially for the construction of crucibles capable of withstanding not only the high temperatures, but also the great chemical activities of the hot poured metals, do not meet all requirements, and investigations at the Laboratory have resulted in the production of special refractories suitable for these purposes. The casting, pressing and extrusion of these special refractories was demonstrated. Partly as the result of the success achieved in the production of these materials, it has been found possible to prepare very pure iron, chromium, manganese, silicon and beryllium, all of considerably higher purity than has previously been attained anywhere.

Balances employed in the standardisation of weights were exhibited in the Metrology Department. Weights used for scientific purposes are customarily verified to an accuracy of 1 part in 1,000,000, but in special cases even greater accuracy can be obtained. Experimental sets of weights being tested for stability, hardness and resistance to corrosion were exhibited. The tape bench used for the verification of standard tapes used in geodetic surveys has been found to have lengthened by nearly $\frac{1}{4}$ in. since it was built in 1908. Comparators capable of detecting differences of length of $1/1,000,000$ in. were exhibited.

The new standard "Shortt" clock, now used as the standard reference clock at Greenwich Observatory, was shown. This clock, which is free of escapement drive, comprises two pendulums, a master and a slave, working synchronously and maintained electrically. The former is of invar steel of zero coefficient of expansion, suspended by a strip of ellinvar of zero elasticity, and swings in an atmosphere of only 1-in. mercury pressure.

In the Physics Department a determination of the heat of combustion of carbon monoxide is being undertaken. The apparatus being employed, utilising the method of continuous flow calorimetry, was shown. A novel method for the measurement of flame temperatures has been developed in the department. The image of the tungsten sphere of a "pointolite" lamp is focussed through the flame on to a spectroscope. A sodium salt is introduced into the flame, and if the temperature of the flame is greater than that of the tungsten sphere, bright sodium lines show up on a continuous spectrum background. If the temperature is lower, reversal of the sodium lines takes place, the lines appearing dark. By careful adjustment of the temperature of the tungsten sphere, a point is reached at which all trace of either bright or dark lines disappears. This balance can be effected to within a few degrees. The temperature of the tungsten filament is then

determined by an optical pyrometer. A valve-controlled high-frequency furnace employed in an accurate determination of the melting point of palladium, and using a current of about 150 amps. in the oscillatory circuit at a frequency of about 1,000,000 cycles per sec. was shown. The department assists in the work of the X-ray and radium protection committee, established in 1921, by making measurements of the lead equivalent of materials used for X-ray protection, and by inspecting equipments. Plants used in determining the lead equivalents of such materials at voltages up to 100,000 and 200,000 volts were exhibited. Representative samples of protective materials, including heavy plaster slabs and cement blocks used in the construction of X-ray rooms, were also shown.

The subject of colour measurement is of considerable commercial importance in the dyeing, paint and varnish, and many other industries. Work carried out at the Laboratory has now rendered possible the introduction of scientific methods of colour measurement in place of the empirical and unrelated methods on which technical colour workers have had to rely in the past. The colorimeter developed in the Laboratory was amongst the exhibits in the Optics Department.

SOCIETY OF GLASS TECHNOLOGY

The one-hundredth meeting of the Society of Glass Technology was held in Sheffield on Wednesday, June 15, the President, Mr. Walter Butterworth, Sen., M.A., in the chair. Sir W. H. Hadow, C.B.E., D.Mus., LL.D., Vice-Chancellor of the University of Sheffield, was present and congratulated the Society on reaching its one-hundredth meeting.

A paper entitled "Gaseous fuels for furnace heating" was presented by Mr. R. Wiggington, B.Sc.

The chief gaseous fuel is producer gas, made by the partial combustion of coal (or coke) in an air-steam blast. Considerable variation in composition may be obtained by modifying the ratio of air to steam. Increasing the steam causes the partial replacement of carbon monoxide by hydrogen, and of nitrogen by carbon dioxide. A moderate use of steam improves the gas, but a further increase is disadvantageous. In a bunsen flame, the flame speed determines the back-firing tendency and the height of the inner cone. Hydrogen will thus give a shorter flame than carbon monoxide or methane.

In a non-aerated jet flame, on the other hand, the flame length depends chiefly on the air requirement. Hydrogen and carbon monoxide, each needing $2\frac{1}{2}$ times their own volume of air, will give equal jet flames, while methane, needing 10 volumes of air, will have a flame 4 times as long as either. Reduction of the oxygen in the atmosphere will cause a lengthening of the flame, which will finally leave the burner top and float about just before extinction.

The flame in a furnace may be regarded as a jet flame modified by turbulence to something approaching a bunsen flame. Hydrogen will still give a shorter flame than carbon monoxide in such circumstances. A long flame is generally preferred to give uniform heating.

Hydrogen more than other gases is liable to undergo flameless catalytic "surface combustion" in contact

with red hot brickwork. This (in ordinary furnace) is undesirable, as it leads to non-uniform heating and greater wear and tear of the refractories.

Gas rich in carbon monoxide is to be preferred on account of its longer flame, greater radiating power, and smaller liability to surface combustion. Uniformity in the gas (or at all events, absence of accidental variations) is obviously also very desirable, apart from the actual composition. These ends can only be secured by proper control over the blast saturation temperature of the producer; a thermometer in the blast pipe, or some more elaborate equivalent, is essential. Some form of positive blower is much easier to control than the usual steam jet. Sufficient steam to minimise clinker trouble must be used.

ROYAL PHOTOGRAPHIC SOCIETY Scientific and Technical Group

The Royal Photographic Society of Great Britain will hold its 72nd Annual Exhibition in September and October, 1927. This is the most representative exhibition of photographic work in the world, and comprises the recent achievements of photography, both pure and applied. It is desired to make the Scientific and Technical Section as representative as possible, and with this end in view exhibits are invited, which may comprise apparatus, models, prints, diagrams, transparencies, or any other form of record illustrating the applications of the photographic method to biology, botany, mineralogy, microscopy, geography, geology, spectroscopy, photometry, engineering, colorimetry, textiles, etc. Those who have material at their disposal suitable for exhibition will serve the best interests of photography if they will send their exhibits, before August 13, 1927, addressed to the Royal Photographic Society, 35, Russell Square, W.C.1. All communications should be addressed to the Hon. Secretary of the Scientific and Technical Group, Mr. Olaf Bloch, 35, Russell Square, W.C.1.

CANADIAN EXPLOSIVES

The annual report of the Explosives Division of the Dominion of Canada for the calendar year 1926 shows a net increase of two factories operating over 1925. There was no serious accident in manufacture, those arising being due to burns. The production for the year was as follows:—

Class I.	Gunpowder	...	383,543 lb.
„ II.	Nitrate mixture	...	1,167,773 „
„ III.	Nitro-compounds	...	34,350,210 „
„ IV.	Chlorate mixtures	...	133,400 „
„ V.	Fulminate, Div. I.	...	94,508 „
„ VI.	Ammunition	...	Not fully disclosed.
„ VII.	Fireworks	...	Approximate value, \$185,000.

There was an increase of about 4% in the blasting explosive classes, as compared with the output of 1925. The chief explosive materials imported were for re-manufacture, and consisted of nitro-compounds for explosive factories 111,890 lb., nitrocellulose 324,950 lb. Nitrocellulose for lacquers etc. amounted to 388,530 lb. Propellants 116,415 lb., Cordeau-Bickford fuse 275,688 ft., and fireworks 332,000 lb., were the chief items.

CORRESPONDENCE ASBESTOS FIBRES

SIR,—I have read through the article, "The characteristics and properties of the main types of asbestos fibres," in the issue of June 11, with considerable interest, as it is seldom that there is any reference in the technical press to this increasingly important industry.

There are several points, however, particularly references to the amphibole group, which I think it would be difficult to corroborate.

It is mentioned that the individual fibres of crocidolite (*i.e.*, South African Blue) are not so strong as the white chrysotile. This fact is referred to again in the concluding paragraph, where it is stated that "weight for weight, a chrysotile yarn is much stronger than crocidolite." It is my experience that the reverse of this is the case, and the results of tests made over long periods show that a blue asbestos yarn (crocidolite) is at least 50% stronger than a white asbestos (chrysotile) yarn of the same weight. In support of this contention I refer to a memorandum published in 1926, entitled "Asbestos with special reference to Canada," issued by the Natural Resources Intelligence Service, Canadian Department of the Interior, Ottawa, where it states that the strength of crocidolite is higher than chrysotile.

In referring to amosite the subject is dismissed lightly in a few words. I am afraid, however, that the author is not fully conversant with the position regarding amosite as it is to-day. This is the newest type of asbestiform mineral, and while these remarks may have been applicable to the mineral mined at first, yet this defect has been largely remedied with the material now being produced, for which a large and increasing market is being found.

Further, it is stated that the percentage of combined water in crocidolite asbestos varies from 4% to 10%. For these figures I can find no corroboration, either in my own tests or from reference to reports of the Department of Mines and Industries of The Union of South African Government. It can be stated that the maximum percentage of combined water as measured by the ignition loss in crocidolite and amosite is 4%. While the hypothesis that high combined water content is indicative of increased strength and flexibility may be true in the case of chrysotile, it is certainly not true in the case of crocidolite and amosite, for it is found that in the best grades of spinning fibres this figure falls to about 1%, whereas in the lower grades this figure rises to between 2% and 3%.

The fixing of 200° C. as the safe temperature of use for crocidolite is far too low, for the author's own figures in Table III quote 300° C. as producing no deterioration, and 400° C. as very little. Blue asbestos to-day is being freely used to the exclusion of all other materials for insulating surfaces maintained at temperatures as high as 500° C.

It is to be noted that the author definitely states that boiler mattresses made of crocidolite are more efficient than similar mattresses made of chrysotile. This, of course, is now generally accepted.

It is difficult to find corroboration for the author's statements that blue asbestos "is comparatively unstable" and "is liable to oxidise." Conditions prevailing

during the manufacture and use of asbestos cement sheets, for instance, are surely such as would produce oxidation, yet blue asbestos is being extensively used to produce a slate of great strength and durability.

Yours faithfully,

Chingford, E.4

A. J. DUNK

CLEANING OF COAL

SIR,—Prof. Louis' Messel Memorial Contribution dealing with the cleaning of coal will have been studied with interest by a large number of readers, and it deserves to provoke a useful discussion on this most opportune subject.

The difficulty is rightly emphasised by the author of de-watering in an economical way the sludge resulting from wet-cleaning of coal and the froth obtained by the flotation method. Considerable attention has been given to this point on the Continent, and as a result of very careful researches a type of filter has been designed by the Wolf Co. which is giving satisfactory results. A number of collieries in the Westphalian area are using this filter on washery sludge and on flotation coal, and the Dutch State Mines at Limburg, in Holland, have no less than 20 machines working on froth floated fine coal.

As regards the size of coal that can usefully be dealt with on a concentrating table, Prof. Louis infers that "the maximum is at $\frac{1}{2}$ in." Coal up to 1 in. is to-day being successfully wet-cleaned in this country on "Overstrom" coal-washing tables.

In the penultimate paragraph it is stated that the principle of difference in elasticity has been used in the Berrisford separator. Does not the Berrisford separator depend for its action on the difference of frictional resistance between coal and dirt sliding over a polished surface?—Yours, etc.,

HUNTINGTON, HEBERLEIN & CO., LTD.

London, E.C.4

A.S.L.I.B. DIRECTORY

SIR,—May I be allowed through the medium of the press to offer my thanks to all those who have kindly responded to my request for information in connection with the preparation of the Directory of Sources of Specialised Information, and at the same time beg those who could assist but have not yet written to me to do so at once as we are fast approaching the close of our work. I should especially like to be able to include some more collections in the possession of private individuals. I am, Sir, etc.,

G. F. BARWICK,
Secretary

Association of Special Libraries and
Information Bureaux, London, W.C.

AN ENQUIRY

An inquirer will be glad to receive information as to the names of some firms who can supply powdered metals 200 mesh to dust. Replies should be addressed to The Editor, CHEMISTRY AND INDUSTRY, 46-47, Finsbury Square, E.C.

PERSONAL AND OTHER ITEMS

The degree of LL.D. was conferred on the Rt. Hon. Sir Alfred Mond, Bart., M.P., at a graduation ceremony held at St. Andrews on June 28.

Mr. G. Le M. Mander, of the firm of Mander Bros., paint manufacturers, of Wolverhampton, has been adopted by the East Wolverhampton Liberal Council as prospective candidate, Mr. G. R. Thorne, M.P., having decided not to stand at the next General Election.

The Rt. Hon. Sir Alfred Mond, Bart., M.P., has resigned from the Board and the chairmanship of the Magadi Soda Co., Ltd., and Sir John Brunner has joined the Board and accepted the chairmanship. Lieut.-Colonel G. P. Pollitt, D.S.O., has been appointed to the Board.

Third Census of Production (Cement Trade)

Particulars are given below of the values of the output returned for the years 1924 and 1907 for the cement trade. The particulars given for 1924 relate to works in Great Britain only, and those for 1907 to the United Kingdom as a whole. The output in Ireland for that year was not sufficient to disturb comparisons:—

Products	1924		1907	
	Quantity Tons	Selling Value £	Quantity Tons	Selling Value £
Cement for building and engineering purposes ..	3,143,000	6,705,000	2,877,000	3,139,000
Chalk, prepared (including whitening) ..	80,000	147,000	—	70,000
Lime —				
White lime ..		46,000	—	19,000
Hydraulic and other lime ..		95,000		61,000
Casks (not included above in value of goods) ..		402,000		21,000
Quarry products sold ..		36,000	—	—
All other products ..		220,000	—	125,000
Total value ..		7,651,000	—	3,735,000

The quantity of cement manufactured in 1924 showed an increase of about 9% over the output in 1907, whilst the average value at works increased from about 24s. per ton in 1907 to 43s. per ton in 1924, or 79%. In both years manufacturers were instructed to exclude from the values to be stated for their products the value of returnable casks or cases. In 1924 exports of calcareous cement amounted to 651,000 t., valued at £1,609,000, or approximately 49s. per ton f.o.b., and net imports to 160,000 t., valued at £117,000 c.i.f., or an average of 52s. per ton. About 21% of the total quantity of cement made in 1924 was exported. In 1907 the cement exported, 764,000 t., was nearly 26½% of the quantity made, and in comparing 1924 with 1907 it must be remembered that 78,000 t. of the 1924 exports was consigned to the Irish Free State, shipments to which were not classed as exports in 1907. The amount available in Great Britain in 1924 appears to have been greater than in 1907 by roughly 500,000 t. The net output of the works in the industry in 1924 amounted to £4,679,000, and the net output per person employed was about £363 in 1924 and £132 in 1907. The cost of materials per ton of cement produced was 53% greater in 1924 than in 1907, and products other than cement were relatively more important in the later year. The aggregate cost of materials fell from about 48% of the total value of output in 1907 to about 39% in 1924. In this connexion it may be noted that,

per head of the aggregate number employed, the output of cement was 194 tons in 1907 and 244 tons in 1924. The larger out-turn of cement per head was due doubtless to the more general employment of rotary kilns.

In 1907 the number of persons employed in the industry was 14,819, and in 1924 the number totalled 12,874. The total capacity of the engines at the cement works and quarries in the industry was 90,256 h.p. in 1924, of which nearly 20% was in reserve or idle, compared with 60,079 h.p. in 1907. The capacity of electric generators at cement works in 1924 was 43,700 kw., and in 1907, 6685 kw.

Spanish Potash Production

A Spanish ministerial decree fixes the production of potash salts in Spain at a maximum of 60,000 tons and a minimum of 15,000 tons, the content of potassium chloride being 80% in both cases. Not more than 25% of the total output may be exported.

Chemical Employment in the United States

According to the U.S. Bureau of Labour Statistics, the number of pay rolls in the U.S. chemical industry during December decreased by less than 0.5%, compared with November. The number in the fertiliser industries fell by 11%, and in the petroleum refining industries by 0.6%, whereas there was an increase of 0.4% in the chemical industry. A total of 283 establishments manufacturing chemical and allied products reported 90,128 persons on the pay roll in December (91,581 in November), the distribution being: chemical industries, 29,458 (29,586); fertilisers, 7811 (8806), and petroleum refining, 52,859 (53,189).

Tin Poisoning

Poisoning by tin or its salts is a very rare occurrence in industry; in fact, only three cases of alleged poisoning appear to be recorded in literature. One case (*J. Ind. Hyg.*, February, 1927) was of a German, aged 66, who had been for ten years occupied in mixing a solution of tin tetrachloride in hydrochloric acid for use in the manufacture of silk. The arrangement for mixing was crude, but although highly irritating fumes were evolved, the worker was but little inconvenienced by them. Unusual symptoms were shown which suggested a diagnosis of neuritis. Traces of tin were found in the urine and faeces on two occasions, but on another no tin was found. The conclusion was reached that it does not seem reasonable to attribute poisonous properties to tin while only three cases of alleged poisoning can be discovered in the literature, and until other cases are added, a verdict of "not proven" must be given.

Italian Essential Oils

In consequence of the action of the United States Customs in regard to the admission of Italian essential oils, the Italian Minister of National Economy has issued an order providing that henceforth samples for analysis must be submitted of all consignments of essential oils destined for export. As a result, the Chamber of Commerce of Messina, acting in conjunction with the Camera Agrumaria and the Experimental Station, now refuses to grant an export permit to consignments of essential oils unless accompanied by a certificate of analysis. A control laboratory is to be opened shortly in Milan.

REVIEWS

INDICATORS, THEIR USE IN QUANTITATIVE ANALYSIS AND IN THE COLORIMETRIC DETERMINATION OF HYDROGEN-ION CONCENTRATION. By Dr. I. M. KOLTHOFF, translated from the 2nd German edition, revised and enlarged, by N. HOWELL FURMAN, Ph.D. Pp. xii + 269. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, 1926. Price 17s.

This translation is based on the second German edition of Kolthoff's book, which has also appeared in a French version by M. Vellinger (*CHEM. AND IND.*, 1926, 45, 247). Reference may be made to this review for a further account. The book, as its title implies, deals only with colorimetric determinations; potentiometric determinations by the hydrogen electrode etc. are described in the supplementary volume on "Electrometric titrations," by the same author (see *CHEM. AND IND.*, 1926, 45, 912), and in M. Kopaczewski's book.

The theoretical part is based on the classical theory of hydron and hydroxylion equilibria, as applied particularly to weak acids and bases which obey the law of concentration action (dilution law). The numerous and useful computations which have been rendered possible by this theory are clearly expounded. The full experimental directions for the use of each indicator or test paper are to a considerable extent the result of the author's research. One could have wished for a more adequate treatment of sparingly soluble acids and salts (the solubility product). Also the acidities and alkalinities due to strong acids and alkalis are hardly referred to, and not tabulated. It is thus evident that this short review calls merely for an enlargement of scope, and is written with full appreciation of a most excellent practical text book.

E. B. R. PRIDEAUX

CHEMICAL SYNONYMS AND TRADE NAMES: A DICTIONARY AND COMMERCIAL HANDBOOK. By W. GARDNER. Third edition, revised and much enlarged. Pp. 355. London: Crosby Lockwood & Son, 1926. Price 30s.

The short time within which this book has reached its third edition indicates that it fills a real need. A considerable improvement was shown in the second edition, but the third edition shows a still further advance, as the number of definitions and cross-references in the dictionary has been increased by 3000 to 20,000, and the number of pages from 327 to 355, whilst much of the matter has been rewritten and improved. Indeed, the progressive enlargement of the scope, and the amount of information given in the references, make one wonder whether the work may not eventually blossom out as an encyclopædia. However, as it stands, the book is most comprehensive, the definitions are concise and informative, and the volume will be useful to everyone who has to do with chemical and commercial products in name or fact. Both author and publishers deserve praise for the new edition, which is now free from the supplement placed at the end of the second edition, the new matter having been incorporated in the body of the book. The production conforms to the high standard set by previous editions.

PARLIAMENTARY NEWS

Sugar Beet Industry

In answer to Mr. Stephen, Sir J. Gilmour said it was not yet possible to give any figures for the current season, but from information received by him from the two companies who manufacture sugar from home-grown beet in Scotland, the number of persons who supplied beet of the 1926 crop was 1051. The amount of subsidies paid to the companies in respect of the 1926 crop was £71,421 8s. 5d.; under the British Sugar Subsidy Act, no subsidy was paid direct to growers. In 1926 the area under crop was 3649 acres, and it is estimated that in 1927 there will be 12,500 acres under crop. The total output for Scotland from the 1926 crop was 71,971½ cwt. of sugar, and 16,705½ cwt. of molasses. The Government had assisted the development of two factories in Scotland by way of guarantees under the Trade Facilities Act. The Orchard Sugar Co., Ltd., had received a guarantee of £150,000 in respect of the Greenock factory, and a guarantee of £865,000 had been given to the Second Anglo-Scottish Beet Sugar Corporation, of which approximately £250,000 was allocated to the cost of the Cupar factory. June 21.

British Celanese Ltd.

Mr. McNeill informed Mr. W. Thorne that the Government had recently sold 500,000 preference shares, the remainder of its holding in the British Celanese Company, at 20s. per share. June 22.

Fuel Research

The Duchess of Atholl informed Mr. Hardie that no entirely new process of coal treatment had been developed at the Fuel Research Station to the point of commercial application. The general policy, subject to considerations of public interest, was to place the results of Government research at the disposal of all responsible persons or firms in this country engaged in the industry or industries concerned. In the case of many improvements to processes of coal treatment now worked on the large scale by gas undertakings in this country, which have been suggested as the result of work at the Fuel Research Station, the results have been made generally available without charge. The general object of most fuel research, as well as other research undertaken by the Department of Scientific and Industrial Research, was not so much to develop commercial processes as to provide fundamental data on which commercial processes could be developed by private enterprise. June 23.

Research in the Sugar Industry

In reply to Mr. Kelly, Earl Winterton said he was aware that in 1925-26 India imported 738,224 tons of refined sugar as against 670,965 tons in the preceding year. A scheme for the establishment of a sugar research institute was laid before the Government of India some years ago. The Government of India intimated last year that they did not know when they would be in a position to give effect to the scheme, which involved a heavy outlay. A great deal was being done now to increase the production of sugar in India, and also to improve the quality of the sugar grown. June 27.

Cement

Sir K. Wood informed Mr. Dennison that on an average about 2½ tons of cement was required in the

construction of a brick subsidy house, in cases where cement was used. He had no information as to the quantity of foreign cement used for this purpose. According to recent quotations in Glasgow, the price of Scottish cement (blast furnace) was 47s. 6d. per ton, as compared with 47s. for foreign cement. Section 10 of the Housing (Financial Provisions) Act, 1924, provides that, in approving proposals for the construction of houses, the Minister of Health shall not impose any conditions which would prevent the materials required being purchased in the cheapest market at home or abroad. Local authorities have been urged by the Government to arrange that all contracts for or incidental to works carried out by them should, in the absence of special circumstances, be placed in this country. June 27.

COMPANY NEWS

MAGADI SODA CO., LTD.

A loss of £35,498 is reported for the year 1926, compared with a profit of £23,937 for 1925. This adverse result is attributed to production being discontinued in the early part of February, 1926, in order to clear old stocks. During this period of cessation the plant was overhauled and improvements effected, the benefit being apparent since production recommenced in August, 1926. The sum of £6680 is available for distribution, which will enable interest at 1% (which with 5% already distributed makes 6%) to be paid to debenture holders, leaving £1681 to pay a dividend at the rate of 0.768% to the first preference shareholders. Production and sales for 1927 have so far been satisfactory. Sir Alfred Mond, M.P., has resigned from the Board and the chairmanship, owing to his many other engagements, and Sir John Brunner has joined the Board and accepted the chairmanship. Mr. Arthur Colegate has resigned from the Board, and Mr. A. R. Gregory has been elected in his place. The directors have also appointed Mr. Duncan Marsh and Lieut.-Colonel G. P. Pollitt, D.S.O., to the Board.

ZINC CORPORATION, LTD.

The sixteenth ordinary general meeting was held on June 15, Sir Robert Horne, G.B.E., K.C., M.P. (chairman), presiding. He expressed deep regret at the death of the late chairman, Mr. F. A. Govett, who was chiefly responsible for the position in the mining world which the Corporation now held. His son, Mr. J. R. Govett, had been appointed a member of the Board, and Mr. W. S. Robinson had been elected managing director. The profit for 1926 amounted to £124,048, against £541,946 for 1925. A final dividend was declared of 4s. per share on the ordinary shares, making 7s., leaving £22,000 to be carried forward against £13,373 brought in. A year ago shareholders were advised to regard 1925 as a "peak" year, and not to expect a continuance of such profits in 1926. The decreased profits resulted from the loss of about a month's productive operation due to water shortage at Broken Hill and the reduction in metal prices. But for the former their ore output would have created a record for the company. The drop in the prices of metals had been serious, the difference between the average of 1925 and 1926 being no less than £4 15s. per ton as regards lead,

£2 2s. 4d. per ton for zinc, and 3·3293d. per ounce for silver. There had also been a further substantial fall, the differences between the average prices of 1925 and those ruling on the date of the meeting being no less than £11 6s. per ton of lead, £7 3s. 9d. per ton of zinc, and 5·6951d. per ounce silver. In 1926 production of lead and spelter exceeded the demand. The following figures show the world's production of lead and spelter in long tons:—*Lead*: 1914, 1,136,000; 1924, 1,301,501; 1925, 1,463,500; 1926, 1,538,500. *Spelter*: 1914, 864,300; 1924, 1,004,500; 1925, 1,128,500; 1926, 1,263,000. The chief work carried out at the mine at Broken Hill during the year was the sinking of the main shaft, and in 1927 the developments should be more productive from the point of view of opening up ore. On the metallurgical side, the work of the new plant had shown further progress during the year. The recovery of lead in lead concentrates had risen to approximately 92%, as against under 86·5% in the old plant, whilst the recovery of zinc in zinc concentrates was almost 80%, as against 50%. The company had joined with the British Metal Corporation and the Tanganyika Concessions in the formation of a company entitled the British (Non-Ferrous) Mining Corporation, Ltd., under the chairmanship of Sir Cecil Budd. This new company will be in a position to investigate and handle the mining proposals that are continually being brought to the three companies above-mentioned. In conclusion, the chairman said that although the immediate future could not give the same result as the years just past, the outlook for the Corporation appeared to be definitely favourable.

MINERALS SEPARATION LIMITED

A dividend has been declared of 10%, less tax, for 1926 (the same as for 1925), payable on June 30.

AMERICAN CYANAMID CO.

The usual quarterly dividend has been declared of $1\frac{1}{2}\%$ on the preferred stock, and a dividend of $1\frac{1}{2}\%$, plus $\frac{1}{2}\%$ extra, on the common stock.

PINCHIN, JOHNSON AND CO., LTD.

At an extraordinary general meeting of the ordinary shareholders, held on June 22, a resolution was passed to increase the share capital of the company to £1,350,000 by the creation of 250,000 additional £1 ordinary shares. This extra capital was required in order to acquire additional interests that would profitably and suitably fit in with the company's programme of development. For some time past the Board had been considering the question of applying its efforts to extending its activities in the ships' bottom and anti-fouling composition section of the paint trade, the field in that market being a very wide and extensive one. An agreement had been entered into whereby the company acquired the assets and goodwill of the Red Hand Compositions, Ltd., an old-established and successful company in this section of the trade. The business of the Red Hand Compositions, Ltd., will continue to operate as a separate trading unit, under the present efficient management. Only a small proportion of the additional shares to be created would be required to give effect to the agreement, leaving a considerable number of ordinary shares authorised but unissued, which in the near future would be applied for the direct benefit of the shareholders on such terms as the Board would eventually determine.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
Bisulphite of Lime. £7 10s. per ton, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate.—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
Arsenic Sulphide, Yellow.—1s. 9d. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 1d. per lb.
Diphenylguanidine.—3s. 9d. per lb.
Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals,—8d.—9d. per lb. Crude 60's, 2s. 3d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 4½d. per gal. Pale, 95%, 2s.—2s. 2d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 1s. 0½d.—1s. 1½d. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 8d.—2s. 0½d. per gal. Pure, 1s. 10d.—2s. 3½d. per gal.
 Xylol.—1s. 11d.—2s. 4d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24%,—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—8½d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 8½d.—9d. per gal., according to quality. Solvent 90/100, 1s. 2d.—1s. 11d. per gal. Solvent 95/100, 1s. 5d.—1s. 6d. per gal. Solvent 90/190, 1s. 1½d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals,—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—75s.—85s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d.—8d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4½d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. £40—£43 per ton. Powder £44—£47 per ton. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7½d.—1s. 8d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 3½d.—1s. 5d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 9d.—2s. 11d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton; Powder £39 per ton, in 5-cwt. casks. Resublimed.—Lump 1s. per lb., Powder 1s. 3d. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. 6d. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal £24—£27 per ton, Powder £26—£29 per ton, according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 6d. per lb. Potassium.—1s. 10d.—2s. 1d. per lb. Sodium.—2s. 1d.—2s. 4d. per lb. All spot.

Calcium Lactate.—1s. 3d.—1s. 5d. per lb.

Chloral Hydrate.—3s. 2d.—3s. 5d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7d. per lb., according to quantity.

Creosote Carbonate. 6s. per lb.

Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiaac Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ¼ lb., 9s. 6d. per doz.; ½ lb., 6s. 6d. per doz. 10 vols.—2s. 3d.—2s. 11d., according to quality and package.

Hydroquinone.—4s. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—4d. per lb., 20s.—22s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £02 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 11s.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonol.—11s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—3s. per lb.

Phenazone.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.

Resorcin.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911.—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hypsulphite.—Photographic, £15 6s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonol.—7s. 6d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.

Thymol, Puriss.—10s. 3d.—11s. 6d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (ex Anethole).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—8s. 9d. per lb.

Ethyl Cinnamate.—7s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—9s. per lb. Geraniol (Pulmarosa).—17s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. per lb.—(ex Shui Oil) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 6d. per lb. Vanillin.—17s.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. 1d. per lb. Bergamot.—28s. 6d. per lb. Bourbon Geranium.—14s. 6d. per lb. Camphor.—67s. 6d. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure.—6s. per lb. Eucalyptus, 75/80%.—2s. 4d. per lb. Lavender.—Mont Blanc 38/40%, 21s. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 18s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 6d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Aug. 20th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on July 7th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications
Allia-Chalmers Manufacturing Co., and Newhouse. Crushers. 15,725. June 13.
Andrews. Elutriators for testing finely-divided etc. materials. 15,855. June 14.
Bräuer. Refrigeration. 16,045. June 16. (Ger., 25.6.26.)
Dann. Furnaces. 15,825. June 14.

Du Pont de Nemours & Co. Catalysts etc. 15,717. June 13. (U.S., 12.6.26.)

Higgins. Carrying out chemical reactions at high temperatures. 16,245. June 18.

I.-G. Farbenind. Carrying out catalytic oxidations. 15,723. June 13. (Ger., 14.6.26.)

Kendall. Manufacture of concentrated stable gels. 15,941. June 15.

Kidde & Co. Detection of suspended matter in aeriform fluids. 15,863. June 14. (U.S., 17.6.26.)

Marks (Petroleum Process Co.). Treating fluids etc. 15,711. June 13.

Mielek. Continuous treatment of liquids with gases. 15,854. June 14. (Ger., 15.6.26.)

Piron. Distillation process. 15,698. June 13. (U.S., 27.7.26.)

Walker. Centrifugal mills. 15,657. June 13.

I.—Complete Specifications

30,808 (1925). Empson. Centrifugal filtering-apparatus. (271,916.)

9030 and 9932 (1926). Tinker. Drying apparatus. (272,316 and 272,319.)

14,782 (1926). Empson Centrifugals, Ltd., and Alexander. Centrifugal purifying and dehydrating apparatus. (272,339.)

20,404 (1926). Geigy A.-G. Mixing liquids for carrying out reactions and producing dispersion systems. (257,274.)

24,422 (1926). Parker. Centrifugal extractors. (272,368.)

*15,717 (1927). Du Pont de Nemours & Co. Catalysts and catalytic processes. (272,555.)

*15,723 (1927). I.-G. Farbenind. Carrying out catalytic oxidations in the gaseous or vapour state. (272,557.)

II.—Applications

Dunlop (McQuade). Carbonising coal. 15,796. June 14. I.-G. Farbenind. Manufacture of liquid hydrocarbons etc. 15,722. June 13. (Ger., 14.6.26.)

Johnson (I.-G. Farbenind.). Manufacture of liquid products from coal etc. 16,068. June 16. Production of hydrogen. 16,253. June 18.

Mills and Noble. Coal briquettes. 15,663. June 13.

N. V. Silica en Ovenbouw Mij. Coke ovens. 16,094. June 16. (Ger., 16.6.26.)

Sacchi. Production of hydrogen. 15,758. June 13.

Vercin f. Chem. Ind. Producing active carbons. 15,926. June 15. (Ger., 3.7.26.)

II.—Complete Specifications

6253 (1926). Foersterling. Manufacture of air gas. (248,770.)

6420 (1926). Standard Telephones & Cables, Ltd. (Western Electric Co.). Manufacture of granular carbon. (272,279.)

6811 (1926). Henshaw. Condensers for recovery of by-products in carbonisation of coal etc. (272,293.)

6949 (1926). Williams, and Minerals Separation, Ltd. Froth-flotation concentration of coal. (272,301.)

20,866 (1926). Svenska Akt. Mono. Gas-analysing apparatus. (257,609.)

26,227 (1926). Still. Distillation of solid fuels. (272,375.)

6878—9 (1927). Allgem. Ges. f. Chem. Ind. Converting high-boiling into low-boiling hydrocarbons. (271,042 and 272,433.)

*14,170 (1927). I.-G. Farbenind. Manufacture of hydrocarbons from mineral oils, tars, etc. (272,483.)

*14,767 (1927). Hellmann. Ovens for treating fuels. (272,493.)

*15,376 (1927). Comp. des Mines de Bruay. Distillation of fuels at low temperatures. (272,522.)

*15,386 (1927). Trautmann. Extraction of hydrocarbon oils from coal. (272,526.)

*15,525 (1927). I.-G. Farbenind. Destructive hydrogenation of carbonaceous materials. (272,538.)

*15,526 (1927). I.-G. Farbenind. Treatment of coal tars mineral oils, etc. (272,539.)

*15,722 (1927). I.-G. Farbenind. Manufacture of liquid hydrocarbons etc. from coal, tars, mineral oils, etc. (272,556.)

III.—Complete Specifications

*14,179 (1927). I.-G. Farbenind. See II.

*15,526 and 15,722 (1927). I.-G. Farbenind. See II.

IV.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of compounds from indene and phenols. 15,865. June 14. Manufacture of condensation products of the aromatic series. 15,996. June 15. Manufacture of dyestuffs. 16,087. June 16.

Chem. Fabr. vorm. Schering. Manufacture of condensation products from alkylated phenols and ketones. 15,992. June 15. (Ger., 29.6.25.) 15,993—4 and 16,198. See XX.

I.-G. Farbenind. Production of metallic compounds of dyestuffs. 15,724. June 13. (Ger., 15.6.26.) Manufacture of dyestuffs. 15,967. June 15. (Ger., 15.6.26.) Production of dyestuffs. 16,172. June 17. (Ger., 17.6.26.)

Imray (I.-G. Farbenind.). Manufacture of naphthalene derivatives. 16,092. June 16.

IV. Complete Specifications

6020 (1926). I.-G. Farbenind. Manufacture of anthraquinone compounds. (248,759.)

10,159 (1926). British Dyestuffs Corp., Rodd, and Linch. Preparing triarylmethane dyes. (272,321.)

*13,509 (1927). I.-G. Farbenind. Production of anthraquinone derivatives. (272,469.)

*15,422 (1927). I.-G. Farbenind. Manufacture of compounds of the perylene series. (272,528.)

V. Applications

Bernard. Preparation of cellulose compounds. 15,812. June 14. (Fr., 24.6.26.)

Diehl and Huebner. Spinning artificial silk etc. 15,786. June 14.

Leuchs. Manufacturing artificial silk etc. from viscose. 16,264. June 18.

N.V. Nederlandsche Kunstzijdefabr. Manufacture of artificial textile products. 16,080. June 16. (Italy, 16.6.26.)

Ohsaka. Production of artificial silk. 15,704. June 13.

Textile et Filature Soc. Anon. Preparation of kapok etc. for spinning. 15,785. June 14. (Fr., 14.6.26.)

V.—Complete Specifications

*13,806 (1927). Du Pont Rayon Co. Manufacture of viscose. (272,475.)

*15,785 (1927). Textile et Filature Soc. Anon. Preparation of kapok etc. for spinning. (272,564.)

VI.—Application

I.-G. Farbenind. Dyeing textile goods. 16,093. June 16. (Ger., 18.6.26.)

VI.—Complete Specification

*14,178 (1927). I.-G. Farbenind. Production of dyeings on cellulose esters or ethers. (272,482.)

VII.—Applications

Austin and Bailey. 16,105. See XIII.

Johnson (I.-G. Farbenind.). Manufacture of calcium nitrate etc. 16,067. June 16. 16,253. See II.

Sacchi. 15,758. See II.

Uhde. Separating ammonia from gases etc. 15,984. June 15. (Ger., 15.6.26.) Synthesis of ammonia. 15,985. June 15. (Ger., 15.6.26.)

VII.—Complete Specifications

30,647 (1926). I.-G. Farbenind. Purification of alkali cyanide solutions. (262,456.)

30,881 (1926). I.-G. Farbenind. Production of sodium sulphide. (264,464.)

VIII.—Application

Port. Manufacture of splinterless glass. 15,736. June 13.

VIII.—Complete Specifications

29,473 (1926). Quartz & Silice. Manufacture of ceramic materials. (263,765.)

707 (1927). Soc. Anon. des Manuf. des Glaces et Prod. Chim. de St. Gobain. Glass. (264,490.)

IX.—Applications

Pickstone. Manufacture of cement mortar etc. 16,031. June 16.

Soc. Anon. La Trinidad. Manufacture of asphaltic etc. emulsions. 15,705. June 13. (Fr., 15.10.26.)

IX.—Complete Specifications

23,206 (1926). Hack. Material for roadways etc. (258,870.)

29,060 (1926). Okuri. Insulating compositions containing mica. (272,384.)

*13,961 (1927). Thompson. Concrete. (272,479.)

X. Applications

Barton. Manufacture of metallic sublimates. 15,897. June 15.

Canning & Co., Ltd., and Pope. Electroplating apparatus. 16,257. June 18.

Coles. Transmutation of metals. 15,653. June 13. Transparent metals. 15,654. June 13.

L.-G. Farbenind. Recovering metals from scrap. 15,753. June 13.

Jones. Reduction of non-ferrous oxides etc. 15,659. June 13.

Metallbank und Metallurgische Ges. Production of diffused layers on metals. 15,957. June 15. (Ger., 15.6.26.)

Norbury. Thermal treatment of silver alloys. 15,673. June 14.

Picard and Sulman. Extraction of tin etc. from ores. 15,665. June 13.

Turnbull. Galvanising baths. 15,777. June 14.

Verein. Stahlwerke. Manufacture of cast iron. 15,851. June 14. (Ger., 15.6.25.)

Wüst. Purifying pig iron. 16,155. June 17. (Ger., 17.7.26.)

X.—Complete Specifications

10,062 (1926). Beckinsale and Waterhouse. Lead alloys. (272,320.)

12,008 (1926). Tullis. Purifying aluminium and its alloys. (272,326.)

21,209 (1926). Grunwaldt. Removal of impurities from minerals etc. (258,246.)

*15,304 (1927). Moulin and Berger. Manufacture of zinc and zinc products. (272,517.)

XI.—Applications

Canning & Co., Ltd., and Pope. Electrolytic apparatus. 15,764. June 14. 16,257. *See* X.

Jackson (Burgess Laboratories). Dry cells. 15,744. June 13. Kelsen. Anode for electrolytic purposes etc. 15,754. June 13. (Austria, 11.6.26.)

Metallwerk Plansee Ges., and Schwarzkopf. Electric furnaces. 16,006. June 15. (Ger., 16.6.26.)

Silica Gel Corp. Electric storage batteries. 15,668. June 13. (U.S., 12.6.26.) Electric batteries. 15,872. June 14. (U.S., 15.6.26.)

XI.—Complete Specifications

13,366 (1926). Darimont. Double-fluid cells. (266,602.)

25,051 (1926). British Thomson-Houston Co., Ltd. Electric furnaces. (259,599.)

29,060 (1926). Okuri. *See* IX.

*15,121 (1927). British Thomson-Houston Co., Ltd. Treating filaments. (272,500.)

*15,668 (1927). Silica Gel Corp. Storage batteries. (272,550.)

*15,754 (1927). Kelsen. Anode for electrolytic purposes. (272,563.)

XII.—Complete Specifications

*15,203—4 (1927). Harvel Corp. Treating cashew-nut-shell oil. (273,509—10.)

XIII.—Applications

Austin. Production of white lead. 16,105. June 16. (U.S., 22.6.26.)

Carroll. Anticorrosive heat-resisting paint etc. 16,233. June 18.

Nobel Industries, Ltd. (Du Pont de Nemours & Co.). Coating compositions. 16,262. June 18.

Schmidt. 16,079. *See* XX.

XIV.—Applications

Johnson & Johnson (Great Britain). Ltd. (Johnson & Johnson). Manufacture of rubber emulsion. 16,000. June 15.

Synd. Franco-Néerlandais. Regeneration of rubber. 16,028. June 16. (Fr., 25.8.26.)

XIV.—Complete Specification

27,490 (1926). Goodrich. Thermo-plastic derivatives of rubber. (260,637.)

XV.—Applications

Jaroslav's Erste Glimmerwaren-Fabr. Manufacturing plastic masses from casein etc. 16,162. June 17. (Ger., 17.6.26.)

Johnson (L.-G. Farbenind.). Manufacture of tanning-agents. 16,254. June 18.

XV.—Complete Specification

15,550 (1927). Keleti. *See* XXIII.

XVII.—Applications

Elektro-Osmose A.-G. Purifying sugar solution. 16,095. June 16. (Ger., 16.6.26.)

Ellis (Chem. Works formerly Sandoz). Oxidation of aldoses. 16,187. June 17.

Marks (Corn Products Refining Co.). Manufacture of dextrose. 15,977. June 15.

Mautner. Increasing stability of starch, sugar, etc. 15,980. June 15.

Nouvelles Industries Chimiques. Recovery of nitrogen and acetone from molasses etc. 15,726. June 13. (Belg., 21.9.26.)

XVII.—Complete Specification

6346 (1926). Stern. Making starch products. (272,274.)

XIX.—Applications

Carpmael (L.-G. Farbenind.). Conserving foods etc. 15,864. June 14.

Ebor Trading Co., Ltd., and Greville. Treatment of cereals. 16,221. June 18.

Greville. Manufacture of wheat flour etc. 15,950. June 15.

Miles and Reilly. Preparation of vegetable food. 16,185. June 17. (U.S., 8.7.26.)

XIX.—Complete Specifications

26,645 (1926). Agopian. Production of concentrated preparations of vitamine C. (272,376.)

*13,504 (1927). Zierer. Preparation of yoghurt milk etc. (272,468.)

XX.—Applications

Bertsch, and Böhme A.-G. Rendering alcohols soluble. 15,954. June 14. (Ger., 15.6.26.)

Carpmael (L.-G. Farbenind.). 15,865 and 15,996. *See* IV.

Chem. Fabr. vorm. Schering. Manufacture of mixed alkaloid salts. 15,766. June 14. (Ger., 26.6.26.)

Manufacture of alkylisopropylphenols etc. 15,993—4. June 15. (Ger., 29.6.26.)

Manufacture of alkylated phenols etc. 16,198. June 17. (Ger., 14.7.26.) 15,992. *See* IV.

Consort. f. Elektrochem. Ind. Manufacture of acetic anhydride. 15,966 and 16,179. June 15 and 17. (Ger., 16.6.26 and 17.6.26.)

Ellis (Chem. Works formerly Sandoz). 16,187. *See* XVII.

Johnson (L.-G. Farbenind.). Manufacture of organic compounds. 16,252. June 18.

Nouvelles Industries Chimiques. 15,726. See XVII.

Schmidt. Production of artificial materials from condensation products of urea etc. 16,079. June 16. (Ger., 8.12.26.)

Stephens (Wülfing). Manufacture of primary propyl ester of 2-phenylquinoline-4-carboxylic acid. 16,191. June 17.

Tcherniac. Manufacture of alkyl ethers of phenolic amides. 15,695. June 13.

Verley. Substituting alkyl group in the aromatic nucleus. 16,097. June 16. (Fr., 31.3.27.)

Wecker. Manufacture of esters of fatty acids etc. 15,681. June 13. (Ger., 23.6.26.)

XXI.—Applications

Devienne. Toning etc. photographic prints. 15,968. June 15. (Fr., 21.6.26.)

Harding, Ltd., and Leuch. Manufacture of photographic material. 16,184. June 17.

Liguoro. Production of photographic films. 15,979. June 15.

XXIII.—Complete Specifications

*15,550 (1927). Keleti. Producing a disinfectant, tanning agent, etc. (272,541.)

*15,572 (1927). Boehringer Sohn. Production of disinfecting agents. (272,543.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Crockery, druggists' sundries (Commercial Bureau, Australia House, Strand, W.C.2, Ref. No. 454). *Belgium*: Waterproof cloth (638). *British India*: Chemists' sundries, perfumery, soaps, patent medicines (630); paint (zinc, lead and various, ground and mixed), weldless steel (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Bulgaria*: Drugs (B.X. 3586). *Canada*: Cocoa butter (631). *New Zealand*: Water meters, concrete mixing machines (633); steelwork (B.X. 3579). *Norway*: Leather (645). *South Africa*: Steel (A.X. 4815). *Spain*: Metal scrap (iron, steel, copper, gunmetal, brass, copper wire and heavy copper) (647).

Safeguarding of Key Industries

The Board of Trade give notice that the Treasury, by order dated June 23, have exempted under the provisions of section 10 (5) of the Finance Act, 1926, for the period from June 27, 1927, to March 6, 1928, the following articles from the duty imposed by section 1 of the Safeguarding of Industries Act, 1921, as amended by the Finance Act, 1926: ammonium perchlorate, dial (acid diallyl barbituric), Elbon (cinnamoyl para oxyphenyl urea), hydroquinone, integrators (planimeter type), R lead acetate, lipoidin, phytin, planimeters, potassium guaiacol sulphonate (thiocol), urea (carbamide).

British Standard Specifications

The British Engineering Standards Association has issued British Standard Specification No. 281—1927 for blanc fixe, No. 282—1927 for lead chromes (primrose, lemon, golden or middle, and orange), No. 283—1927 for Prussian blue, No. 284—1927 for carbon black, No. 285—

1927 for bone black, No. 286—1927 for vegetable black, No. 287—1927 for lamp black, and No. 288—1927 for mineral black. They contain clauses regulating the composition, together with standard reception tests, for the purchase of these materials, and appendices giving methods of carrying out the tests. These specifications have been prepared at the request of the paint manufacturers by a committee representative of both the buying and manufacturing interests, and as in the case of all British Standard Specifications, they will be reviewed as experience of their working or progress in the industry renders it necessary, and revised issues will be published from time to time. Copies of these eight new specifications (Nos. 281/288) can be obtained from the B.E.S.A., Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

News from Advertisements

1. The Department of Scientific and Industrial Research announces various vacancies for research chemists (p. vi).

2. A qualified chemist is wanted immediately for a mine on the Eastern Mediterranean coast (p. vi).

3. The Egyptian University, Cairo, requires a glass blower (p. vi).

4. The Air Ministry announces a vacancy for a test assistant in the Metallurgical Department of the Royal Aircraft Establishment (p. vi).

5. A routine worker is required in the laboratory of a large dairy company (p. vi).

6. The Manchester Municipal College of Technology announces particulars of various courses (p. vi).

7. The Royal Technical College, Glasgow, announces particulars of the forthcoming session (p. vi).

8. An expert in micro-chemical methods and photo-micrography seeks appointment (p. vi).

9. Chemist experienced in the manufacture of Bakelite products seeks position (p. vi).

10. A laboratory, together with quantities of apparatus and chemicals, for disposal (p. vi).

11. A Pensky-Marten's flash-point apparatus is wanted (p. vi).

12. There are 92 firms using the Buyers' Guide in this issue of CHEMISTRY AND INDUSTRY.

PUBLICATIONS RECEIVED

THE 63RD ANNUAL REPORT ON ALKALI ETC. WORKS. By the Chief Inspectors. Proceedings during the year 1926. Alkali etc. Works Regulation Act, 1906. Pp. 33. H.M. Stationery Office, 1927. Price 1s.

REPORT ON THE WORK OF THE MINING RESEARCH LABORATORY FOR THE YEAR 1926. University of Birmingham. Executive Board of Mining Research. Pp. 16. Birmingham: D. McMichael, 1927.

A REPORT OF AN INVESTIGATION INTO THE ALLEGED HIGH MORTALITY RATE FROM TUBERCULOSIS OF THE RESPIRATORY SYSTEM AMONG SLATE QUARRYMEN AND SLATE WORKERS IN THE GWYRFAL RURAL DISTRICT. By Dr. T. W. Wade. Reports on Public Health and Medical Subjects. No. 38. Pp. vi + 38. Ministry of Health. Welsh Board of Health. H.M. Stationery Office, 1927. Price 1s.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW
SERIES

LONDON, JULY 8, 1927

No. 27

EDITORIAL

The Applications of Science

A SCIENCE grows, and can only grow, as other sciences and arts advance. Had the ancient Greeks, or the ancient Romans, known ten times as much chemistry as they did, the difference in their health, happiness and prosperity would have been quite trifling. A far greater knowledge of chemistry would have been necessary to make an appreciable difference to the Greek or Roman civilisation, and this additional knowledge could hardly have been obtained until engineering, physics and other subjects had themselves become of considerable importance. It is difficult to imagine real chemistry before the invention of the steam engine, of gas, of electricity, and of printing. Chemistry without cheap and reliable glass, the modern balance, the Buusen burner and the electric spark would only have been a complicated alchemy. It is probably because the applications of science would have done so little to benefit the ancient civilisation that these were so profoundly despised for so many centuries. Had these applications been many and obvious it is hard to believe that the greatest men of genius in the past would have rejected them as unworthy of consideration. That they did so consider them is undoubted; a distinguished writer who was a contemporary of Julius Cæsar had the temerity to allude to the discovery of the arch, and the use of metals, as benefits arising from the increase of knowledge. Seneca violently objected and pointed out that the aim of philosophy was to teach mankind to be independent of arched roofs and other material contrivances, that the invention of transparent windows, central heating for houses, and shorthand was drudgery only fitted for slaves, and that the only object of philosophy was to teach men to form their souls. The invention of the potter's wheel moved him to indignation. Plato, Aristotle, and Socrates had similar views; knowledge was to be sought for the good of the mind and for no material benefit to mankind; this doctrine long persisted in academic circles, but is

possibly now extinct. There must be very few people now in this country who dislike a new accession of scientific knowledge because it will probably be useful. Plato thought that the study of the theory of numbers raises the mind from the material universe to the contemplation of pure truth. Compare this with the following quotation from Helmholtz, referring to Lord Kelvin:—"He has striven with great consistency to purify the mathematical theory from hypothetical assumptions, which were not a pure expression of the facts. In this way he has done very much to destroy the old unnatural separation between experimental and mathematical physics, and to reduce the latter to a precise and pure expression of the laws of the phenomena." Last Sunday morning we motored to Gorbamby, near St. Albans, where Lord Bacon lived, and we thought of his prediction that, as more and more discoveries are made in physics, there will be more and more branches of mixed mathematics. Thomson and Tait, in their Treatise on Natural Philosophy, made mathematics the accurate servant for expressing the relation of facts, and to some extent they freed physics from the undue domination of formal mathematics. Socrates advocated the study of astronomy as a species of mental contemplation, but he would have scorned the prediction of the eclipse or the preparation of tables of the tides. Bacon advocated an astronomy which would set forth the nature, the motion, and the influences of the heavenly bodies, as they really are. The greatest men of genius among the ancients had a poor opinion of the invention of the alphabet and of the discovery of drugs to prolong the life of the ailing and suffering. Yet such men were skilled in geometry, and could prove that the square root of 2 could not be expressed as a vulgar fraction. In the year 1902 Sir William Ramsay wrote "When we consider the beginnings made by Gilbert, by Franklin, by Volta, and by Faraday, and contrast them with the outcome of these discoveries, the electric telegraph and the dynamo machine, we cannot avoid the inference that

the future has in store even greater developments than these. . . . Every encouragement should be given to the investigator, for it is to him that all our advances in physical and material well-being are ultimately due." The first man to make the world know that science could and should be used to make advances in our physical and material well-being was Bacon. He was the first and most powerful advocate of applied science, the man who directed science from the maze of Plato and Aristotle, to the path of Kelvin and Ramsay, the man who steered it from the mysteries of alchemy to the plain truths of applied chemistry. There is a great debt of gratitude owing to Lord Bacon; he was the spiritual founder of the Society of Chemical Industry.

The Annual Meeting

The Society of Chemical Industry has held many important annual meetings: they have had very different characteristics, but they have during recent years had one common feature in that they have been held in University cities. One of our greatest and oldest University cities has hitherto lacked the presence of our Society, but perhaps in the fullness of time this will be remedied. Welcomed as we are here by the University of Edinburgh and honoured by the presence of representatives of the other Scottish universities, we cannot help feeling how much we owe to academic men and academic institutions. The meeting in Edinburgh is well attended and successful, and the proceedings at the opening ceremony were unusually pleasant. The speeches were few and good: they gave the impression that the speakers had thought about their speeches. Mr. Evans was brief in explaining his financial summary and graceful in acknowledging his vote of thanks and the vellum book adorned with the autographs of his past and present colleagues on the Council. The President's address, which is published in full in this issue, is an admirable account of the part taken by chemistry in those developments of medicine which are concerned in the prevention and the cure of disease. The problem is not so simple as merely to discover a drug which will kill the disease organisms before it kills the patient. The experiments of Mithridates satisfied the world that a carefully selected dosage of poisons conveys a considerable degree of immunity. All the text-books state how Styrian peasants acquire the arsenic habit and how little injury is caused by it; the unanimous nature of these statements makes us suspect their truth, but that immunity can be obtained in some cases by such methods is an undoubted fact. Mr. Carr goes a long way towards explaining how the process operates. The chemistry of the body is extremely complicated, and has a very considerable system of automatic control; this is, by the way, not only true of the chemistry, but also of the physiology and anatomy of the body. It has an ordained future, and it offers considerable resistance to outside interference. Colonel Pollitt is only an extreme instance of this; we all possess it to an extent which only familiarity prevents us from considering as marvellous. Cut off the lizard's tail, it grows a new one; introduce into the human body bacteria in excess of the due immigration quota, and the body at once endeavours

to get rid of them; introduce drugs or other chemical compounds which are not part of the original scheme of work, and the same thing happens. The body resists the foreign elements, and if unsuccessful in its effort it does its best to neutralise their injurious activities. Mr. Carr gives us a number of illustrations of how this may be done. In some cases there is introduced a supply of external drugs which will kill the invading organisms or render them harmless; in other cases drugs are introduced which encourage the body to prepare its own destructive agency—its poison gas, as it were—to kill or incapacitate the hostile forces. The effect of this stimulus may persist after the invading force is subdued, or it may terminate before such a decision is reached. The Presidential address this year explains clearly and simply many of the steps in the process. His account of quinine, salvarsan, insulin, thyroxine, and the chemotherapeutical dyestuffs shows a part of the mechanism which is concerned. His account of the research which has led to our present degree of knowledge shows how, during the last five and twenty years, chemists and physiologists by working together have helped the physician to prolong human life and mitigate human suffering. The Society of Chemical Industry occupies a position which is quite unique; it is the only body in this country which includes in its wide ambit the application of chemistry to medicine, to the gas industry, to agriculture, to the manufacture of artificial silk and synthetic ammonia. It includes, of course, much more than this; it suffers—no, perhaps we should not say suffers, but rejoices—as the result of a diffidence such as, according to one of the speakers, is the predominant attribute of Mr. Carr and Mr. Evans. This diffidence, so far as the Society is concerned, is a species of pride such as is felt by the Scotsmen about their lochs and mountains, the kilt and the strathspey. They know how excellent they are, and if you are acquainted with these features of Scotland and do not think as they do, you are obviously not worth consideration. So in their estimation the man whose life will not be preserved by whiskey has a life that is not worth preserving. The Society is the focus in which rays from all the chemical reflectors meet; it has this other feature, which is typical of the focus: it does not make a great deal of noise. Perhaps that is why its annual meetings are so agreeable. We have our great men among us, men who have done work of outstanding and world-wide importance, but they give themselves no airs, thank Heaven, and chat with us ordinary mortals and offer us a cigar and introduce us to their wives and daughters until we hardly realise that these men will, by the next generation, be seen in their true proportions, standing head and shoulders above the rest. We read in our books in how kind a way Biot received Pasteur; we are too much surrounded by events to feel duly elated by having a cup of tea with Barger, or sharing a taxi-cab with Pollitt, or playing cards with Henderson and Carr. Nevertheless the way in which we members of the rank and file can mix with our undoubted leaders and learn from them at first hand their own views and the details of their own work makes these meetings very delightful. We judge that this meeting will be as interesting and pleasant as any we have attended.

NATURAL SOURCES OF ENERGY IN AUSTRALIA*

By PROF. JOHN READ, M.A., Ph.D.

General survey.—The chief natural sources of energy in Australia are coal, brown coal, and water power. Although two-fifths of the continent has a rainfall of less than 10 in. per annum, the possibilities of developing hydro-electric power in the eastern coastal zone, from Queensland to Tasmania, are very considerable. In the absence of natural petroleum, Queensland in particular offers attractive prospects for the production of power alcohol on a large scale. The occurrences of natural gas and kerosene shale are interesting but of minor importance.

Natural petroleum.—Although natural petroleum has not yet been discovered in Australia proper, it has been struck in small amounts in Papua, the part of New Guinea under Australian mandate. Oil from the Vailala field is remarkably clean and free from odour; it yields 36% of benzine and 46% of kerosene; and resembles Borneo petroleum in containing appreciable amounts of benzene and homologous aromatic hydrocarbons. It consists largely of paraffins, and pure specimens of $C_{23}H_{48}$, $C_{25}H_{52}$, and $C_{27}H_{56}$ have been isolated from the higher fractions (Read and Williams, J., 1919, 38, 319; Read and Andrews, J., 1920, 39, 289). From 1919 to 1921 the Anglo-Persian Oil Co. conducted an exploration of the territory of Papua for petroleum, aided by an allocation of £100,000 from the British and Commonwealth Governments; and more recently the Commonwealth Government has authorised advances up to £160,000 to persons and companies engaged in the search for commercial petroleum in Australia or Papua. Meanwhile, the annual Australian import of motor spirit and kerosene exceeds 40 million gallons. In Queensland signs of oil have been detected, and natural gas has been struck in enormous quantities, notably at Roma in the artesian basin 300 miles N.W. of Brisbane. The "wet" gas of Roma, encountered at a depth of 3,700 ft., yields 1·2 pints of liquid petrol per 1,000 cu. ft. when passed through suitable absorbers. Large supplies of "dry" gas occur in the Longreach area, about 400 miles N.W. of Roma, and as an indication of the former presence of petroleum two deposits of wax have been found in this district. It seems possible that low-pressure oil-beds may occur in Queensland, although it is unlikely that strong gushers will be struck.

Power alcohol.—Queensland is favourably situated for the production of power alcohol, since the cheapest sources—such as sugar-molasses, palm soap, and starchy plants like arrowroot and cassava—can be grown only in tropical or sub-tropical regions. At present about 10 million gallons of molasses are produced annually in the Australian sugar industry, and only about a quarter of this amount is utilised in making alcohol. The use of alcohol as a common motive power in Australia would necessitate an enormously increased production, which could not be met by the fullest utilisation of waste molasses. Consequently, the systematic cultivation of such crops as sorghum, cassava, and sweet potatoes,

for the production of power alcohol, may conceivably play an important part in the agricultural development of Australia. The whole question of the production and utilisation of power alcohol in Australia has been fully treated in Bulletin No. 6 (1918) of the Commonwealth Bureau of Science and Industry.

Coal.—Coal measures occur in eastern Queensland, Tasmania, and Western Australia, but the main worked deposits are in New South Wales, to the north and south of Sydney; altogether, Australia possesses about 2·2% of the estimated coal reserves of the world, or somewhat less than Great Britain. Coal-gas, coke, and ammonium sulphate are in great demand, but the population is too small for the maintenance of a coal-tar industry. At Mortlake, on Sydney Harbour, the Australian Gaslight Co. possesses one of the largest and most efficient gasworks in the world; it has a battery of 272 vertical retorts, and supplies gas over an area of 210 sq. miles. The Broken Hill Proprietary Co. has also erected a benzol plant at Newcastle. An electricity supply undertaking has been developed by the Department of Public Works of New South Wales at Port Kembla, on the southern coalfield 57 miles from Sydney. The present capacity is 20,000 kw., and the system will eventually interconnect with the Burrinjuck and Shoalhaven River hydro-electric schemes. The original object was to provide power for the construction of dams and other works, but it is hoped that the cheap power now available will foster industries and assist decentralisation.

Kerosene shale.—The kerosene shales of New South Wales are unique in their wide distribution and comparative abundance. The deposits occur on the margin of the coal area, in association with the permo-carboniferous upper coal measures, which lie below the Hawkesbury sandstone. The seams rarely exceed a mile in length or 5 ft. in thickness. The deposit at Hartley Vale, in the Blue Mountains, was known in 1824 or earlier, and the Scottish discoveries which brought oil-bearing shales into prominence were not made until many years later. On an average, the shales of New South Wales yield about 70% of volatile hydrocarbons and 14% of fixed carbon, the corresponding values for Scottish shales being 55% and 12·5%.

The deposits were worked for retorting and exporting from about 1865, but the industry languished with the exhaustion of the richer seams. From 1865 to 1901 the total output reached about a million tons, mainly from Hartley Vale and Joadja, valued at some £2,000,000. The price per ton fell from 49s. in 1885 to 15s. in 1901. Retorting grades now predominate over export grades, and shale oil is unable to compete with imported petroleum; so that the working of these deposits has been brought to a standstill. The inferior seams yield from 40 to 60 gallons of crude oil per ton. The magnificent deposit at Joadja, with 89% of volatile hydrocarbons and only 6·25% of fixed carbon, gave the phenomenal yield of 150 gallons of oil and 17,500 cu. ft. of gas per ton; the illuminating power of the gas was equal to that of 22 cwt. of sperm candles.

The available quantity of undeveloped seams is probably large, especially in the Capertree-Wolgan and Barigan areas (Carne); but in the absence of cheaper

* Summary of a lecture delivered on July 6 during the Annual Meeting of the Society at Edinburgh.

labour and interdependent industries the further exploitation of the kerosene shale deposits of New South Wales is problematical. Tasmanian shales are also known, averaging about 40 gallons of crude oil per ton; a specimen from the north-west of Queensland yielded only 20 gallons per ton.

Brown coal.—The most important deposits of brown coal in Victoria are situated in the Latrobe Valley area, including Morwell and Yallourn, about 80 miles south-east of Melbourne. The Port Albert area, which is easily accessible from the port of Welshpool, possibly offers 1000 million tons of "open cut" brown coal; this amount, however, is insignificant in comparison with the vast deposits of the Latrobe Valley (Herman). A third deposit at Altona, an outlying suburb of Melbourne, is deeper and expensive to mine. The first two deposits are State-owned, while the Altona field belongs to private corporations.

Victorian brown coal consists of a matrix of pollen grains, spore cases, and decomposed vegetable matter, with sporadic inclusions of lignite. It is brown or black in colour, and is easily reduced to a brown powder. As a rule, it contains more than 50% of moisture when freshly mined. The proximate analysis is very similar to that of Bittersfeld brown coal. Experiments conducted from 1918 onwards by the Department of Mines of Victoria have shown that the tar obtained by carbonising the brown coal at about 700° C. is much inferior, both in quality and quantity, to coal-tar; it contains a higher proportion of phenols than the latter material, and is also fairly rich in aromatic hydrocarbons. The yield of ammonium sulphate varied from 7 to 10 lb. per ton. When heated gradually to about 500° C., dried Morwell brown coal gave 27.5 gallons of oil and 1.75 lb. of ammonium sulphate per ton.

These investigations indicate the possibilities of carbonisation. Up to the present, however, little attention appears to have been paid to the much more important possibility of applying modern processes of hydrogenation to these vast deposits, with the aim of producing liquid fuels at economic rates. For the time being, the energy of the Victorian brown coal deposits is to be utilised solely by direct combustion of the raw material. Since 1918 the activities of the State Electricity Commission of Victoria have resulted in the erection of large State-owned power stations, associated with an efficient and extensive distribution service. An ultimate capacity of 150,000 kw. is proposed for the main power house at Yallourn, 6 miles from Morwell. The average overburden here is only 28 ft. of sand and clay, and the 150 million tons of brown coal which is estimated to exist in an area of 1 square mile to the south of the site should suffice to maintain such a power-house for 100 years. The coal is excavated from an open cut, 600 ft. wide, by means of electric shovels, which deliver through a travelling loader into trucks on an automatic rope haulage system. The first section of the power house, with a capacity of 50,000 kw., requires 4000 tons of coal and about 260,000 tons of water daily. The latter is obtained from the Latrobe River, and is used mostly for condensing the steam after its passage through the turbines, which are direct coupled to three-phase alternators generating at 11,000 volts pressure.

In recent years about two-thirds of the total output of German brown coal has been briquetted; some 20 million tons were treated in this way in 1922. A briquetting factory, with a maximum annual capacity of 100,000 tons, has been installed at Yallourn, where the steam-dried powdered coal is moulded, without any addition of binding material, under a pressure of 200 tons. Briquettes with 13.5% of moisture have a calorific value of 9000 B.Th.U. per lb. The loss incurred in operating the electricity supply in 1924—25 was £241,000, while the loss on briquettes in the following year was £40,000. It is estimated that by 1930 a profit should be manifest; and Yallourn will doubtlessly become an increasingly valuable asset to the State of Victoria. It may be taken as established, after lengthy and laborious investigations, that the low-grade brown coals of Gippsland can be utilised economically for the provision of electrical power, light, and heat; a rapid industrial development should follow the exploitation of these unique deposits, the harnessing of which must be included among the notable achievements of electrical practice.

Hydro-electric power.—It is proposed eventually to interconnect the Yallourn power system with the Sugarloaf-Rubicon and Kiewa River hydro-electric schemes; the initial capacity of the plant at the Sugarloaf reservoir has been fixed at 18,000 h.p. Of all the Australian States, however, Tasmania offers the best prospects for the development of hydro-electric power, a total amount of more than 500,000 h.p. having been definitely located and surveyed in the island. The Great Lake, with an area of 58 square miles, has a central situation 3350 ft. above sea level. A multiple-arch dam, 40 ft. high and 1180 ft. long, has been built across the southern end, and the Tasmanian Government Hydro-electric Department now disposes of 63,000 h.p. from the Great Lake scheme, through the power station at Waddamana, in addition to 12,000 h.p. from the Shannon River scheme. It is hoped to supply cheap hydro-electric power generally to townships and agricultural districts, and also to encourage the development of industrial concerns in Tasmania. At present the Electrolytic Zinc Co. of Australasia is the chief industrial consumer, 120 tons of electrolytic zinc being produced daily at the works at Risdon, near Hobart; hydro-electric power is also used by the same company in working the zinc-silver-lead deposits of the West Coast. The Australian Commonwealth Carbide Co., and Cadbury-Fry-Pascall, Ltd., also operate factories near Hobart by means of hydro-electric power. The rates prevailing in Hobart are 3d. to 5d. per unit for lighting, 1d. for domestic power, and ½d. to 2d. for motive power.

In New South Wales a power house has been erected at the Burrinjuck Dam, the primary purpose of which is to conserve water for the Murrumbidgee Irrigation Areas, some 200 miles further down the river. A first instalment of 5000 kw. is now available, with transmission to Canberra and through a closed ring system to Cootamundra and Wagga. Hydro-electric schemes are also contemplated at the Shoalhaven River in the south of the State and at the Clarence River in the north.

A good deal of water power is available in northern Queensland, and the Cairns Hydro-electric Power Investigation Board was constituted by Act of Parliament in 1922; irrigation schemes are also in progress in the Dawson Valley and Inkerman areas.

New Zealand also possesses very important resources of this kind, and altogether the available water power of Australasia has been estimated (Koehn and Kaplan) at about 30 million h.p., as compared with 100 million h.p. for the United States, 26 million h.p. for Canada, 59 million h.p. for Europe, and slightly less than 1 million h.p. for Great Britain.

Solar energy.—In conclusion, it may be pointed out that in time to come the sun-baked wastes of the "dead heart of Australia" will perhaps be made to pulsate with energy, as providing one of the most favourable regions in the world for trapping the energy of solar radiation by means of sun-engines. Ackermann's experiments with parabolic reflectors at Cairo, in 30° N. latitude, have demonstrated the possibility of securing 60 h.p. per acre of earth-surface in this way. The loss incurred through the angle of incidence of the radiation is here only 13%, and in Australia it would be sensibly less, seeing that the continent lies mainly to the north of latitude 30° S.

CANADIAN MINING AND METALLURGY

The International Nickel Co. will instal additional equipment at the Copper Cliff smelter, consisting of sintering furnaces etc. High grade copper ore has been discovered, in larger quantity, on the 2000 ft. level of the Frood mine, and instead of being a nickel proposition, it has developed into a question of copper production with nickel as a side-line, containing a high percentage of precious metals, principally platinum and palladium. The company is considering the question of the erection of a second electrolytic unit for the production of nickel at the Port Colborne, Ont., refinery.

The Consolidated Mining and Smelting Co. is extending its operations in British Columbia. The Sullivan mine, Kimberley, has a daily output of 4000 tons of ore. The company has purchased a controlling interest in the George Copper Mine, Bear river, Portland Canal district, B.C. It is anticipated that operations will soon be commenced at the Sunloch copper mine, Jordan river, near Victoria, and Coast copper mine, Quatsino, both situated on Vancouver Island. It is probable that a smelter will be constructed on the coast to treat these ores, and possibly also those from Britannia and other mines on the mainland.

The Flin Flon mine, situated in Northern Manitoba, north of The Pas, has passed from the prospecting stage, and the erection of a 3000-ton smelter is under the consideration of the Whitney syndicate (U.S.A.). The developed ore body above the 900 ft. level contains 20,000,000 tons of metalliferous ore of a complex character, carrying copper, zinc, gold and silver to the average value of \$13.40 per ton. It is estimated the metals can all be recovered for less than \$9.50, thus leaving a good margin for profit. Further exploration, below the 900 ft. level, may probably yield equally good ore.

COLOUR USERS' ASSOCIATION.

At the eighth annual meeting, held on June 28, the chairman, Mr. H. Sutcliffe Smith, in the course of his address, said that the Dyestuffs Advisory Licensing Committee had continued to carry out its duties. During the year 5800 applications for licences had been dealt with. The licences granted during 1926 showed a very large increase over the two previous years, the biggest increase being recorded in the imports from Germany. There was a marked increase in the quantity and value of the licences granted during 1926 as compared with the two previous years, but it must be remembered that the country's needs for foreign colour during the previous years were to a large extent met from Reparations, the imports of which ceased at the end of 1924. It was, however, a matter for serious consideration by the British makers that it was yet necessary to license the import of nearly 1,900 tons of colour, value £944,000.

The statement had often been made that 80% of the colour used in this country is of British manufacture, whereas pre-war the position was reversed, and 80% of the colour used in this country was of foreign manufacture. That was a great achievement of the British makers. It was, however, a matter for serious reflection that, whereas now only 20% of the colour used in this country represented by the foreign imports aggregates £944,000, pre-war 80% of the consumption was valued at only £1,800,000.

Although the world's capacity for the production of dyewares is now nearly twice that of pre-war, the prices of dyewares throughout the world had not yet fallen to the general level of wholesale prices. On the other hand, it has to be borne in mind that as the class of colour now generally used is of a much better type than formerly, and there has been a marked increase in the use of vat and other high-class dyes on account of their fastness to washing and light, and the demand on the part of the consumers for superior dyed fabrics, the cost of dyewares has gone up very considerably. It was estimated that, whereas in 1913 the colour bill of this country was approximately £2,000,000, to-day, with a reduced output, it must be not less than £5,000,000. This increase must not be taken as an increase in the cost of the same types of dyewares, but as very largely due to the use of these higher grade dyes already mentioned. There is no doubt that the textile trade to-day was giving a much higher standard in dyeing and finishing.

The activities of the Joint Technical Committee, which consists of technologists representing both dye-makers and users, have been mainly confined to the revision of the "non-contentious" list, that is to say, the list of colours for which there are no adequate substitutes made in this country. It is nearly five years since the list was compiled, and, whilst modifications have been continuously effected, it has long been felt that a complete revision was desirable in order to make it more representative of the current situation. It was eventually decided that the position could be met by dividing the list into two parts, viz. :—

List A.—Products which are in substantial consumption, and for which no adequate substitutes are available.

List B.—Products for which no exact equivalent of British manufacture is available, but which are

- (1) Capable of substitution, for purposes of major importance, by existing British products; and/or
- (2) Used in such small quantities that their addition to the "A" list is considered undesirable.

Applications for licences to import products included in "A" list would be granted immediately and without question, whilst those in the "B" list may be queried by the Technical Advisers to the Dyestuffs Advisory Licensing Committee where substantial evidence has been submitted by a British maker of his ability to supply a satisfactory substitute. The simplification of these lists will be of the greatest assistance to the Dyestuffs Advisory Licensing Committee.

Part I of the Safeguarding of Industries Act of 1921, which imposed import duties on a scheduled list of synthetic, organic and fine chemicals, expired in August, 1926. Before this date, however, the President of the Board of Trade set up a private Committee to advise him as to what action should be taken when this portion of the Act expired. The recommendations made by the Committee were included in the Finance Act of 1926, the period of operation of Part I of the Act being extended for a further 10 years, and subsequently the Board of Trade issued a supplementary list of over 500 synthetic, organic and fine chemicals for inclusion as dutiable articles. The Association took advantage of the new provision for the exclusion of dutiable articles included in the list, but not manufactured in the country, by putting forward a requisition that oxalic acid should be exempted from duty under the Act, and in due course the removal of the duty on this article for one year was notified by the Board of Trade.

It was opportune to give an expression of the general views of users on the formation of Imperial Chemical Industries, Ltd. The experience of modern, large-scale industry, especially in America and Germany, had shown the value of large combinations in the realisation of the best economic results, and if this country was to maintain its commercial position it could not afford to ignore this new trend. The merging of the great chemical manufacturers of Germany made it imperative that the British and Imperial chemical industry should form an equally united front, and this new formation should place the British industry in a position to deal with similar large groups in other countries on equal terms.

After discussing the advantages of big-scale production, Mr. Sutcliffe Smith said there was a fear that by the elimination of selling competition the users might be exploited not only nationally, but internationally. So long as industry was controlled by men of ability and integrity, as we had in the large-scale industries in this country to-day, he thought there was no ground to fear monopolistic dangers.

Steady progress was being made by the British dye-making industry. In 1913 Great Britain produced only about 5000 tons of aniline dyes, equivalent to 3% of the world's production, whereas in 1925 (the latest published figures) the production amounted to nearly 15,000 tons, or approximately 10% of the world's production. With the exception of the United States, no other country had made such remarkable progress in the production of dyestuffs. The estimated capacity of

the British makers was upwards of twice the current output. The progress had been phenomenal, and it was gratifying to those who had confidence throughout those strenuous years that the British dyemaking industry would eventually take its place as an important factor in the world's production of dyewares.

One of the secrets of success of the great German dye producers before the war was attributable to the excellent technical service which they rendered to their users. Not only was this service beneficial to the recipients, but it assisted in the development of the industry by bringing the manufacturers regularly into contact with the difficulties and problems of the users and their requirements. The British makers were evidently fully alive to this aspect, and with their experimental laboratories, manned with highly trained technical staffs, they were now able to give British users a service and assistance which cannot be surpassed.

In addition to introducing new colours to the market and producing equivalents for many colours which were formerly imported, considerable progress had been made in the production of colours for other industries. Mention might be made of the new group of level colours introduced by the British Dyestuffs Corporation, Ltd., as a solution of the long outstanding problem of the variability of the dyeing properties of viscose, and the new series of Coricol colours which will be of the greatest assistance to the leather industry of this country. The application of physics to dyeing problems has not been lost sight of in the production of wetting out agents and insoluble colours in a dispersed form.

He was glad to be able to record these achievements on the part of British makers, because he felt that in far too many quarters British progress was underrated. In this highly technical industry it had been amply demonstrated what British chemists and chemical engineers have been able to do in a short space of time, and it had shown that in technical skill they were equal to any demands that may be made upon them. Whilst there were many products which it is yet necessary to import, it could not be expected that it should be otherwise, as it was not possible for British makers to achieve in ten years what it took the great German industry fifty years to accomplish.

The undoubted progress of the German dyemaking industry was largely due to the fact that it had a large export trade, its output for the overseas market being many multiples of its internal consumption. Production on an adequate and economic scale in this country will only be achieved when British exports are on a similar scale to those of Germany. The following figures show the exports of dyes and dyestuffs obtained from coal tar as furnished by the Board of Trade:—

Year	Weight Cwts.	Value £
1913	48,673	177,246
1924	104,396	923,933
1925	104,161	847,639
1926	75,727	614,112

These figures were encouraging, showing that the exports in weight had decidedly increased over pre-war, but it was unsatisfactory to note that 1926 shows a marked decrease on 1925.

In making another plea for closer co-operation and liaison between the universities and the dyestuffs industry, he felt confident that the leaders of the chemical industry would not lose sight of the importance of this aspect in the development and progress of the chemical industry, and the dyemaking industry in particular. There was need for the establishment of a scheme whereby the expert knowledge and power for research embodied in our university organisations may be utilised to the fullest extent in the practical laboratories of manufacturers. A large amount of research work was being done in these works and laboratories, and there was a great amount of unofficial co-operation between all sections of the industry. But there was considerable scope for close liaison between the academic and the practical institutions. We had only to consider the great progress made in the German chemical industry by arrangements of this nature to realise the benefits that can be derived from them. More emphasis should be laid on the possibilities and advantages to be gained by an enlargement of research service in an almost undeveloped direction, by an extension of co-operative research work on lines which, while modified by the particular circumstances of the case, would follow very much on those adopted for co-operation on the wider scale. Such mutual arrangements between firms and firms, and, more important, between firms and universities and other research organisations, would lead to a more economical use of the service, and prevent the overlapping which is very obviously the chief defect in the present system. If such a suggestion were to be followed up in practice, there was little doubt that there would accompany it that still further development of the application of research which is necessary for the future success of our chemical industry.

Considerable attention had been devoted in the Press recently to the reopening of negotiations between the chemical interests of Great Britain and the Interessens Gemeinschaft of Germany. It would be remembered that in 1924 the Association took an active part in the opposition to the agreement proposed then between the British Dyestuffs Corporation, Ltd., and the Interessens Gemeinschaft. As users, we affirmed two main principles:—(a) The colour users must be assured of free access to the best quality and range of dyestuffs produced anywhere, and (b) users must be on as favourable terms as regards prices as any of their world competitors, and these prices should not be on such a basis as to retard the sale of their productions in overseas markets.

The full terms of that agreement were never disclosed to the public, but it is evident there was not entire satisfaction on these two principles, as the Government refused to sanction the arrangement.

Mr. Sutcliffe Smith said he was of the opinion, and he believed he voiced the sentiments of the principal users of this country, that an agreement on sound lines, safeguarding our two main principles, and whereby there would be a proper interchange of technical and manufacturing knowledge, would not be disadvantageous to British users and the world generally; but there must be no risk of an arrangement in which the British manufacturers would not be on an equal footing with the Interessens Gemeinschaft, and by which the British industry would not be progressive.

Just as fusion of the large units in this country should lead to beneficial results in an economic sense, so it must be apparent that international co-operation should not be detrimental. In any new international arrangement the two principles already stated would require to be held sacred. The effects of consolidation should be reflected in quickened research, leading to rapid developments in the production of new types of dyestuffs and chemicals at still lower prices, thus assisting the textile and other colour-using trades to regain their peak volume of business. In the event of an international amalgamation the British user would expect the suspension of the Dyestuffs (Import) Regulation Act, and the supersession of the present cumbrous licensing system by free access to the world for his dyestuffs. The time was ripe for such an arrangement, now that the British industry with its united front was in a position to meet the German manufacturers on an equal footing.

The sacrifices made by the users during the past six years under the restrictions imposed by the Dyestuffs (Import) Regulation Act in paying prices considerably above the world's lowest rates must not have been in vain. Users were as determined as ever that a virile dyemaking industry should be maintained in this country capable of supplying its needs at all times. It was now recognised that the manufacture of dyes is of first importance, not only as a key industry in the production of textiles—the largest export of wholly or partly-manufactured goods, representing 40% of the total—but also by virtue of its potentialities as a research medium. The basis of such an industry is continuous research for the discovery of new products, the improvement in manufacturing processes, and the utilisation of by-products.

This industry should form a training ground for the development of chemists and technicians, and their employment for other industries, a factor which was fully recognised by the Germans in the development of their dye industry. There is no doubt that to-day British technologists are competent to deal with any of the intricate problems which face modern industry. The heavy chemical industry of this country is proof of the fact that Great Britain has not been lacking in the production of scientific inventors in the realm of chemistry, and the number is as large as in any other country.

Considerable attention was devoted by the recent International Economic Conference in Geneva to the development of the chemical industries. There were two distinct counsels. It was urged in the memoranda submitted by the German Section that the future success lay in confining the production of a chemical to those countries in which the conditions of manufacture are most favourable. The British point of view differed. It was urged in the British memorandum that the protection of the chemical industry "goes somewhat beyond that of self-sufficiency, profit or employment," and that it was "to render secure an outlet for the abilities and desires of educated workers and craftsmen and to afford the workers an opportunity for the exercise of the greatest amount of skill." The British point of view was particularly applicable to the dyestuffs industry, because, apart from its being a training ground for chemists, on it is dependent the commercial development of the infinitely greater textile and other industries.

As a result of negotiations opened by the Association, the Dyestuffs Advisory Licensing Committee had reduced the $2\frac{1}{2}$ times factor to 2 times, when considering applications for licences to import dyestuffs on price grounds. This seemed a very striking indication of the progress the British dyemaking industry was making in that they are now able to meet the lower factor. This should place them in a much stronger competitive position to obtain new business immediately, and as progressive reductions take place in the factor during the remaining period of the Dyestuffs (Import) Regulation Act, the dyemaking industry should be in a position, at the expiration of that period, to meet world competition without artificial assistance.

Considering the price of British dyestuffs, it was observed that the average import price per pound in 1926 showed an increase over 1925. As there were price reductions during 1926, it would appear that the increase in the imported price was mainly due to the use of better types, which was reflected in an improvement in the dyeing and finishing of textile goods.

The general level of prices, however, not only in this country but on the Continent and in America, was considerably higher than it should be, and it was hoped that the co-ordination and development of the chemical resources of this country arising out of the formation of Imperial Chemical Industries would result in an early reduction.

He agreed with the statement in the monograph on the chemical industry submitted to the Economic Conference of the League of Nations that sufficient emphasis was not always laid on the auxiliary products used in the textile industry. The total quantity or value of dyestuffs used in the production of textiles appeared to be small as compared with the heavy chemical products used in that industry. There was no doubt that the price of chemicals was a very important item in the cost of production in the colour-using industries, particularly the textile trade. Not only did these costs affect chemicals directly used, but they had a material bearing indirectly in that they are a component part of the cost of dyestuffs. It was satisfactory to find that in many instances the prices of chemicals, as related to the prices ruling in 1914, compare favourably and are approximately on a level with the Wholesale Prices Commodity Index figure. It was to be regretted, however, that there were yet far too many chemicals used in large quantities, the prices of which are much too high. Attention had been directed to this, not only by users, but also by colour makers themselves, owing to the adverse effect it had upon the cost of their intermediates. It was to be hoped, therefore, that the economies foreshadowed by Sir Alfred Mond in connection with the new merger company will reflect themselves in a speedy revision of those prices which users consider are yet too high.

In conclusion, attention was directed to the important changes in industry which were being made almost daily. Many had happened in the past; many more will develop in the future. If we were to maintain our position in the forefront of industry, all that combined effort, vigilance, and wise policy can bring to us will be needed.

MINERALOGICAL SOCIETY

A meeting of the Mineralogical Society was held on June 14, Prof. W. W. Watts, F.R.S., the President, in the chair. The following papers were read:—

"The atomic volume relations in certain isomorphous series," by A. F. Hallimond. The paper was based on accurate data made available by the researches of Dr. Tutton and other workers. For isomorphous salts of the eutropic elements K, Rb, Cs, the differences Cs-K and Rb-K stand in constant ratio, and the same ratio holds good for the free metals, though these are considerably larger than in the combined state; the constancy does not extend to the salts of NH_4 or Tl. A modified additive relation was indicated, the volumes of the metals when free and when combined being in the same ratio as the differences for the free metals and for the respective isomorphous series. In the same way, volumes can be calculated for combined Na and Li from those from the free metals. Salts of Cl, Br, I exhibit a similar constancy in the ratio of their differences, and this would appear to be a distinctive character of each "eutropic" group of elements. Volumes are calculated for combined Cl, Br, I. These and other values for the acid radicles in the above series are in very close agreement with existing knowledge of the size of the atoms, a fact which affords strong confirmation of the validity of the method now proposed for computing the volume of the elements in the combined state.

"The Petrology of the Bodmin Moor granite (eastern part), Cornwall," was described by Dr. P. K. Ghosh, and "The distribution of purple zircon in British sedimentary rocks" was described by Prof. P. G. H. Boswell.

" β -Quartz twins from Cornwall," by Dr. J. Drugman. β -quartz seems to be sufficiently differentiated from α - or low-temperature quartz for the two to be treated quite apart from each other. This is specially the case with the twin-laws observed in these.

"The separation of manganese in rock analysis," by E. V. Holt and Dr. H. F. Harwood. In carrying out the exact analysis of rocks, the whole of the manganese they contain can be completely precipitated with the alumina and ferric oxide by employing the following procedure:—The solution, after removal of silica, is diluted to 400 c.c., heated to boiling after the addition of ammonium chloride, and ammonia added to alkalinity. Bromine water is then run in slowly from a tap funnel, whose stem is drawn out to a fine jet, small additional quantities of ammonia being simultaneously added to keep the solution alkaline. When the addition of the bromine is complete, the liquid is boiled for one minute, and then filtered. The precipitate is re-dissolved and the precipitation repeated; in the combined filtrates, lime and magnesia are determined by the usual methods.

"Corundum twins from Transvaal," by Dr. L. J. Spencer. Large twinned crystals of corundum, up to 6 inches across, but only about an eighth of an inch thick, are abundant in plumasite rock near Bandler Kop, northern Transvaal. The twin-plane is a face of the primary rhombohedron, and the twinned crystals have a form resembling arrow-heads.

CORRESPONDENCE

A QUESTION OF PROPAGANDA

SIR,—In reading your Editorial in the current issue, I could not help being struck by one sentence. It started admirably, but the concluding sentence simply nullified the whole effect.

"We ourselves make a point of invariably using the term pharmacy instead of chemist's shop."

So far so good. Now for the bathos, "except when we ask a maid or a child or the gardener to buy something for us."

I venture to express my humble opinion that this is just where you are losing a golden opportunity to do a little propaganda. If the maid, child or gardener is more than usually intelligent, you can also add that the letters M.P.S. over the shop door mean Member of the Pharmaceutical Society, so that the gentleman concerned probably much prefers to be called a pharmacist.

A small point perhaps, but if all our 5000 members adopted this attitude consistently year after year public opinion would certainly be influenced favourably.—Yours, etc.

R. FARADAY INNES

PERSONAL AND OTHER ITEMS

Mr. George Gray, Prof. G. T. Morgan, F.R.S., Mr. L. Guy Radcliffe, and Mr. Harold Talbot have been elected to the Council of the Society of Chemical Industry.

During the Oxford Encœnia last week the honorary degree of D.Sc. was conferred upon Sir Robert Hadfield, F.R.S., who was welcomed by the Vice-Chancellor as *vir strenuissime, in metallurgia spectatissime, callide novas ferri coquendi artes reperire. Cyclopus officinis ignotas*. Prof. R. Wüstätter, who also received the honorary degree of D.Sc., was admitted by the Vice-Chancellor as *vir doctissime, in Chemia Organica spectatissime, qui indagavisti unde florum nascantur colores, quibus fermentis, vita animalium et plantarum alatur et sustentetur*.

On Saturday last at the Degree Congregation of the University of Birmingham, the honorary degree of Doctor of Laws was conferred upon Prof. Arthur Lapworth, F.R.S., Chemistry Department, University of Manchester. The Principal (Dr. Grant Robertson) pointed out that the Professor was a son of Prof. Charles Lapworth, of the Geological Department of Mason College, Birmingham, and was a former student there. Prof. Lapworth had placed himself in the front rank of investigators by his work on synthetic chemistry, and had made a place for himself amongst the British chemists of his generation by his insight in developing a broad analysis of the meaning of chemical reactions and by his stimulating contributions to the dynamics of chemical phenomena.

Emeritus Prof. H. Louis, M.A., D.Sc., has been elected to succeed Dr. T. S. Haldane as President of the Institution of Mining Engineers.

Dr. H. Levinstein has been elected president of the Society of Dyers and Colorists.

The University of Maryland has conferred the honorary degree of D.Sc. on Sir John Russell, F.R.S., director of the Rothamsted Experimental Station.

Mr. Christopher Barber has been appointed general manager of Silica Gel, Ltd.

Dr. E. C. B. Wilbraham has taken up an appointment with the Pyrene Co., Ltd.

Mr. A. C. B. Mathews has accepted an appointment with Messrs. Naylor Bros., Ltd.

Mr. B. F. Conigrave has joined the board of the British Cyanides Company.

Dr. L. Harris, who was awarded the Meldola Prize by the Institute of Chemistry two years ago, has been appointed director of the research institute which is to be erected in Cambridge under the control of the Medical Research Board.

The degree of D.Sc. in chemistry has been awarded by the Birmingham University to J. A. V. Butler, for numerous papers on "Studies in heterogeneous equilibria," and to H. A. Scarborough, for papers on "Saponification and properties of mixed solvents."

The London University has conferred the following doctorates:—D.Sc. in chemistry on F. H. McDowall, for a thesis entitled "Constituents of *Myoporum laetum* Forst (The 'Ngaio')"; I. R. McHaffie, for a thesis entitled "The effect of the presence of an indifferent gas on the concentration and activity of a vapour in equilibrium with a condensed phase or system of condensed phases"; S. O. Rawling, for a thesis entitled "The sensitivity of photographic emulsions"; and F. Tattersfield, for a thesis on "The relationship between the chemical constitution of organic compounds and their toxicity to insects."

Research in Mining at Sheffield

A new mining department is to be erected at the University of Sheffield at a cost of £21,200. The new department will provide facilities both for education and for the investigation of important mining problems.

New Acts in Force

On July 1, the Public Health (Smoke Abatement) Act, 1926, which extends and revises the provisions of the Public Health Act, 1875, and the Public Health (London) Act, 1891, came into force, and on the same day the regulations prohibiting the use of preservatives in food were made applicable to bacon, ham, egg yolk and articles containing preservatives introduced by the use of preserved margarine.

British Sugar Beet Society

At the meeting of the British Sugar Beet Society, Ltd., held on June 14, Mr. G. H. Roberts, who presided, submitted a resolution winding up the society. The society, he said, had accomplished the purpose for which it was founded, and since its activities affecting beet growers had been transferred to the National Farmers' Union, while the various factory companies were forming themselves into a manufacturers' association, there was no longer any need for its continuance. Sir James Martin seconded the resolution, and said that the subscribers and guarantors were agreed on the necessity of this step, and as the Executive Committee had reported that the society should be wound up, the resolution should be agreed to. In making an amendment to the resolution Colonel E. Royds stated

that the society had a balance of £1,000, and he believed the guarantors would be willing that that should be devoted to the future work of the society. He believed it had a big future. Other bodies which were to take over some of its functions were not as yet in existence, and there was much the society could do in assisting and encouraging the provision of new factories, obtaining Government support, preventing overlapping, and preventing disputes between growers and factories. Colonel Malcolmson, who seconded the amendment, said that the feeling of unrest overseas, with regard to the development of sugar beet, made the continued existence of the society desirable. No other body could carry on so effectively the non-political propaganda of the society.

After further discussion the chairman said he had been for years a prominent worker in the society, and it was only after very careful consideration that he had come to the conclusion that the society's purpose had been fulfilled. There was no object served by keeping a society in existence if they were not able to finance it. The four members present who opposed the winding-up of the society were asked to review the situation and then to meet the Executive Committee at a further meeting of the society. This was agreed to.

PARLIAMENTARY NEWS

Safeguarding of Industries (gas mantles)

Sir Philip Cunliffe-Lister informed Mr. Harris that the imports of gas mantles in the first four months of 1925, 1926 and 1927, respectively, were 67,656 gross, 14,958 gross, and 11,203 gross. The average price realised by members of the trade association on the sale by them of all their mantles during the year ended on March 31 last showed an increase of 1s. a gross on the average price realised by them during the preceding year. These sales were estimated to cover 85% of all the mantles sold in this country. Against this there had been increases in the cost of certain materials. The retail prices of the classes of mantles most commonly used had, so far as could be ascertained, remained substantially unchanged. —June 28.

Production of Crude Petroleum

In reply to Mr. John, Sir P. Cunliffe-Lister said that the world production of crude petroleum was estimated to have been about 47 million tons in 1910, 62 million tons in 1915, 98 million tons in 1920, and 150 million tons in 1926. — June 28.

Beet Sugar Subsidy

In a written reply Mr. Guinness informed Mr. Thurtle that the expenditure during the financial year ended March 31, 1927, in respect of the subsidy on home-grown beet sugar and molasses was £3,225,858. Of this amount, approximately £1,004,300 was returned to the State in the form of Excise Duty. There had been no remission of Excise Duty since the passing of the British Sugar (Subsidy) Act, 1925. — June 29.

Sugar (Clearances)

In answer to Sir J. Power, Mr. McNeill stated that the quantities of sugar cleared during the two months of April and May, 1927, for home consumption were as follows:—Imported refined sugar, 2,029,000 cwt., British refined sugar, 2,744,000 cwt., sugar manufactured from home-grown beet, 295,000 cwt.—June 29.

COMPANY NEWS

MOND NICKEL CO., LTD.

The gross profits for the year to April, 1927, amounted to £528,730, compared with £574,371 for 1926, and the net profit, after providing £73,750 for interest on debentures (against £96,393) and meeting general charges of £60,267 (against £52,943), amounted to £394,712, a reduction of £30,323. It is proposed to maintain the dividend at 12½%, less tax, by a final payment of 1s. 6d. per share. After placing £15,000 to debenture stock reserve, and allowing £19,735 for directors' fees, the balance of £33,189 has been carried forward, compared with £48,212 brought in. The coal trade stoppage seriously interfered with refining operations, and the costs of production were increased in consequence.

CASSEL CYANIDE CO., LTD.

The directors have issued a circular to shareholders regarding the exchange of shares into Imperial Chemical Industries. For two existing Cassel shares of 5s. each there will be exchanged £1 ordinary share in Imperial Chemical Industries, Ltd., and, in addition, for each five existing Cassel shares of 5s. each there will be exchanged 1 deferred share of 10s. each in Imperial Chemical Industries. The offer is conditional upon its acceptance by the holders of not less than 75% of the shares.

WESTERN VISCOSE MILLS, LTD.

The first ordinary general meeting was held on July 1, Sir Drummond Drummond Fraser, K.B.E., chairman, presiding. The company was concentrating on quality and testimony had been forthcoming that the company's yarn was one of the best on the market. The yarn had had a ready sale from the first, and negotiations were pending with large buyers for home and overseas trade. Sir Max Muspratt, Bart., said that the manufacture of artificial silk was a combination of complicated chemical and engineering processes, with no small demand on human skill. Apart from the inevitable delays in completing equipment, due to the coal stoppage, most praiseworthy progress has been made, and the successful launching of large-scale manufacture reflected the greatest credit on the management. Great expense was saved by the careful study of each stage of the process in the experimental plant, the unavoidable losses of starting a new process thus being incurred in hundred-weights instead of in tons. The highest quality of viscose silk was being aimed at, and, with all the experience and training gained, was being steadily attained; it also dyed well.

BRITISH CELANESE, LTD.

An extraordinary general meeting was held on June 30, at which resolutions were confirmed for the removal of certain directors, namely, Mr. J. G. Raphael, Capt. the Rt. Hon. F. E. Guest, and Mr. L. Chandler. Dr. Dreyfus, who presided, referred to the financial position of the company, and said that it might be that no reorganisation would be necessary. He would recommend to the Board such a scheme as would deal with the position in such a way that it would not take too long. The potentialities of the business and its earning power were the main factors.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 India-rubber Subst^tutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals,—8d.—9d. per lb. Crude 60's, 2s. 6d.—2s. 8d. per gal.
 Acid Cresylic, 90/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 3½d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 11d.—1s. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 8d.—1s. 10½d. per gal. Pure, 2s.—2s. 3½d. per gal.
 Xylol.—1s. 11d.—2s. 4d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—9d. per gal. Middle Oil, 7½d.—8d. per gal. Heavy, 8½d.—8½d. per gal. Salty, 7d. per gal., loss 1½%.
 Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/100, 1s. 5d.—1s. 6d. per gal. Solvent 95/100, 1s. 5d.—1s. 6d. per gal. Solvent 90/100, 11d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals,—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—77s. 6d.—85s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4½d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—5 cwt. lots. Cryst. 41s. per cwt. Powder 45s. per cwt. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7½d.—1s. 10d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 4d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. per lb.
 Benzophenanthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—5 cwt. lots. Crystal 25s. per cwt. Powder 27s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium.—1s. 10d.—1s. 11d. per lb. Sodium.—2s.—2s. 2d. per lb. All spot.
 Calcium Lactate.—1s. 3½d. per lb.
 Chloral Hydrate.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate. 6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ½ lb., 9s. 6d. per doz.; ¼ lb., 6s. 6d. per doz. 10 vols.—2s. 3d.—2s. 11d., according to quality and package.
 Hydroquinone.—2s. 11d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 22s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 11s. 6d.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 6d.—1s. 8d. per lb.
 Methyl Sulphonate.—9s. 6d.—9s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 2d.—1s. 4d. per lb.
 Phenacetin.—2s. 9d.—3s. per lb.
 Phenazone.—4s. 3d.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d. per lb. for 1 cwt. lots.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins.
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—97s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—6s. 6d.—6s. 9d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.

Thymol, Puriss.—10s. 3d.—11s. 6d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. 3d. per lb.

Aubepine (*ex Anethole*).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. **Amyl Butyrate.**—5s. 3d. per lb. **Amyl Salicylate.**—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. **Benzyl Alcohol** free from Chlorine.—2s. per lb. **Benzaldehyde** free from Chlorine.—2s. 6d. per lb. **Benzyl Benzoate.**—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—8s. 9d. per lb.

Ethyl Cinnamate.—7s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—9s. per lb. **Geraniol** (Palmarosa).—17s. 6d. per lb. **Geraniol.**—6s. 6d.—10s. per lb. **Heliotropine.**—4s. 9d. per lb. **Iso Eugenol.**—13s. 6d. per lb. **Linalol.**—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. **Linalyl Acetate.**—(*ex Bois de Rose*) 18s. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. 6d. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—3s. 9d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. **Safrol.**—1s. 6d. per lb. **Terpineol.**—1s. 6d. per lb. **Vanilin.**—17s.—18s. 6d. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. **Anise.**—3s. 1d. per lb. **Bergamot.**—28s. 6d. per lb. **Bourbon Geranium.**—14s. 6d. per lb.

Cumpher.—67s. 6d. per cwt. **Cananga, Java,** 26s. per lb. **Cassia, 80/85%.**—8s. 3d. per lb. **Cinnamon, Leaf.**—6d. per oz. **Citronella.**—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. **Clove, pure.**—6s. per lb.

Eucalyptus, 75/80%.—2s. 4d. per lb. **Lavender.**—Mont Blanc 38/40%, 21s. per lb. **Lemon.**—8s. per lb. **Lemon-grass.**—4s. 6d. per lb. **Orange, Sweet.**—10s. 6d. per lb. **Otto of Rose.**—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. **Palma Rosa.**—10s. 6d. per lb. **Peppermint.**—Wayne County, 18s. per lb. **Japanese,** 8s. per lb. **Petitgrain.**—7s. 6d. per lb. **Sandalwood.**—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Aug. 27th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on July 14th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Akt. Separator. Treating liquids. 16,348. June 20. (U.S., 22,626.)

British Thomson-Houston Co., Ltd. (General Electric Co.). Refrigerator evaporators. 16,628. June 22.

Chapman. Separation of substances of different specific gravity. 16,798. June 24.

Chem. Fabr. u. Seruminstitut Bram. Separating mixed substances. 16,503. June 21. (Ger., 21,626.)

Hill. Grinding-mills etc. 16,765—6. June 13.

Hole. Condensation product. 16,305. June 20.

Johnson (I.-G. Farbenind.). Treatment of gases with liquids. 16,344. June 20.

Kaiser-Wilhelm-Institut für Eisenforschung. Determining temperature of gases. 16,452. June 21. (Ger., 16,726.)

Krupp Grusonwerk. Apparatus for expressing liquid constituents from materials. 16,395. June 20. (Ger., 23,626.) Apparatus for expressing liquids from materials. 16,474. June 21. (Ger., 20,626.)

Mortrud. Evaporation apparatus. 16,483. June 21. (Norway, 25,626.)

Noppol. Tunnel kilns. 16,841—2. June 24.

Porteus. Mixing, cooking, and drying apparatus. 16,916. June 25.

Ross. Crushers for granular materials. 16,462. June 21.

Thame. Sublimation of volatilisable substances. 16,739. June 23.

Tuckett. Apparatus for drying granular etc. materials. 16,764. June 23.

Vernay. Filtering-apparatus. 16,619. June 22. (Fr., 3,826.)

I.—Complete Specifications

1416 (1926). Frankl. Separation of gaseous mixtures. (246,172.)

4003 (1926). I.-G. Farbenind. Preparing emulsions. (247,588.)

7572 (1926). Fasting. Rotary kilns. (272,616.)

16,348 (1926). Highfield and Highfield. See XXIII.

18,444 (1926). Wiegand. Evaporating apparatus. (272,703.)

21,646 (1926). Camuset. See XVII.

24,113 (1926). Excelsior Feuerlöschgerate. Extinguishing fires. (260,262.)

26,744 (1926). Heskamp. Working shaft furnaces. (272,751.)

26,781 (1926). Caals. Filter cloths. (269,841.)

903 (1927). Amundsen. Production of cold. (266,683.)

1516 (1927). Hase. Optical pyrometer. (272,799.)

*28,193 (1926). Svenska Akkumulator Akt. Jünger. Filters. (272,841.)

*6126 (1927). Industrial Associates, Inc. Spray drying. (272,859.)

*13,638 (1927). Chem. Fabr. vorm. Schering. Manufacture of colourless melted products. (272,875.)

*15,311 (1927). Geigy A.-G. Preparations convertible into dispersions. (272,896.)

*15,854 (1927). Mielck. Continuous treatment of liquids with gases. (272,913.)

*15,982 (1927). Schäfer. Purifying-separator for liquids. (272,927.)

*16,503 (1927). Chem. Fabr. u. Serum-Institut Bram. Separating mixed substances. (272,968.)

II.—Applications

Johnson (I.-G. Farbenind.). Separation of oils from mixtures. 16,346. June 20. 16,347. See III.

II.—Complete Specifications

3984—9 (1926). I.-G. Farbenind. Manufacture of hydrocarbons and derivatives from coal etc. (247,582—7.)

7205 (1926). Patart. Production of liquid hydrocarbons etc. from heavy organic materials. (249,519.)

9861 (1926). I.-G. Farbenind. Manufacture of hydrocarbons etc. from mineral oils, bitumens, etc. (250,948.)

15,504 (1926). Urbana Coke Corp. Apparatus for coking coal. (256,192.)

16,222 (1926). I.-G. Farbenind. Destructive hydrogenation of coal, tar, mineral oils, and the like. (254,713.)

23,527 (1926). Geipert. Testing samples of coal by distillation. (268,718.)

25,316 (1926). Plassmann. Low-temperature distillation of fuel. (260,569.)

26,225 (1926). Still. Coke ovens. (260,974.)

28,894 (1926). Verein f. Chem. u. Metallurg. Produktion. Re-activating decolorising charcoal. (264,799.)

29,398 (1926). Menell. Vertical retort for extracting oil from shale, coal, peat, etc. (272,760.)

32,715 (1926). Humphreys & Glasgow, Ltd. Apparatus for carburetting water-gas. (266,080.)

32,716 (1926). Humphreys & Glasgow, Ltd. Apparatus for making water-gas and other cyclical gas-making processes. (266,681.)

9523 (1927). Nielsen and Laing. Manufacture of illuminating and industrial gases. (272,822.)

12,680 and 13,508 (1927). Manufacture of hydrocarbons and derivatives from coal etc. (272,829-272,835.)

*15,642 (1927). Trautmann. See III.

*16,094 (1927). Silica en Ovenbouw Mij. Coke ovens. (272,942.)

III.—Application

Johnson (I.-G. Farbenind.). Manufacture of hydrocarbons. 16,347. June 20.

III.—Complete Specifications

15,075 (1926). Meiro. Extraction of crystals from anthracene, naphthalene, and like distillates of coal tar. (255,429.)

15,076 (1926). Meiro. Distillation of coal tar, tar oils, etc. (267,074.)

16,222 (1926). I.-G. Farbenind. See II.

*15,642 (1927). Trautmann. Extracting benzene during distillation with scavenging or circulating gas. (272,903.)

IV.—Applications

British Dyestuffs Corp., Ltd., Shepherdson, and Thornley. Manufacture of black and grey vat dyes. 16,731. June 23.

British Research Association for the Woollen and Worsted Industries, and Barker. Testing dyestuffs etc. 16,557. June 22.

Carpmael (I.-G. Farbenind.). Manufacture of dyestuffs. 16,377. June 20.

Deshborough, Knight, and Thomson. Nitration of materials. 16,822. June 24.

I.-G. Farbenind. Manufacture of aliphatic and hydroaromatic sulphonic acids. 16,486. June 21. (Ger., 21.6.26.) Manufacture of dyestuffs. 16,511. June 21. (Ger., 24.6.26.)

Manufacture of amino-alkylanilino derivatives of aromatic amino-oxy and polyamino compounds. 16,752. (Ger., 8.7.26.)

Johnson (I.-G. Farbenind.). Manufacture of dyestuffs. 16,972. June 25.

Scottish Dyes, Ltd., Anderson, Thomas, and Thomson. Production of benzanthrone derivatives. 16,894. June 24. Production of dyestuff intermediates. 16,964. June 25.

IV.—Complete Specifications

6244 (1926). I.-G. Farbenind. Manufacture of azo-estuffs. (248,706.)

6618 (1926). Imray (I.-G. Farbenind.). Manufacture of azo-dyestuffs. (272,580.)

6838 (1926). Leitch & Co., Ltd., and Everest. See XIII.

7197 (1926). Marks (Du Pont de Nemours & Co.). Recovery of antimony in the manufacture of flavanthrone. (272,597.)

13,969 (1926). I.-G. Farbenind. Manufacture of substituted aromatic sulphonic acids. (253,118.)

*15,724 (1927). I.-G. Farbenind. Production of metallic compounds of dyestuffs. (272,908.)

*15,967 (1927). I.-G. Farbenind. Manufacture of dye-stuffs of the anthracene series. (272,924.)

*16,172 (1927). I.-G. Farbenind. Production of dyestuffs containing copper and chromium. (272,949.)

*16,486 (1927). I.-G. Farbenind. Manufacture of aliphatic and hydroaromatic sulphonic acids. (272,067.)

V.—Applications

Czapek. Imparting silk lustre to viscose etc. bodies. 16,500. June 21. (Ger., 8.7.26.)

Food Chillers, Ltd. Waterproofing fabrics, paper, etc. 16,861. June 24. (Australia, 22.7.26.)

Lilienfeld. Treatment of fibrous material. 16,370. June 20.

Melliand. Treating products obtained from vegetable fibres. 16,888. June 24. (Ger., 25.6.26.)

Scholler. Saccharification of cellulose-containing materials. 16,732. June 23. (Ger., 23.6.26.)

Soc. Inoxi. Production of crepe effects on artificial silk threads. 16,551. June 22. (Fr., 14.1.27.)

Weingand, and Wolff & Co. Imparting silk lustre to viscose etc. bodies. 16,500. June 21. (Ger., 8.7.26.)

V.—Complete Specifications

6964 (1926). London Electric Wire Co., & Smiths, Ltd., and Wildy. See XI.

18,727 (1926). Neutrasol Products Corp. Manufacture of artificial silk etc. (255,909.)

21,177 (1926). Wolff & Co., Czapek, and Weingand. Production of artificial silk. (257,925.)

31,264 (1926). I.-G. Farbenind. Production of valuable fibre half-stuff. (264,803.)

31,849 (1926). Allison and Brown. Treating absorbent materials. (272,781.)

*16,080 (1927). Nederlandsche Kunstzijdefabr. Manufacture of artificial textile products. (272,939.)

VI.—Applications

Aspinall, and Aspinall, Ltd. Bleaching fabrics etc. 16,918. June 25.

British Celanese, Ltd., and Cadgène. Dyeing cellulose derivatives. 16,585-6. June 22. (U.S., 30.6.26.)

Ellis (Soc. Fabr. Soie Rhodiaseta). Production of dull effects on fibres. 16,641. June 22.

Food Chillers, Ltd. 16,861. See V.

Johnson (I.-G. Farbenind.). Printing on acetate silk etc. 16,345. June 20.

Pollopa, Ltd., and Spencer. Dyeing. 16,785. June 24.

Rivat. Dyeing cellulose derivatives. 16,585-6. June 22. (U.S., 30.6.26.)

Wakefield. Dyeing fabrics. 16,673. June 23.

VI.—Complete Specifications

7237 (1926). Tom. Impregnation of fibrous materials. (260,540.)

27,718 (1926). Meyer-Sansboeuf Ges. Improving vegetable textiles. (263,102.)

30,344 and 31,731 (1926). Gminder. Treatment of vegetable fibrous materials with mercerising and like liquids. (262,154 and 267,470.)

*16,093 (1927). I.-G. Farbenind. Dyeing. (272,941.)

VII.—Applications

I.-G. Farbenind. Production of anhydrous metal chlorides. 16,761. June 23. (Ger., 13.8.26.)

Jackson (Rhenania Kunheim Verein Chem. Fabr.). Recovery of argillaceous earth from aluminium phosphates. 16,836. June 24.

Schuster. Manufacture of chromic acid. 16,741. June 23.

VII.—Complete Specifications

8500 (1926). Towler and Marsh. Ammonia stills etc. (272,641.)

23,541 (1926). I.-G. Farbenind. Production of phosphorus pentoxide or phosphoric acid. (260,225.)

23,948 (1926). Meyerhofer. Producing metal compounds. (272,733.)

26,166 (1926). Mond (I.-G. Farbenind.). Production of alumina. (272,748.)

27,494 (1926). I.-G. Farbenind. A.-G. Production of cobaltous acetate. (262,075.)

1164 (1927). I.-G. Farbenind. Manufacture of phosphorus and phosphorus oxides. (264,520.)

1850 (1927). Krebs. Apparatus for electrolysing solutions of alkali metal chlorides. (264,865.)

6107 (1927). Dupire. *See* XI.

*29,027 (1926). Omnium des Industries Chimiques. Production of ammonia. (272,842.)

*15,984 (1927). Uhde. Separating ammonia from gases. (272,929.)

*15,985 (1927). Uhde. Synthesis of ammonia. (272,930.)

VIII.—Applications

Corsan. Iridescent glass. 16,905. June 25.

Goldschmidt and Knudsen. Refractory material. 16,581. June 22.

IX.—Applications

Coles. Cement. 16,430. June 21.

Heaton. Manufacture of bricks, tiles, etc. 16,942. June 25.

Johnson (I.-G. Farbenind.). Manufacture of plaster compositions. 16,343. June 20.

Tooth. Compositions for heat insulating etc. 16,539. June 22.

IX.—Complete Specifications

893 (1927). La Trinidad. Manufacture of bituminous or tarry emulsions. (264,497.)

4110 (1927). Eckel. Cement. (268,736.)

X.—Applications

Ashcroft. Metallurgy. 16,866—7. June 24. Separating tin from ores etc. 16,868. June 24.

Johnson (I.-G. Farbenind.). Manufacture of iron. 16,968. June 25. Metallic coatings of chromium etc. 16,969. June 25. Production of iron, nickel, etc., from mixtures. 16,971. June 25.

Jones and Taylor. Material for case-hardening metals. 16,909. June 25.

Metals Protection Corp. Chromium plating. 16,876. June 24. (U.S., 9.9.26.) Polishing chromium. 16,878. June 24. (U.S., 9.9.26.)

X.—Complete Specifications

7445 (1926). Smith. Treatment of metal surfaces. (272,610.)

10,258 (1926). Crowell & Murray Co. Beneficiation of ores. (251,959.)

15,525 (1926). I.-G. Farbenind. Preventing oxidation of magnesium and its alloys. (254,302.)

18,638 (1926). Mond (Goldschmidt A.-G.). Aluminium alloys. (272,706.)

20,904 (1926). Alberti, Thielmann, and Begas. Extraction of zinc from zinc-iron-silicious slags. (259,188.)

108 (1927). Kamishima. Alloy of high specific electrical resistance. (272,788.)

6027 (1927). Lacell. Production of magnesium. (268,316.)

*14,725 (1927). Cholewinski. Bearing metals. (272,889.)

*15,851 (1927). Verein. Stahlwerke. Manufacture of high-grade cast iron. (272,912.)

XI.—Applications

Crood (Jessup & Moore Paper Co.). Electrolytic cells. 16,582. June 22.

Harrison. Electrolytic apparatus. 16,493. June 21.

Parville. Electric accumulators. 16,492. June 21.

IX.—Complete Specifications

6964 (1926). London Electric Wire Co., & Smiths, Ltd., and Wildy. Increasing insulating properties of cotton fibre etc. (272,587.)

27,351 (1926). Felten & Guillaume Carlswerk A.-G. Production of insulating-paper containing phenol resins. (270,243.)

32,181 (1926). British Thomson-Houston Co., Ltd. Electric furnaces. (263,792.)

1850 (1927). Krebs. *See* VII.

6107 (1927). Dupire. Electrolytic apparatus particularly for electrolysing alkali chlorides. (267,912.)

*15,872 (1927). Silica Gel Corp. Electric batteries. (272,916.)

*16,006 (1927). Metallwerk Plansee Ges., and Schwarzkopf. Electrical resistance furnaces. (272,933.)

XII.—Application

Johnson (I.-G. Farbenind.). 16,346. *See* II.

XIII.—Applications

Auer. 16,578—9. *See* XX.

Baly and Baly. 16,784. *See* XX.

Bell and Treleven. Manufacture of luminous paint. 16,371. June 20.

British Thomson-Houston Co., Ltd. Resinous compositions. 16,327. June 20. (U.S., 25.6.26.)

I.-G. Farbenind. Manufacture of coloured compounds. 16,487. June 21. (Ger., 12.8.26.)

Naugatuck Chemical Co. Removing liquid from resinous products. 16,332. June 20. (U.S., 25.8.26.)

Pollovas, Ltd. Manufacture of aldehyde condensation products. 16,783—4. June 24.

XIII.—Complete Specification

6838 (1926). Leitch & Co., Ltd., and Everest. Reduction of pigment colours and lakes to a finely-divided state. (272,585.)

XIV.—Complete Specifications

*7700 (1927). Chem. Fabr. Kalk, and Oehme. Vulcanisation of rubber. (272,860.)

*12,457 (1927). I.-G. Farbenind. Gelatin for light-sensitive silver salt emulsions. (272,867.)

XV.—Application

Du Pont de Nemours & Co. Leather substitute. 16,859. June 24. (U.S., 24.6.26.)

XVI.—Applications

Johnson (I.-G. Farbenind.). Manufacture of fertilisers. 16,970. June 25.

Rhenania-Kunheim Verein Chem. Fabr. Manufacture of fertilisers. 16,331. June 20. (Ger., 28.6.26.)

XVII.—Application

Scholler. 16,732. *See* V.

XVII.—Complete Specifications

21,646 (1926). Camuset. Diffusion plants for making extracts from sugar beet, sugar cane, etc. (258,849.)

*13,866 (1927). Chem. Fabr. vorm. Schering. Manufacture of fructose from inulin. (272,876.)

*16,005 (1927). Elektro-Osmose A.-G. Purifying sugar solution. (272,943.)

XVIII.—Application

Olsen. Manufacture of yeast. 16,523. June 21.

XIX.—Applications

Bellwood. Drying fish etc. 16,272. June 20.

Food Chillers, Ltd. Conservation of meat, eggs, etc. 16,862. June 24. (Australia, 30.7.26.)

Warburg. Preparation of mineral waters. 16,625. June 22. (Ger., 22.7.26.)

XIX.—Complete Specifications

12,637 (1926). Schlotterhose. Production of fish-meal. (272,663.)

25,546 (1926). Macpherran. Dehydrating fruits vegetables. (272,741.)

XX.—Applications

Altenburg and Eichelbaum. Preparations of animal organs. 16,513. June 21. (Ger., 28.7.26.)

Auer. Coagulation etc. of products containing unsaturated carbon compounds. 16,578. June 22. Altering aggregation of products containing unsaturated carbon compounds. 16,579. June 22.

Baly and Baly. Manufacture of aldehyde condensation products. 16,784. June 24.

I.-G. Farbenind. 16,486. See IV. Manufacture of cyclic ketones. 16,846. June 24. (Ger., 24.6.26.)

Pollopos, Ltd. 16,783-4. See XIII.

XX.—Complete Specifications

31,955 (1925). Macewen. Manufacture of solution of derivatives of dioxidiamino-arsenobenzene. (272,567.)

12,997 (1920). Casale. Preparing alcohols and other oxygenated organic compounds. (252,713.)

15,427 (1926). Heyn. Production of salts of amino-guanidine or amino-alkylene-guanidines. (272,686.)

*10,646 (1927). Commercial Solvents Corp. Catalysts for synthetic methanol production. (272,664.)

*15,954 (1927). Böhme A.-G. Rendering higher alcohols soluble. (272,919.)

*15,966 and 16,179 (1927). Consort. f. Elektrochem. Ind. Manufacture of acetic anhydride. (272,923 and 272,951.)

*16,486 (1927). I.-G. Farbenind. See IV.

XXI.—Complete Specifications

27,200 (1926). Didier. Three-colour photography. (272,754.)

*15,968 (1927). Devienne. Toning and fixing of photographic prints. (272,925.)

XXII.—Applications

Desborough, Knight, and Thomson. 16,822. See IV.

Imperial Chemical Industries, Ltd., and Alexander. Explosives. 16,362. June 20.

XXIII.—Complete Specifications

3315 (1926). Beck, and Deutsche Gold- und Silber-Scheideanstalt. Destroying animal pests. (272,570.)

16,348 (1926). Highfield and Highfield. Treatment of feed-water for steam boiler plants. (272,693.)

*15,508 (1927). Jamotte. Combustible disinfectant, antiseptic, or parasiticide product. (272,900.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number: *Argentina*: Steel (A.X. 4846). *Australia*: Chemicals (648). *British India*: Process chemicals, chemicals (650); galvanised corrugated mild steel sheets, glass, steel tyres (Director General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Denmark*: Glazed pipes, fireproof materials, roofing (654). *Germany*: Oils (lubricating, textile and leather), paraffin wax (657). *Holland*: Copper tubes, condenser tubes (663). *Italy*: Copper sulphate (664). *South Africa*: Spring steel (A.X. 4841); Steel lighting poles (A.X. 4842); steel bars (A.X. 4838). *Spain*: Essences for perfume manufacture (666). *Syria*: Artificial silk yarns (671).

Uncompounded Drugs and the Merchandise Marks Act, 1926

The Board of Trade has exempted uncompounded drugs, from whatever source derived, which are sold for medicinal purposes, from the requirement that imported goods bearing a British name or trade mark must also bear an indication of origin. The exemption does not apply, however, if the drugs are sold or exposed for sale under a proprietary name.

News from Advertisements

1. The Egyptian University, Cairo, requires a glass blower (p. x).

2. An assistant chemist is wanted for petroleum refinery in India (p. x).

3. One or two academically trained chemists, preferably with experience in the manufacture of acetic anhydride, are wanted (p. x).

4. A food factory in South London is advertising for a laboratory assistant (p. x).

5. The Royal Technical College, Glasgow, again announces particulars of the forthcoming session (p. x).

6. Viscose chemist (lady) requires a laboratory or plant appointment (p. x).

7. An organic chemist and chemical engineer seeks technical or business appointment in the London area (p. x).

8. Second-hand Redwood Viscometer and other instruments are wanted (p. x).

9. Several volumes of various chemical journals are required (p. x).

10. A technical chemist is required for a situation in the East (p. x).

11. There are 96 firms using the Buyers' Guide in this issue of CHEMISTRY AND INDUSTRY (p. x).

PUBLICATIONS RECEIVED

AN INTRODUCTION TO BUILDING SCIENCE. By F. L. Brady, M.Sc., A.L.C. Pp. viii + 280. London: E. Arnold & Co., 1927. Price 7s. 6d.

CHEMISTRY. By P. E. Spielmann, Ph.D., B.Sc., A.R.C.Sc., A.Inst.P., M.Inst.P.T. Pp. 80. Benn's Sixpenny Library. London: Ernest Benn, Ltd., 1927. Price 6d.

THERMOMETRIC CONVERSION CHART. By P. L. Marks, L.R.I.B.A. London: Crosby Lockwood & Son, 1927. Price 3s. 6d.

THE DISPOSAL OF SEWAGE. By T. H. P.-Veal, B.Sc., A.M.I.C.E. Pp. xiv + 173. London: Chapman & Hall, Ltd., 1927. Price 10s. 6d.

A SHORT HAND-BOOK OF OIL ANALYSIS. By A. H. Gill, S.B., Ph.D., Sc.D. Eleventh edition, revised and enlarged. Pp. 293. London: J. B. Lippincott Co., 1927. Price 18s.

SOAP AND GLYCERINE MANUFACTURE. By E. T. Webb. Pp. 224. London: Davis Bros., 1927. Price 25s.

KOLLOIDCHEMISCHE TECHNOLOGIE. Ein Handbuch kolloid-chemischer Betrachtungsweise in der chemischen Industrie und Technik. Edited by Dr. R. E. Liesegang and others. Pp. viii + 1047. Dresden & Leipzig: Th. Steinkopff, 1927. Price, paper, 66 m.; bound, 70 m.

ATOMS AND MOLECULES. By R. M. Caven, D.Sc. Being Part I and Chapter XII of the Foundation of Chemical Theory. Pp. viii + 141. London: Blackie and Son, Ltd., 1927. Price 7s.

JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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No. 28

EDITORIAL

Trypanocides

THE progress of the British dyestuffs and fine chemicals industries has amply justified the measures of protection which have been afforded during the past few years. The quality, range of production, and price levels arranged demonstrate that there has been no abuse of the confidence placed in the manufacturers, who have striven in every way to meet the natural desire of the consumers to buy in the cheapest market, and the fact that 80% of the British requirements for dyestuffs has been met for some time from home factories stands in strong contrast with the pre-war position. The general acquiescence of the dyestuffs industry in the new price factor decided upon by the Dyestuffs Advisory Licensing Committee provides the latest evidence of the determination of the industry to face foreign competition boldly. British fine chemicals are winning a splendid reputation throughout the world, and the quality of British research in this field is surpassed nowhere. British-made insulin is recognised abroad as second to none, and is finding acceptance even in Germany and in former German-fed markets, whilst the story of real progress in its production and consequent price reductions has often been told. Borocaine, a synthetic local anæsthetic with special advantages over cocaine, and synthetic anæsthetics such as eucaine, is still a comparatively new product. Synthetic thyroxin came upon the market in a remarkably short space of time after its constitution had been determined and its synthesis so brilliantly achieved by Harrington. Similarly, intensive work upon the question of the irradiation of cholesterol and its associated sterols was rapidly followed by the commercial production of an irradiated ergosterol, which supplies for the first time an artificial vitamin D preparation of amazing potency.

Ever since Ehrlich blazed a trail into the unknown country of chemotherapy, German, French and British chemists have been seeking a synthetic remedy for the scourge of sleeping sickness, but success has been largely denied them until, a few years ago, Bayer 205 was produced. Still more recently Fourné made his com-

pound No. 309. It is gratifying to note that fundamental work is still proceeding in this country upon the relation of chemical constitution to trypanocidal power, as is shown by the appearance of Part VI of King's investigations in the current number of the Journal of the Chemical Society. It will be remembered that it was King who suggested that the secret Bayer 205 was probably made by the action of carbonyl chloride upon the amino derivative of a substance produced by the twofold introduction of *p*-nitrobenzoyl chloride into the molecule of H acid. That this suggestion was near the mark was proved by the synthesis of Fourné 309, which appears to be closely allied to the German preparation, but in which *p*-nitrobenzoyl chloride and 2-nitro-*p*-methylbenzoyl chloride are employed in place of two molecules of the former benzoyl derivative.

Perhaps two of the most important series of trypanocidal drugs are those which contain the phenylarsenic acid grouping and a naphthylaminesulphonic acid grouping linked with one or more aminobenzoyl residues, and it has been the bold conception of King and his co-workers, amongst other things, to prepare compounds containing at one and the same time these two potentially powerful groupings. The series of complicated researches already reported has revealed a masterly grip of the science of organic synthesis and makes fascinating reading, although it is to be regretted that as yet no compound has shown the trypanocidal powers of the Bayer or Fourné preparations.

The complexity of the syntheses recorded may be gauged from the following broad outline. In the first place the three *ortho*, *meta* and *para* aminobenzoyl-*p*-aminophenylarsinic acids were prepared, and by a repetition of the process of nitro-benzoylation and reduction of the nitro groups to amino groups, further aminobenzoyl groupings were added. The number of compounds possible is very large, and many have been prepared and examined in regard to their trypanocidal activity, and the work has been still further extended and elaborated by the preparation of symmetrical carbamides with the aid of phosgene. Unfortunately, however, amongst the trinuclear compounds prepared,

the only one which had any curative action upon trypanosomiasis was *p''*-aminobenzoyl-*m'*-aminobenzoyl-*p*-aminophenylarsinic acid which, in a dose of 0.175 mg., caused the temporary disappearance of trypanosomes from the animals experimented upon, but relapse occurred relatively soon. Again, with the aid of phosgene, such a compound as that just indicated can be duplicated in a symmetrical carbamide, and many carbamides, clearly of very high molecular weight and representing arsenical preparations of the greatest known complexity, have been made, but whilst of extreme interest in many ways, they are comparatively inapplicable as trypanocides.

Further complications with regard to the amphoteric nature of possible curative preparations have been studied, as yet without avail, but the elaborate programme is not yet at an end and, with the recollection of Ehrlich's six hundred and five unsuccessful preparations which had to be made and tested so unwearyingly before salvarsan or "606" was given to the world, we may in all humility counsel the British workers to persevere until ultimate victory crowns their magnificent efforts.

The Cure of Sleeping Sickness

The value of a successful curative drug for the scourge of sleeping sickness can scarcely be overestimated, particularly in its incidence upon the development of the tropical parts of the Empire. Small wonder, then, that the merits of Bayer 205 should have received careful scrutiny at the hands of experts. It is known that the chemotherapeutic index—that is, the ratio of the minimum curative dose to the maximum amount tolerated by the animal under test—of Bayer 205 is as low as 1 to 160, a figure which contrasts markedly with the 1 to 2 ratio of such a preparation as atoxyl, one of the early trypanocidal drugs. Fournier's compound shows an index which is as low as or lower than that of the German preparation, and we shall hope to hear more of its practical value. All we know up to the present is that remarkable cures have been effected with the aid of Bayer 205, as has been shown by the reports of the Medical Expedition sent out under the auspices of the British Colonial Office. Another disease of the sleeping sickness type which affects horses in South America, has been successfully treated with Bayer 205. Similarly, sleeping sickness in horses and cattle in Malaya has been cured in 50–75% of the cases kept under observation. In this country, it is recorded that seven out of nine human beings suffering from sleeping sickness, *T. gambiense*, were cured. Again, 200 cases of sleeping sickness in South African natives have been successfully treated with the German preparation, and even where the central nervous system was affected the remedy has not been without result. Much remains to be done both in the preparation of more powerful trypanocides, and in their full testing out and application.

Bathos, Alternate Polarities and China

A valued correspondent has accused us of that sinking sensation, bathos: it is probably true: we have been accused of worse crimes, even flippancy, but to this we plead not guilty. What our correspondent calls bathos we consider accuracy. Every time that prolonged meditation calls forth some noble sentiment and sonorous

phrase, the still small voice of reason calls upon us, in the near future, sometimes even the next sentence, to counteract the exaggeration and discount the premium. This is typical of the structure of man's mind, and of many other organic substances; they are divided into layers, probably concentric, which correct each other's exuberance or poverty; if the one layer soars above the average, the next layer will sink below it, for the law of truth, the average, the neutral state, will ultimately prevail. A section through the human mind would therefore show a sinuous curve, resembling a snake in the grass, the forked tongue of which is followed by harmless coils, and these by the sting in the tail. As a matter of fact, the sting is comparatively rare in modern snakes, and the nearest approach to it is the rattle. This, again, is typical of the editorial mind. If a man is modest of his achievements, who can say whether this is modesty or vanity? There is no vanity so pernicious as the conscious understatement of our abilities. And yet the man may recognise this fact and descend to a philosophical level which is indifferent to both the affectation of vanity and the affectation of modesty. This desire to counteract the excess is the true explanation of alternate polarities in chains of carbon atoms and of the bathos which a casual observer may detect on the surface layer of some of our editorial effusions. Action and reaction are equal and opposite. It is the extreme Socialists who are the main strength of the stern unbending Tories: it is the latter who are the main cause of the Socialists. When Mr. Edwin Thompson enlivened the proceedings at the Society's banquet in Edinburgh by a bright and amusing speech, which could be easily heard throughout the hall, he afforded another instance of this sort of alternation of the vehement and the quiet, the positive and negative. We wrote an editorial in April in which we alluded to China. The information at our disposal was then obviously a few days—perhaps even two or three weeks—old, and we are informed now by residents in China that we have given a wrong impression of the state of affairs. As we have no wish to do this, we take this, the first, opportunity of publishing our correspondent's corrections, which have taken a few weeks to reach us. They inform us that the labour situation is very serious, and is causing very grave concern to employers, and that the ideas we had about Shanghai are not in accordance with the facts. The river frontage of the French concession and International Settlement is about six miles, and the area of these two is about fifteen square miles: the resident foreign population is 38,000 and the resident Chinese population 1,100,000. The tramways, electricity department, and waterworks company are huge concerns with a capital running into several millions; that, though the factories in the Shanghai area were working at nearly normal capacity in the large area then occupied by the Cantonese Army, most of the factories were closed down, and many have been utterly destroyed. To what extent some of the other statements in our correspondent's letter have been modified during the last five weeks we do not know, but we think that reactions have taken place in that country also. Whether alternations have taken place or not, we have no desire to place misleading information before our readers, and are always grateful to those who help us to greater accuracy.

THE ANNUAL MEETING

There is no doubt that the Edinburgh meeting has been a conspicuous success. It was well attended, about four hundred took part in it, though comparatively few stayed from the beginning until the very end. We missed a number of those who have held high office in the Society and have been constant in their attendance at these meetings, for instance Sir William Pope, Dr. E. F. Armstrong, Mr. W. J. U. Woolcock, and Dr. Levinstein, various engagements and other causes prevented these from coming, so too Prof. H. E. Armstrong, M. Agache, Dr. Fourneau, and some others who, we hoped, would be present. Our ex-president, Prof. Louis, recently nominated as President of the Institution of Mining Engineers, had to leave before the meeting was concluded, so had our ex-treasurer, Mr. E. V. Evans, and our ex-member of Council Mr. Emile Mond, replete with the best products of Princes Street and with recollections of Loch Katrine. On the other hand, many old friends and young friends came early and sat up late and were loth to go home. We were glad to welcome Dr. Kurt Meyer and Frau Meyer; Dr. Meyer's excellent speech at the dinner was received with enthusiasm, and we shall hope for his presence at our future meetings and to listen to other speeches of his, equally well-phrased, equally full of matter, and equally brief.

The Edinburgh meeting left a rather confused impression on our minds: there was so much to do, and see and say, and listen to, and all of it very good. We came away with mingled recollections of the Presidential address, Col. Pollitt's address, the beauty of Edinburgh and the surrounding country, the local patriotism of the Scots, and the skill and enthusiasm of the local committee, and in particular the chairman and secretary, who had organised most successful papers, discussions, visits, receptions and dances. We have already written on the address of the President, while his words were still fresh in our mind, but before we had any opportunity of reflecting upon them. The distance of Edinburgh from London compelled us to write with the utmost speed of which we are capable, and we were, in consequence, unable to indicate how excellent and how well written his address was; fortunately the paper is already published, and speaks for itself.

Colonel Pollitt looked at his subject broadly, and spoke of it as some black-and-white artists draw pictures, giving us the essential features surely and simply with no unnecessary frillings and no redundancy of thought or word. His industrial schemes are too broad to be conceived by any narrow mind, he "makes one city of the universe, where some may gain and all may be supplied." We feel sure that all our readers will profit by his address; it deserves a far wider audience. One of our writers told us recently that Carlyle had a bad digestion and mistook it for a deranged universe; Col. Pollitt, on the other hand, can see the universe as it is, and frame his plans accordingly, down to all the essential details.

Many volumes have been written about Edinburgh, Melrose, Abbotsford, and the Trossachs; many more

could be written, and still the subjects would not be exhausted; there never were any other city and district which, naturally beautiful, have by the lapse of years and by historical, romantic and literary associations from ancient to modern times, become so full of charm. It is no mere chance arrangement: no atoms casually together hurled, could e'er produce so beautiful a world; from the Castle yard we saw Edinburgh and the Firth of Forth at midnight: we saw Loch Vennachar and Loch Earn during alternations of rain and sunshine; we intended to see much more, and have the intention still firmly fixed in our minds. The civic reception was full of interest, the robes of the Lord Provost, the bairns, the councillors and the attendants took us into the mediæval past, and it was a delight to see the Solemn League and Covenant and the many relics of Scott, Burns, Ferguson, and other famous men. It is worth while to leave the smoke, the wealth, the roar of London, and the bustling street, in order to see the quiet of Holyrood, and the peace that is among the lonely hills. The Scots have every reason to be proud of their capital, their country, their history, their poetry, and their songs, and they are proud of them; they are a singular mixture of hard heads and soft hearts; they are full to the brim of sentiment, and sentiment is so often false. Bonnie Prince Charlie, even the whole house of Stuart, did not deserve the beautiful Jacobite songs written about that unhappy ill-fated cause, the sentiment of which persisted long after it ceased to be a practical piece of politics. It was a lost cause in 1715, when the Earl of Derwentwater lost his head: folks said it was na a very good one, but it was a sair loss to the poor gentleman; it was a lost cause in the '45, and only an outrageous love of sentiment could have kept alive in many people until the end of the century a dream, a hope, which they knew would not be realised, of a restoration of the Stuarts. We now reap the benefit of this sentiment, we wander about in a real, handsome city with railways and chemical laboratories, and the whole place is pervaded with a remembrance of old, unhappy, far-off things, and battles long ago.

The local chairman, the local secretary, and the local committee did their arduous and pleasant work extremely well; there was enough organisation and not too much: it is quite possible to have too much; we are not cogs in a machine, but human beings. We praise the Edinburgh Section on this occasion, and they fully deserve all the praise which we and others can offer to them: they are the obvious people who should be praised, and yet we think they will not consider us as grudging in our meed if we say that the chairmen, secretaries, and members of all the local committees, group committees, and so on form a body of highly loyal and conscientious workers who rightly believe in the Society, work for it, and are sincerely attached to it. We know how pleasant it is to work for the Society, and how happy a family we are; we are perhaps inclined to forget, some of us, how much work and devotion are given by all those who take on their shoulders the organisation of the papers and meetings of the Society; if we are inclined, ourselves, to

place on the highest plane the work of the many secretaries the reason is obvious; we once occupied the position of a local secretary. The Society of Chemical Industry has given life to chemistry: the earliest chemist wrote, many years ago, "He is not dead who has given life to science." Like the lad who was half buried in the ruins of a house in the High Street of Edinburgh, the Society is no dead yet.

The Luncheon

After the Annual Meeting a luncheon was given, by invitation of the Edinburgh and East of Scotland Section. Mr. W. A. Williams was in the chair.

After the loyal toast, Dr. Angus MacGillivray, in welcoming the Society on behalf of the University of St. Andrews, observed that his first duty was to offer, on behalf of Principal Irving, his very great regrets at not being present at this meeting. Principal Irving was known to those present as a distinguished chemist. To his colleagues around the University Court he was known as a brilliant administrator. When he was appointed he was a very young man. He was a scientist, and not a theologian, but his conduct in the chair at St. Andrews justified in every way his appointment, and it was safe to say that youth and a scientific training were no bar to the office of Principal and Vice-Chancellor of a Scottish University. Dr. MacGillivray then described the history of the teaching of chemistry at St. Andrews since 1840, and said that St. Andrews University on either side of the Tay was worth seeing and worth going to see, and he hoped they would take the welcome that had been offered to them.

Prof. Alexander Findlay said that, like the previous speaker, he had to commence by expressing the regret of the Vice-Chancellor and Principal of the University of Aberdeen that, owing to his many university duties at this time, he was unable personally to offer the Society a very hearty welcome to Scotland. Although Aberdeen University had not been associated directly with the teaching of industrial chemistry, the principles of chemistry had been taught from a very early period in the two independent universities which existed and flourished within a mile of each other. The time was not very far distant when it would have appeared almost inconceivable that the university should be glad to be associated with and to welcome a Society the main aims of which were industrial. Those unhappy days were fortunately past. We now all were glad to realise that those who pursued pure science, believing that it itself alone shall be its reward, and those whose interests lay mainly in the industrial applications of science, now marched forward in happy and fruitful co-operation, and we recognised that pure and applied science act and react upon each other most beneficently. We had learned that there would be no application of science unless that science already existed to apply, and we were now also learning, but had not yet perhaps fully learned, that the problems of industry gave a stimulus to purely scientific research which resulted in discoveries of the highest theoretical interest and industrial and economic importance. Because this Society, with its large membership, pursuing and promoting both pure and applied chemistry, showed in such a high degree the spirit of co-operation, the University of Aberdeen bade it heartily

welcome. There was another reason why they welcomed it to Scotland. This Society was doing a noble work in preserving the humanity of industries. These annual meetings enabled chemists to come together in social intercourse, and he believed—and perhaps most of them recognised—that that was a matter of the very highest importance. Those who worked and lived in centres of large industry could not understand and appreciate the feelings of loneliness and forlornness which assailed those who were loyally keeping the flag flying in small provincial and outlying areas; and it was no wonder that sometimes, especially among the younger chemists, the earlier enthusiasms should begin to die out. Now, these annual meetings gave a golden opportunity to all such chemists of coming and spending a happy week in social intercourse with others of like interests, of exchanging ideas, and of refreshing their minds in an atmosphere of active endeavour and scientific achievement. He sometimes wished, as a chemist, that the Chemical Society would imitate this Society in holding such gatherings as the present. Because of the humanity and good comradeship of this Society of Chemical Industry, the University of Aberdeen extended to it a very hearty welcome to Scotland. It was not the first time it had been in Scotland; the University of Aberdeen hoped it would not be the last.

In reply, Mr. Francis H. Carr, C.B.E., the President of the Society of Chemical Industry, said it was indeed a disaster to have to follow two such eloquent speeches; but the sincerity of those speeches transcended even their eloquence. We in the Society of Chemical Industry appreciated and knew that knowledge, and knowledge of our art, was the one method of our progress, and that our knowledge we gained by close and perpetual contact with the universities of this country. Therefore it was an especial pleasure to the Society to come to Edinburgh, where three great university centres brought their rays to focus on one point and came to welcome us in the way they had welcomed us. It was thought, after all, which was the impulsive force of industry, just as it was of the purely academic study. We kept alive by progress, and our progress resulted entirely from thought; and it was the raw material which universities produced which gave industries their force and capacity. The most important raw material that we had to handle was the human element produced by the universities. And therefore he felt that, in acknowledging this welcome, he ought at the same time to express the indebtedness of chemical industry to the work of the universities in providing this raw material. With all sincerity and in the most genuine spirit, he returned, on behalf of the Society, very cordial thanks for the welcome they had given it.

In the afternoon a garden party was held in the Zoological Park. The proceedings were interrupted by a heavy downpour, but in compensation the animal houses provided much interest and amusement. In the evening there was a reception by the President in the Palais de Dance, Fountainbridge, followed by a dance which lasted until 1 a.m.

The proceedings on Wednesday opened with a joint meeting with the Biochemical Society, to discuss "The physiological and industrial aspects of the chemistry of

carbohydrates." Professor Barger, F.R.S., was in the chair. The papers read at this meeting will be found in this issue as well as in that of July 8.

At the same time, the Chemical Engineering Group held a meeting under the chairmanship of Mr. F. Heron Rogers, M.I.Mech.E., M.I.Chem.E., to hear a paper by Dr. J. L. A. Macdonald, D.S.O., on "Some aspects of the manufacture of fibrous cellulose" (cf. this J., July 1, 1927, 251T). The paper was followed by the projection of a kinematograph film showing the production of esparto paper, for which thanks are due to Mr. W. Harrison, LL.B., chairman of the Inveresk Paper Co., Ltd. The meeting was followed by a luncheon, held in the University Union.

On Wednesday afternoon, two parties were formed, one going to the University Chemical Department to hear Professor Read lecture on "Natural sources of energy in Australia" (cf. CHEM. & IND., July 8, p. 613), and then to visit the University Chemical Laboratories.

The University Chemical Laboratories

Much could be written about the visit, on July 6, to the University chemical laboratories, which occupy a delightful situation some little distance from Edinburgh, and share with the Eugenics Department a position on a site of slightly over 100 acres, which has been purchased by the city, and will be further developed as required for use. The party on its arrival was met and given a cordial welcome by Prof. Sir James Walker, who conducted it to one of the lecture theatres, where a most interesting discourse (with lantern slides) was given by Prof. J. Read (University of St. Andrews) on "Natural sources of energy in Australia," after which Sir James Walker gave a brief account of the building, and then divided the party into groups, which, accompanied by members of the University, made a tour of as much of the building as was permitted in the limited time at their disposal. The Chemical Department is a long low building, mainly one storey high, traversed by a central passage, into which most of the rooms, which are lofty and well lighted, open: four lecture rooms are together, and open into one centrally-placed "preparation room" from which all are served.

Economy of space, utility, and freedom from useless ornamentation are the dominant keynotes, the interiors of the walls are unplastered, and the exposed red bricks of which they are built give an air of simplicity often foreign to laboratories. The lecture rooms are lighted by vertical windows placed in the sides of a chamber opening from the centre of the ceiling, and when required the room can be completely darkened by pressing a button, when the whole upper chamber sinks, and its roof completely closes the orifice in the ceiling of the lecture-room.

In addition to everything necessary for tuition and research in pure chemistry, there is a department devoted to the methods of the technologist; this contains evaporating and distilling plant, filter presses and autoclaves of a size suitable for working on a small industrial scale, intermediate between that of the laboratory and the mass production of large works. The usual services of gas, water, steam, and so on are laid on, and a spirit of mobility is maintained whereby "plant" can be

"shifted" as required, thereby making for economy and allowing a diversity of operations being readily carried on. Thus, the students trained in this University who wish to take up an industrial career should start their work with greater assurance to themselves and satisfaction to their employers than if they had previously handled only laboratory apparatus.

The Edinburgh Corporation Gas Works

The other party drove to Granton, to visit the Edinburgh Corporation Gas Works. Over 100 members were taken in chais-à-bancs to the works, and were met by Judge Harvey, the convener of the Gas Committee, and his wife, supported by Mr. Alexander, works engineer, Mr. Scott, chief chemist, and a number of assistants. The party was divided into six groups. Judge Harvey, in welcoming the party, expressed his pride that the Society should have selected Granton for a visit, when there were so many other interesting industrial concerns to see in the Edinburgh District. He felt that they had one of the most up-to-date carbonising plants in the country, and was sure that there would be much of interest to see. Dr. E. W. Smith thanked Judge Harvey and the Gas Committee for their kindness in welcoming them there, and commented on the fact that in Granton they had a works which, architecturally and from the point of view of layout was incomparable, and a pattern for other gas undertakings.

During the course of the inspection each party was shown the retort house, containing a large installation of Woodall-Duckham continuous working vertical retorts through which already over 230,000 tons of coal had been put.

It was notable that the plant was so clean in its working that ladies amongst the party were able to go from top to bottom without in any way spoiling their apparel. From the point of view of smoke and dust there were no signs that anything was going on in the retort house. The exhauster house, water-gas plant, purifier house, meter house, and laboratories were also inspected.

Mr. Gracie, the Engineer and Manager, was unfortunately unwell, and was unable to be present, and Mr. Jamieson, his assistant, was away on holiday.

Both parties met later on at the reception, held by invitation of the University Court, in the Upper Library Hall, in the Old University Buildings. The guests were received by Professor and Mrs. G. Baldwin Brown. Professor Baldwin Brown, who is Senior Professor in the University and Professor of Fine Art, delivered an eloquent discourse on the historical and artistic interest of the City, which was much appreciated by the guests. Mr. F. H. Carr, the President, responded on behalf of the Society.

The Annual Dinner

The Annual Dinner was held within the North British Station Hotel, Edinburgh, on Wednesday, July 6. The President, Mr. Francis H. Carr, C.B.E., was in the Chair.

The Chairman, in proposing the toast of "The City and University of Edinburgh," said the Society of Chemical Industry was holding its annual meeting in a town which was unique among the towns in which the

Society had sections. It was unique in very many respects, which many had discovered to their delight in the last few days, but it was also unique in respect that in proposing the toast of "The City and University of Edinburgh," he was confident that in associating the town and gown he was doing what they themselves would have chosen as the toast of the evening. Edinburgh was and had been for a long time the centre of the highest art of government in Scotland, a very important centre of education for the whole of Great Britain, and an exceedingly important centre for Scotland. They in the Society of Chemical Industry particularly appreciated the opportunity of being associated with education. It was their business to make use of the product of education to promote the health, the happiness, and the prosperity of the citizens of their great country. The Society was in many respects like a university, for it constituted a sort of post-graduate course of learning which all of them carried on throughout their lives. They made it their business in the Society to disseminate knowledge, classify knowledge, and promote research, and the atmosphere of Edinburgh could not be more congenial or more inspiring in that respect. They had come to a city where long vistas, not only those of the eye but those of the mind, were ever before them. They carried them back through centuries; and what to them was equally important, they looked discerningly into the future. The application of chemistry to industry demanded that chemists really had to continue their education throughout life. The reason of the success of the Society, the very reason for its existence, was they regarded themselves as an educational institution. Their work called for ability in science, ingenuity in experience, and discovery of the facts which it was their duty to apply. The wonderful position which the chemical industry had attained in this country was in very large measure due to the work of our Society, and that tradition could not have been attained unless they had fostered education. During recent years they had aimed in the industry for greater achievement and greater efficiency, and they had argued as to how they could possibly obtain that working together for efficiency by which alone they could make themselves the first, or amongst the first, in the world. Since the last meeting of the Society the different branches of the chemical manufacturing industry had joined together in a united effort to render the whole industry efficient. All this came, in his opinion, from the fact that they as chemical industrialists paid homage to universities and tried to bring the universities into close relation with the principal affairs of their life, and it was that spirit in which they found themselves in Edinburgh, which gives him so much pleasure in proposing the toast of the City of Edinburgh and the toast of the University of Edinburgh in one. For the enjoyments and luxuries they had enjoyed, and the hospitality that had been extended to them, they were indebted to the City, to the Chamber of Commerce, and to the University and its Vice-Chancellor. They were indebted also to the Edinburgh Section of the Society of Chemical Industry, and they were indebted to Mr. Williams, the Chairman of the Local Section, and also to Dr. Williamson. The President then gave the toast of "The City of Edinburgh and the University of Edinburgh," coupled

with the names of my Lord Provost, Professor Barger, and Mr. Williams.

The Lord Provost (the Right Hon. Alexander Stevenson), replying to the toast, said it had often been his privilege to reply to the toast of "The City of Edinburgh," but this was the first time he had been called upon to reply to that toast in conjunction with the University of Edinburgh. Personally, he welcomed the innovation, because between the University of Edinburgh and the Corporation of Edinburgh the relations had always been of the most friendly character. He wished to thank the members of the Society for the compliment they had paid them in holding this conference here. He understood that they were going to America next year, the land of big things, but he was satisfied that they would go to no town or city of the New World that would appeal to them as the City of Edinburgh. Many might think that Edinburgh was a mere "show" city, but he wanted them to realize that they were trying to make Edinburgh not only a city of education, but an industrial city. The Society, in its way, had been doing well, not only in promoting research, but in showing what science could do in the field of industry. He only wished that employers and employees throughout the country would also play their part and recognise that their interests were not antagonistic, but were identical. Then would science be on the one hand and peace on the other, and then we would have that revival of trade for which we were all looking. He had to return thanks for the way in which the toast had been proposed and received.

Prof. G. Barger, F.R.S., who replied for the University, said the duty should have been laid on the broader shoulders of his senior colleague, Sir James Walker, or, alternatively, it should have been entrusted to the Principal of the University, Sir Alfred Ewing, but these gentlemen were absent, and the duty of acknowledging this toast devolved upon himself. It was very appropriate that the University should have been associated with the town in this matter, for the association was one of long standing. He thought the University would welcome now, in its reformed condition, a somewhat closer association than heretofore—an association of the kind such as obtained in Manchester or Birmingham; for they would know full well how expensive it was to run a modern laboratory, particularly a chemical laboratory. They had visited the laboratory to-day for which the University had made great sacrifices; indeed, this laboratory, which was a severe strain on the University, was in very bad odour with his colleagues of the Faculty of Arts—in worse odour than chemical laboratories in general.

Mr. W. A. Williams, associating himself with the reply, said he was not included on the official toast list, but the President had kindly included the Edinburgh and East of Scotland Section in the toast generally with the City and the University of Edinburgh. He thought this far too great an honour, and he felt covered with confusion by all the nice things that had been said, not only by the President, but also by Prof. Barger, and he felt sure the whole of the members of the Section must feel the same. Speaking for the Section, they felt it was their duty to do all they could. Mr. Carr,

in his opening address, said that on previous occasions when the Society had been here they had taken something back with them. On this occasion they hoped that all the members would take back a lasting remembrance and a pleasant remembrance of their short week here.

Dr. W. T. H. Williamson, Hon. Secretary of the Edinburgh Section, briefly associated himself with the reply.

Mr. Edwin Thompson, proposing the toast of "The Guests," remarked that in the time available it was impossible to mention all the guests, but he would like to mention two names on the toast list, namely, Lord Salvesen, who had honoured them by coming, and, as it were, representing the majesty of the Law; also he wished, on behalf of the members of the Society of Chemical Industry, to extend a very genuine and sincere hand of friendship to Dr. Kurt H. Meyer, who had come over from Germany to attend this meeting.

In his reply, Lord Salvesen said he had been interested in chemistry all his life. More than fifty years ago he was a student of the then Professor of Chemistry, and he also then attended the laboratory of an analytical chemist and learned the elements of analytical chemistry. There was no part of his general education that had been more useful to him than a knowledge of elementary chemistry. In his professional life he found it invaluable, not merely in patent cases, but in many other cases. But what had struck him more than anything else was the colossal ignorance of the elementary facts of chemistry which prevailed throughout modern society, and yet chemistry touched life in a way no other science did, and even the housewife would, he thought, be very much better if she knew a little with regard to chemistry. He had to thank them very much for having done him the honour of asking him to be one of the guests.

Dr. Kurt H. Meyer, in acknowledging the toast, said he had to bring also the thanks of the society which he represented, the German Chemical Society, for their kind invitation, and he had to transmit the greetings of that society. It was a particular pleasure to him to join the meeting, because it gave him the opportunity to express his deep respect of British Chemistry, and especially of his master, a Scotsman, the late Sir William Ramsay. He was a student at the University College, London, and what he learned there had had a great influence on his chemical career. Ramsay was a student of a university in Germany, and was a great friend of many of his German colleagues, and he (the speaker) hoped that many of his connexions might be re-established and never ended again. The best way to know one another and to comprehend each other, and to make acquaintance with each other, was to get to know people's ways and manner, and a better understanding between peoples and nations was what we needed in Europe.

The Dean of Faculty (J. Condie Sandeman, K.C.) proposed the health of the chairman, and the chairman briefly replied.

During the evening a Scottish musical programme was given, and the dinner was followed by a dance.

Thursday's proceedings were distinguished by the lecture delivered by the Society's Medallist, Lieut.-Colonel G. P. Pollitt, D.S.O., on "The development of the synthetic nitrogen industry in Great Britain." The lecture, which is dealt with elsewhere, is printed in "Transactions" in this issue.

For fuel technologists the remainder of the day was occupied by the Coal Cleaning Conference, held under the joint auspices of the Fuel Section of the Society, the Institution of Gas Engineers, and the Coke Oven Managers' Association, Dr. C. H. Lander presiding. All the papers read have been published in "Transactions"; and the discussions will be dealt with later.

Interesting excursions were arranged for the Thursday afternoon, different parties going to the paper mills of James Brown & Co., Ltd., Penicuik, and to the works of the North British Rubber Company, Ltd., whilst those who were not industrially inclined were able to join a conducted tour of old Edinburgh.

Visit to the Paper Mills of James Brown & Company, Limited

Many of those who had, on the previous day, viewed with interest the film dealing with the manufacture of paper from esparto grass were able, through the kindness of Major William Jardine, O.B.E., of Eskmills, Penicuik, to see the actual processes in operation in the paper mills of James Brown & Co., Ltd.

Leaving Edinburgh about 2.30 p.m., the party of sixty members braved a genuine Scotch mist during the drive to the works, which are situated in the deep valley of the North Esk, some ten miles inland. Upon arrival, the visitors were met by Major Jardine, and then in small parties commenced their tour under the guidance of the works staff.

The raw material, esparto grass from Africa and Spain, first claimed attention, and the preliminary operations of breaking up the bales, removing dust and feeding into the digesters having been seen, the maceration and washing of the alkali cooked cellulose was followed. Next came the bleaching and further washing of the now snowy pulp, which, after a considerable amount of further beating and the addition of binding materials, was ready for the actual paper-making machines.

Undoubtedly the most fascinating part of the whole process was next revealed. The still fluid pulp, flowing smoothly on to a wide, slowly-moving, endless gauze of fine wire, whereby the excess of water was rapidly drained away, became in the space of a yard or two a cohesive ribbon, some few feet broad, strong enough to be gathered up by the blanketed rollers which passed it endlessly on to the heated revolving drums for drying.

An added interest was felt when it was explained that the machine was actually making paper for the JOURNAL of the Society, and doing so at the rate of three tons in the working day. After the paper-making itself, were shown the subsidiary processes of glazing and burnishing special papers, and finally the cutting up and examining departments were inspected.

The company was entertained to a very enjoyable tea in the works. Prior to leaving, Mr. Edwin Thompson thanked Major Jardine for his kindness in allowing the

party to see the works and for the interest he had shown in the visit. Major Jardine, in reply, said he had been honoured to have the members of the Society there.

The Works of the North British Rubber Co., Ltd.

Another large party was taken to the Castle Mills to inspect the operations of the North British Rubber Co., Ltd. The party was divided up into groups which made a tour of the laboratories and manufacturing departments. The well-equipped chemical laboratories were first visited, and it was noted that a special laboratory was provided to deal with the power and fuel requirements of the factory. Specimens of raw rubber, compounding ingredients, solvents, and final products, as well as samples of rubber in process, were on view. Next the party watched the laborious process of washing crude rubber, admired the large rooms in which the washed crude is dried, and then visited the rooms in which the rubber is mixed with sulphur and other ingredients. Then followed visits to the departments in which motor tyres are vulcanised, and a fascinating inspection of the various steps necessary to make rubber shoes. The huge vulcanising autoclaves were seen in operation, disgoring a seemingly endless train of vulcanised boots. At the conclusion of the visit an excellent tea was provided for the visitors. In returning thanks for the hospitality of the company, the President, Mr. F. H. Carr, said how much the Society was indebted to the company for allowing the Edinburgh Section to benefit from the help of Mr. W. A. Williams.

Thursday ended with a reception in the City Chambers by the Lord Provost and Magistrates of the City of Edinburgh. The museum illustrating the antiquities of the City was thrown open to the inspection of members, who were greatly interested in its artistic and other treasures, which included many valuable manuscripts and specimens of historic importance.

The Walter Scott Country

After the deluges of Tuesday and Thursday the Clerk of the Weather evidently felt that he was not making his proper contribution to the success of the annual meeting, for Friday, the day fixed for the all-day excursion into Sir Walter Scott's country, turned out to be a beautiful day.

Four chais-à-bancs provided the transport, and following a start at 10.15 the city was soon left behind, and the first halt called at Soutra Hill, 1200 feet above sea level. For a few minutes we enjoyed a wonderful view of East Lothian, and then took the road again through Lauder and Earlston.

The route then led through a beautiful stretch of country becoming more wooded until Bemersyde Hill was reached, when the interest and grandeur of the view again compelled a halt.

No wonder that Scott always stopped at this point to feast his eyes on the view, and less wonder still that on his last journey round Bemersyde Hill, to his resting-place in Dryburgh Abbey, his horses drawing the hearse stopped by force of habit at their master's favourite viewpoint.

The horseshoe bend of the Tweed at our feet, backed by the wooded hills, Bemersyde nestling away to the

left, and the Triple Eildons towering like silent watchers beyond, combined to make up what must be one of the most enchanting views of the Borderland.

Dryburgh Abbey, brimful of historic interest, was our next stopping-place. Here a guide conducted us through the ruins, and gave us a complete picture of the life which centred in the abbey 760 years ago. Sir Walter Scott's tomb was pointed out to us, and there certainly could not have been a more appropriate resting place for the Wizard of the North than this spot with its stately cedars and yews.

Time would not allow of a longer stay, and the leading driver set such a pace on leaving as to suggest that he, no less than ourselves, was by this time aware of the calls of the inner man.

Melrose had been chosen for the mid-day halt, and here at the George and Abbotsford Hotel a very excellent luncheon was provided.

On leaving Melrose we had a glimpse of the abbey, and regretted that time would not permit of a closer inspection of its architectural beauties.

A passing view of Abbotsford, the monument of Scott's ambition, was all that was possible.

The beauty of the next part of our journey quite defies description. From Melrose the road follows the valley of the Tweed amid delightful scenery, and it was with a feeling of having come down to earth that we drove up to the imposing Hydro Hotel at Peebles.

Here a cup of tea was very welcome, and we were then able to enjoy for a short while the view from the terrace of the hotel.

The direct road to Edinburgh was not followed, but a digression made on the Glasgow-Biggarr road, and so home through West Linton and Penicuik. So closed a day which was remarkable no less for the excellence of the arrangements than for the pleasure it gave to the party.

Scottish Oils, Ltd.

On Friday afternoon a party travelled by road to Grangemouth to visit the refinery of Scottish Oils, Ltd. After a pleasant journey, the refinery was sighted, but for a time no obvious means of access was found. The driver eventually discovered and forced a breach which he found difficult, if practicable, and we were welcomed by Mr. A. M. Wylie, the manager, who, assisted by Mr. J. G. Annan, the chief chemist, and Messrs. R. C. Thomson and A. Patterson, engineers, conducted us round the works. All were of accord in admiring this new works, which was evidently a model of efficiency of design and operation. Economy of labour and heat were most apparent, and, indeed, so few people were in evidence on the plant that a lighthouse keeper's job seemed almost convivial in comparison. After tea Mr. W. J. A. Butterfield conveyed thanks to the Scottish Oils Company, Ltd., for their hospitality. The return journey was made via Queensferry and the Forth Bridge back to Edinburgh.

The Excursion to St. Andrews

It was unfortunate that so small a number of members was able to stay to take part in the interesting excursion to St. Andrews on Saturday, July 9.

The party left Edinburgh at 9.30 for St. Andrews.

The journey gave an opportunity of seeing something of the Forth Bridge for those who had not already made this excursion. As the party arrived at St. Andrews at 11.22, most of the members spent the remainder of the morning in visiting places of historic interest in the town. A fine view of the town and surroundings was obtained from the top of the old ruined tower of the church of St. Regulus, whilst the ruins of the old cathedral, built on the site of the old church, were very striking. Most of the members also found time to visit the old castle and to admire the views of sea and coast from its walls.

The party were welcomed at the University in the afternoon by Prof. Read, and were taken into the main lecture room, where an interesting exhibit had been arranged illustrating the nature of the research work carried out in the research laboratories. Amongst the exhibits were specimens of methyl glucosides and other derivatives used in investigating the constitution of sugars, and also interesting specimens of various varieties of eucalyptus oils and of piperitone and its derivatives.

Copies of theses presented by research students for the Ph.D. degree were shown to illustrate the way in which the work was written up.

Prof. Read gave a short account of the general nature of the research work, and explained the programme to be followed in visiting the laboratories.

The party then proceeded through the fine chemical laboratories of the college, and had an opportunity of seeing some interesting apparatus used (amongst other things a microbalance, a new form of polariscope, etc.), whilst in the research library a collection of interesting old books had been arranged. A visit was also paid to the physics laboratories under the guidance of Prof. Allen. Next the party proceeded to the college chapel, which is the oldest part of the college buildings; the visitors saw the elaborate old tomb of Bishop Kennedy, founder of St. Salvator's College, and heard an explanation of its symbolic carvings and also saw the university mace and other interesting objects. Visits were then paid to the main library of the university in another part of the town at a short distance, to the old library, the new Carnegie building, and the new science reading rooms. Passing through the Botanical Gardens to the Physiological Department, the party was shown over the laboratories by Prof. Herring. The visit ended with tea in the buildings of the Divinity College, and the party returned to Edinburgh by the 5.35 train, having greatly enjoyed a thoroughly well-planned visit.

At the conclusion of another successful Annual Meeting it is of interest to note some of the names of those who were present. The list includes the following:—

W. M. Ames, Dr. David Bain, Andrew Barclay, Alex. H. Bennett, William A. Benton, Major Robert Bruce, W. J. A. Butterfield, A. George Byard, W. A. S. Calder, Francis H. Carr, Dr. R. M. Caven, P. Coburn, Dr. R. T. Colgate, A. W. Cowan, Dr. Cox, F. P. Coyne, Dr. J. A. Cranston, C. J. T. Cronshaw, Noel P. Cross, Dr. William Cullen, G. D. Elsdon, E. V. Evans, Dr. Thomas Ewan, G. A. Findlay, C. P. Finn, G. H. Ford, G. H. Gemmell, T. S. F. Gibson, W. S. Gill, Major Vivian

F. Gloag, F. A. Greene, F. E. Hamer, J. E. G. Harris, H. C. Head, E. A. Hebden, Prof. G. G. Henderson, Prof. W. R. Hodgkinson, H. J. Hodsman, Dr. Alex. Hynd, Major William Jardine, E. Gabriel Jones, L. A. Jordan, H. A. D. Jowett, Dr. W. O. Kermack, C. A. Klein, A. W. Knapp, Dr. C. H. Lander, S. B. Langlands, Dr. A. Lander, Dr. J. P. Longstaff, Prof. H. Louis, Arthur H. Lymn, A. Douglas MacCallum, J. W. McDavid, Lieut.-Col. J. L. A. Macdonald, James MacGregor, Basil G. MacLellan, James MacLeod, A. Marsden, Dr. Percy May, Prof. A. W. C. Menzies, G. F. Merson, Dr. S. Miall, Frances M. G. Micklethwait, J. P. Miller, Emile Mond, J. W. Napier, Philip B. Nicholson, Col. G. P. Pollitt, Prof. J. Read, Dr. E. H. Rodd, F. H. Rogers, J. W. Romanes, V. Ronald, J. D. M. Ross, Prof. F. M. Rowe, A. Rudge, John Russell, Richard Seligmann, Dr. E. W. Smith, John Sutherland, Peter Tainsh, Adam Tait, H. Talbot, Edwin Thompson, Sir James Walker, J. Adam Watson, Dr. H. E. Watt, D. R. Wattleworth, W. A. Williams, W. T. H. Williamson, Hubert R. Wood.

CANADIAN NOTES

According to the financial statement of the Canadian Westinghouse Co., Ltd., this concern made substantial progress during 1926. The company earned 18.3% on the capital stock as compared with 14.3% in 1925. Operating profits are shown at \$1,796,764, from which are written off \$250,000 for depreciation of plant and property, \$140,000 for Dominion taxes for 1926, and \$40,000 transferred to pension fund. The net profits are \$1,366,741. Dividends, at the rate of 8% per annum, plus an extra dividend of 2%, will absorb \$743,290. The balance of \$623,451 is carried forward to profit and loss, and this account shows a surplus of \$4,244,933. The demand for electrical equipment for pulp and paper and hydro-electric power was responsible for the large total business.

The Selective Flotation of Canadian Ores

The Mines Branch of the Dominion Department of Mines at Ottawa has issued Memorandum No. 29, dated March, 1927, dealing with "Selective Flotation as Applied to Canadian Ores." The Memorandum is by Mr. C. S. Parsons, Engineer, Division of Ore Dressing and Metallurgy. Canada possesses many deposits of complex ores, such as lead-zinc iron sulphides, copper-zinc iron sulphides, copper iron sulphides, and other combinations of these minerals, many of which contain values in both gold and silver. The Mines Branch of the Department of Mines, through its Ore Dressing and Metallurgical Laboratories at Ottawa, has made numerous investigations into the treatment of such Canadian ores by selective flotation. The purpose of this review is to bring more directly to the attention of the mining public the information which has been acquired, and the progress which has been made in the treatment of ores by this method, and also to point out the assistance the Government is rendering the mining industry by maintaining at Ottawa fully-equipped ore dressing and metallurgical laboratories for research on the treatment of ores and metallurgical products. A brief description of the flotation equipment of these laboratories is given in order that the reader may better realise the type of work which can be performed.

CANADIAN HYDRO-ELECTRIC POWER

The Manitoba Power Co., Ltd., is extending its plant at Great Falls, Man. The extension will cost more than \$500,000.

The West Kootenay Power Co. (a subsidiary of Consolidated Mining and Smelting Co., Ltd.) has begun the construction of a third unit on the Kootenay River at South Slocan, about 13 miles south of Nelson, B.C. The plant will generate 60,000 h.p., which will be utilised to meet increased demands through extensions of the Trail smelter.

MINING RESEARCH AT BIRMINGHAM

An interesting report on recent work done at the Mining Research Laboratory of the University of Birmingham has just been issued by the Executive Board, under the signature of the Director, Dr. J. S. Haldane (President of the Institution of Mining Engineers). The members of the Board are Professor Sir John Cadman (formerly Professor of Mining at the Birmingham University); Mr. G. P. Hyslop (North Staffordshire Colliery Owners' Association); Mr. W. A. Lee and Mr. W. G. Phillips (representing the Mining Association of Great Britain); Mr. Ivon Graham (Secretary and Assistant Director of the Mining Research Laboratory); and the following, representing the Birmingham University—Professor W. N. Haworth (Chemistry), Professor K. Neville Moss (Coal Mining), and Professor A. W. Nash (Oil Mining).

The investigation of the conversion of coal into oil by hydrogenation was commenced in 1923 for the purpose of ascertaining how far the Bergius method of treatment with high-pressure hydrogen at a temperature in the neighbourhood of 400° C. could be made applicable to English coals, and in order that more information might be obtained regarding the reactions involved. A considerable amount of work had been carried out during the past year for the purpose of obtaining further information regarding the type of coal most suitable for treatment in this way, that is, the type which would give the highest oil yield. Various specimens of coal of different degree of coalification, ranging from lignite to anthracite, and including also cannel coals from different sources, had been tested in detail with very valuable results. Comparative tests had been carried out in the pressure autoclave, using nitrogen in place of hydrogen, and also by carbonisation under atmospherical pressure. These experiments (to which the investigator concerned, Mr. D. G. Skinner, had devoted a large amount of time and thought) had yielded results of great interest and importance in that they had shown that the carbonaceous material which yielded a large amount of tar and oil by carbonisation at low temperatures did not necessarily give a correspondingly higher yield by hydrogenation. A detailed investigation of the hydrogenation of two types of cannel—the true boghead or torbanite, and one typical of the material frequently found in bituminous coal seams—had shown that the yield of oil from the former was not appreciably increased by hydrogenation, whilst that from the bituminous coal cannel was very much greater than by distillation.

The successful commercial application of the Bergius process is not yet assured, and the Board believe it cannot be so until more is known about the nature and value of the products resulting from the treatment of coal with high-pressure hydrogen. The investigations they are carrying out will, they believe, in the long run prove to be of very real economical value—though possibly not in the same directions as those covered by the Bergius patents. As a result of increased financial support from the British Colliery Owners' Research Association, it has been possible to obtain additional analytical assistance, and the programme of work has been extended. A considerable amount of practical work carried out during recent months has indicated that certain types of coal are more suitable than others for treatment with high-pressure hydrogen. The question as to how far fuel in the solid state, and particularly coal, is likely to be displaced in the future by liquid fuel, whether derived from coal or obtained naturally as oil, depends, states the report, to a large extent on the relative thermal efficiencies obtainable with different varieties of heat engines and internal-combustion engines. The director has been devoting much of his attention to this subject, and has now nearly completed a book in which the current assumption that an internal-combustion engine with oil as its fuel has necessarily a higher maximum thermal efficiency than a steam engine with solid coal as fuel is examined and rejected. His conclusion is that with improved furnaces, boilers and engines, solid coal will, on account of the much lower cost of the heat derived from it, more than hold its own against oil as a fuel for engines performing heavy work and will displace oil in many cases where oil has recently come to be used extensively for producing power. The report points out that as a result of the extension of work which has taken place during the past three years, the need for further accommodation for the mining research laboratory has become pressing. It is estimated that a building giving almost treble the space for laboratory, workshop, storage, secretarial and other accommodation could be erected and equipped for £4000. This building would also include space for the Fuel Research Board's investigations. The building suggested should be approximately 60 ft. by 25 ft., and should have two floors and a flat roof for any special open-air tests which might be necessary. It is believed that various colliery owners throughout the country will be willing to contribute to a fund for a new building which might be looked upon as the coalowners' research laboratory, especially for investigations on the physiological, chemical, and physical side of mining. The researches mentioned were rendered possible, the report states, by financial support from the British Colliery Owners' Research Association, whose grant of £2500 covered the general administrative expenses of the laboratory, and of researches on hydrogenation, spontaneous combustion, and physical as well as other chemical problems connected with the mining and treatment of coal. Thanks are expressed to the Association for their recent decision to increase their grant to £3000 per annum for three years from April 1 last.

SOME PROBLEMS IN THE SYNTHETIC RESIN INDUSTRY

By D. A. SPENCER, D.I.C., Ph.D., and
H. D. MURRAY, B.A., A.I.C.

Of all newly-developed fields of industrial chemistry, the one most overburdened with haphazard and still-born patents is that of artificial resins. The reason is not far to seek, for although a large number of valuable applications of resins of the phenol-formaldehyde type became obvious soon after Baekeland's early patents, the disadvantages of the earlier resins, though to a slight extent overcome, are still present.

The term "synthetic resin" in commerce covers the condensation products of formaldehyde with phenolic and urea compounds. The former have been largely employed with fillers to produce moulded articles replacing similar goods made from ebonite and vulcanite; they have also been cast and worked to produce fancy goods of a transparent or translucent nature. The latter have recently found an application as non-inflammable substitutes for celluloid.

The difficulties which have been encountered in the commercial application of these resins may be defined as those arising from the chemical nature of the resins themselves and the physical difficulties of manufacture and finishing. In addition, the increasing number of applications of these resins has necessitated modifications of the properties possessed by the simple condensation products of phenols and aldehydes, the qualities desirable in a shellac substitute being, for example, very different from those of an imitation celluloid.

DIFFICULTIES ARISING DURING MANUFACTURE

Absolute control during manufacture has not yet been attained, with the result that comparative uniformity of the product is only secured by mixing several batches. In the removal of water during or after the preliminary condensation stage in the manufacture of phenol-formaldehyde resins, control becomes increasingly difficult, and it is often necessary to check the reaction by dilution with organic solvents when dehydration is nearing completion. As a result, it frequently happens that complete condensation is not effected. The use of an excess of one of the constituents over the quantity actually required also results in uncombined reactants being present in the finished product. Chief amongst these are water, alkali catalyst, phenol and aldehyde.

When a transparent product is aimed at, an excess of water, in addition to making the resin brittle, causes a general cloudiness. Ammonia is a very general catalyst, either free or as hexamine, as it leaves no objectionable acidity. However, some means of neutralising it is desirable as it sometimes causes blistering during the final curing. The only two methods mentioned in the literature are those of Aylesworth, who adds an acid anhydride to remove excess ammonia and water, or uses a chlorinated phenol. Free phenol is often found in commercial resins, but this is no doubt often intentional, as it increases plasticity, besides giving an antiseptic value to varnishes made therefrom.

Free formaldehyde, while resulting in a harder final product, increases fragility, and is to be avoided where

the resin is to be used for the manufacture of drinking vessels, cigarette holders, and so on, owing to the irritation to the mucous membrane which results when free aldehyde is present.

Whilst it is a relatively easy matter to make an artificial resin which is practically odourless, many firms are turning out a product which is not free from odour. A sample of resin recently examined possessed this fault to a most noticeable extent. The smell was not that typical of either phenol or formaldehyde, but rather that sickly nauseating smell obtained when acetaldehyde is warmed with caustic soda. The applications of such a product are obviously limited. In general, however, it may be said that objectionable odour is a property of certain continental resins and arises from careless manufacture or the use of unsuitable starting materials. Cresol resins are usually the worst offenders in this respect. It is claimed that odourless resins have been prepared by hydrogenation of the liquid condensation product at elevated temperatures in the presence of a suitable catalyst. Resins can also be de-odourised whilst in the liquid form by steam treatment, air blowing, etc. Failing these, the presence of objectionable semi-condensation products might be mitigated by an odourless finishing varnish.

With both phenol-formaldehyde and urea-formaldehyde resins one of the problems in the manufacture of non-filled articles has been, and still is, the production of clear permanent resins. In the actual process of manufacture, the use of pure materials and the exclusion of air produce lightly coloured resins. The use of small quantities of bleaching agents, such as hydrogen peroxide, has also been advocated. By substituting urea for phenol, resins have been prepared which, when cast in the form of sheets, are similar in appearance to ordinary glass, but have the great advantage of flexibility, and are, at first sight, decidedly preferable to glass for use as non-splintering almost unbreakable windcreens on motor-cars, covers for dials on vibrating machinery, etc.

Unfortunately, it has been found that, in practice, warping of large sheets is very liable to occur, whilst on long exposure to strong light the resins darken and turn yellow.

When phenol resins are mixed with a white filler such as gypsum or wood flour, a white opaque product is obtained which should be suitable for piano keys, billiard balls, fancy articles, etc. Here again, however, the darkening on exposure to light is a great drawback, and much research and many patents have been directed towards increasing stability to light. Suggestions include steam distillation to remove any excess phenol, ether, etc., extractions of the first condensation product to remove lencu bases, hydrogenation whilst in the liquid form, protection of free hydroxyl groups by esterification and the use of sulphur-containing salts as condensing agents have also been advocated. As the best modern products, however, still suffer from this disadvantage, it would appear that a solution of the difficulty is still to be sought.

A method of producing a white opaque product from a phenol-formaldehyde resin was discovered by the authors. When small quantities of a hydroxy acid such as citric acid are added to the liquid condensation product, this is

bleached to a pale straw-yellow colour. On setting by heat treatment this becomes opaque, and by suitably regulating the temperature an ivory white substance results. This is not light resistant, but its properties are considerably improved in this direction by the addition of a white filler.

As ultra-violet light appears to be the most effective in promoting darkening, fluorescent substances such as quinine, aesculin and phosphorescent fillers as calcium sulphide etc. were added in the hope that the incident ultra-violet light would be converted into visible, and presumably less active rays, but no improvement was noticed.

Oxidation of the surface may also assist the darkening since the colour of such resins is improved by the exclusion of air during setting and, therefore, the lacquering or varnishing of the finished article might possibly reduce the amount of colour change. In this respect it is of interest to note that the sale of bangles etc. made from synthetic resin has been somewhat restricted in the East owing to the darkening in course of time being regarded as unlucky by superstitious wearers of such ornaments.

Synthetic phenolic resins made with acid catalysts are fusible, that is to say, they are not converted into hard infusible compounds on the application of heat. Such resins have been used to mix with air-drying varnishes which retain their own characteristics. The alkali catalysed resins, soluble in acetone, have been employed as stoving varnishes which are resistant to many acids. These varnishes, however, have to be stoved at a temperature of 120° C.

It would seem that the production of a suitably catalysed, air-drying resin varnish would open up its use in many fields.

In this connexion the recent use of synthetic resins as a substitute for gums in photomechanical printing processes is of interest. A layer of resin containing bichromate salts is sensitive to light, becoming insoluble in organic solvents after exposure. If the reactions which result in this hardening are analogous to those which occur in gelatin-bichromate mixtures, the light merely accelerates a tanning process which proceeds slowly in the dark, and a resin varnish hardening at normal temperatures might, therefore, be obtained by experiments along these lines.

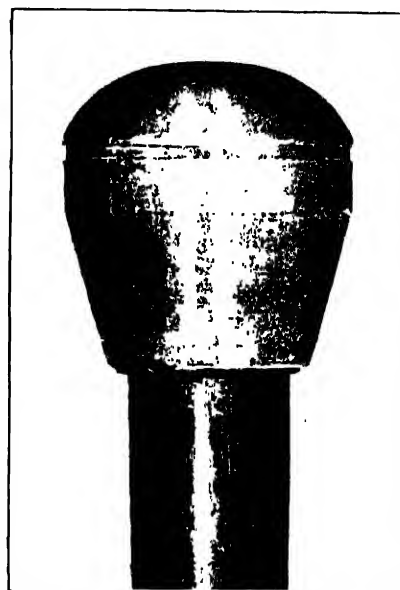
COLOURING RESINS

Whilst there is, generally speaking, no difficulty in dyeing artificial resins, the number of dyes which can be successfully employed is limited. The acid sulphonated members of the triphenylmethane group, and such dyes as eosin, auramine and quinoline yellow appear to be most stable in the resins, though all are somewhat bleached on setting, and many are decomposed if too high a temperature is employed. In passing, a method of colouring a resin by an inorganic salt is worth recording. Specimens of black artificial resin obtained from usual sources are of a dull colour, probably because the effect is obtained by the use of a black filler such as manganese dioxide. If, however, traces of vanadium pentoxide or ammonium vanadate are added to the unset resin and the mixture warmed, the authors found that

a colour ranging from an intense deep blue to jet black (according to the amount added) is obtained. The product is interesting in that, although the colour resembles that which would be expected by the use of a black dye, it is quite stable under conditions of heat etc. which would destroy a dye. In addition, the product has the translucent, velvety blackness typical of jet, and, for the purpose of ornament, should therefore be preferable to the opaque black product as usually obtained by fillers. Possibly other oxides might be used in the same way to obtain permanent translucent colours.

CASTING AND MOULDING

When a clear, transparent product is required the resin must be cast and the articles be made by machining from the cast blocks, since moulding of the powdered intermediate form and subsequent hardening results in



Silver-topped walking-stick with phenol-formaldehyde resin foundation, photographed after being used to drive nails into a plank and similar drastic treatment. Only superficial scratches on the silver, removable on polishing, will be noticed.

a clouded product, possibly owing to imperfect "fusion" of the particles during the final setting. The technique of casting resins is, however, in a very undeveloped stage.

Unless the mould is carefully designed and scrupulously clean, the resin sticks locally, and as the main bulk contracts on setting, splitting or distortion may result. This difficulty has been overcome to a certain extent by the use of glass moulds, which are broken to remove the set product.

Lubrication of the mould surface with a substance in which the resin is soluble, either alone, or with a hardening agent, and grease (wax, machine oil, petroleum jelly) has been advocated. The last-named are, however, liable to cause the surface of the casting to be spotted. When moulding with a filler it is usual to include the lubricant in the moulding powder, and the difficulty of sticking can be practically overcome by this

means, though certain lubricants often included (*e.g.*, stearic acid) bring troubles of their own, the chief of which is staining of the finished article. Naturally, the inclusion of such lubricants is not possible when casting a transparent product. Oiled paper, metal foil, tale dust, also reduce sticking where their application is permissible.

Some manufacturers claim that a mould lined with a heavy vitreous enamel causes little trouble, but the authors found the life of such moulds comparatively short with certain resins, and sticking occurred as before.

It is possible that the major difficulties of casting could be obviated by the use of lead moulds with or without amalgamation of their inner surfaces.

It should be noticed that, as the resins contract on curing, sharp castings of intricate designs cannot be obtained. Indeed, could some resin be found which expanded, however slightly, on setting, it would form a most valuable filler for such articles as silver-backed brushes, walking-stick tops, etc., and, owing to its resiliency, such productions would no longer suffer from the unsightly denting which readily occurs when the ordinary fragile cement or rosin filler is used. In passing, it may be noted that by depositing electrolytically a layer of silver on an ornamental head turned out of synthetic resin, the authors have prepared a quite undentable walking-stick top. By incorporating some filler which reduced shrinkage to a minimum, and using such a product to fill silver and gold ornaments, it should be possible to ensure that on cooling to normal temperatures the contraction of the metal shell was greater than that of its filler and the same end achieved.

When a transparent product is not required the article is moulded, usually under pressure and at elevated temperatures. The moulding powder consists of powdered resin in the intermediate stage, a suitable filler, and occasionally a lubricant. In moulding, staining may occur when the mould is overheated or is opened before curing is complete. This difficulty, together with blistering, flow marks, etc., is not discussed here since it can be eliminated with proper care.

Quicker setting in the mould is desirable. At present the method usually adopted is to prepare an intermediate condensation product which, whilst solid at all temperatures, is elastic when warm and will yield to pressure. In this form it is pressed into heated moulds and then converted into the intermediate but non-elastic form. This is then removed from the mould and baked, the mould being thus released earlier than if the final setting occurred therein.

The use of synthetic resin for gramophone records is a very attractive suggestion, since such records would be far less fragile than those of the usual shellac type. However, a new technique of moulding and manufacture would have to be evolved, requiring new investments of plant, and for this reason alone there seems little prospect of such records being made in bulk. Apart from this difficulty, the first attempts at making experimental synthetic resin records have been disappointing owing to the soft surface and warping. It should be possible to overcome both these defects, and as a preliminary step it would be of interest to use a core of synthetic resin made from flat sheets of the material on

to mount the usual shellac sound-bearing surface. This suggestion would not apparently require much alteration in existing technique, and would certainly remove some of the fragility of the usual record.

Although the infusible product is hard and strong it is somewhat brittle and possesses comparatively little elasticity or flexibility. Unless this latter quality is modified, artificial resins will not replace celluloid or shellac in some of their most important applications. The brittleness is reduced by the incorporation of casein, protein, or cellulose in various forms or by forming solid solutions of the resin with chlorinated hydrocarbons, free phenol, or permanently fusible resin. Rubber and various oils have also been used to increase elasticity, but as a shellac substitute artificial resin is still far from perfect on this account alone.

The uses of synthetic resin are many, and, while so much research is being directed to improving their qualities and enlarging their applications, it may be confidently assumed that their importance in industry will continue to increase for many years to come. In this article only a few of the difficulties which arise in their commercial utilisation have been touched upon, and it is apparent that where such difficulties have been solved in the past they have yielded more to chance experiment than design. Until research has solved the true nature of these resins and has given us means to control the preparation of all the substances contained in them it is improbable that the major difficulties, such as lack of uniformity, will be overcome.

We would bring this problem of resin structure to the notice of organic chemists about to take up research with the warning that it is one which has been touched upon to the continued efforts of a large number of research workers throughout the world.

Royal College

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

MEMBERS ELECTED

July 5, 1927

Amies, Edwin J., Oakleigh, 27, Great Western Street, Aylesbury, Bucks. Manager, Printing Ink Factory.

Armour, Bernard R., 45, East 17th Street, New York City, U.S.A. Executive.

Bevan, Eric A., 90, Wickham Road, Brockley, London, S.E.4. Research Chemist.

Calder, Kenneth A., Ravensthorpe, Harborne, Birmingham. Clerk.

Clayton-Kennedy, Kenneth E., 115, Broadway, New York, N.Y., U.S.A. Consulting Engineer.

Davison, Thomas C., Chemical Laboratory, Great Western Railway Works, Swindon, Wilts. Chief Chemist.

Fetherston, Franklin R., Compressed Gas Manufacturers' Association, Inc., 120, West 42nd Street, New York, U.S.A. Secretary.

Fireman, Dr. Peter, 601, Cass Street, Trenton, N.J., U.S.A. Chemical Manufacturer.

Forrest, Laurence R., Smet Solvay Co., 61, Broadway, New York, N.Y., U.S.A. Chemical Engineer.

Knowles, Wm. M. F., c/o Messrs T. de la Rue & Co., Ltd., 110, Bunhill Row, London, E.C.1. Chemist.

Goldstein, Richard F., 46, St. Paul's Avenue, Cricklewood, London, N.W.2. Research Chemist.

Greenbaum, Dr. Samuel S., c/o United Products Co., 11, Vandewater Street, New York, N.Y., U.S.A. Chief Chemist and Superintendent.

Hellewell, Harry, Londonderry Collieries, Ltd., Seaham Harbour, Co. Durham. Chemist.

King, Harold E., Crowstone, Bardon Lane, Belmont, Surrey. Chemical Manufacturer.

Kirschbaum, Lester, c/o Flintkote Co., Rutherford, N.J., U.S.A. Chemical Engineer.

Kraus, Charles A., Brown University, Providence, R.I., U.S.A. Professor of Chemistry.

Luftman, Richard H., c/o Bogalusa Paper Co., Inc., Bogalusa, La., U.S.A. General Manager.

Van Der Lande, G. J. L., Noury & Van Der Lande, 59, Mark Lane, London, E.C.3. Chemical Importer.

Lewis, George C., c/o The L. Martin Co., 45, East 42nd Street, New York City, U.S.A. Director.

Lightenome, Chas. L., 73, Riverside Drive, New York, N.Y., U.S.A. Chemist and Lawyer.

Livingston, Ernest M., 2870, Heath Avenue, New York, N.Y., U.S.A. Consulting Chemist.

Marks, Dr. Lewis H., 114, Madison Avenue, New York City, U.S.A. Technical Consultant.

Miller, Albert E., c/o Sinclair Refining Co., Room 1902, 45, Nassau Street, New York City, U.S.A. Petroleum Chemist.

Negresco, T. Trajan, Laboratorul de Metalurgie, Scoala Politehnica, 132, Calca Griviti, Bucurest, Roumania. Mining Engineer.

Oswald, William A. H., The Anglo American Oil Co., Ltd., Technical Dept., 52, Queen Anne's Gate, London, S.W.

Pouney, Allan E., 22, Tannfield Road, Sydenham, London, S.E. 26. Chemist.

Poffner, James B., 412, Greenpoint Avenue, Brooklyn, New York, U.S.A. Chief Chemist.

Ruey, William A., Robin Hood Coke Works, Near Wakefield, Yorks. Coke-oven Manager.

Roth, Chas. F., 141, East 36th Street, New York, U.S.A. Executive.

Herbert A., 109, North Street, Hornchurch, Essex. Manufacturing Chemist.

Sampson, Michael T., 19, Mill Lane, Billingham, Stockton-on-Tees. Chemist.

Searle, George H., 20, Windmill Road, Croydon, Surrey. Technologist.

Sewell, Leonard G., "Noonameena," Lightwood Road, Buxton. Works General Manager.

Stevens, William H., Shirley, Page Heath Lane, Bickley, Kent. Analytical Chemist.

Sullivan, Thomas V., Federal Color Laboratories, Inc., Norwood, Ohio, U.S.A. President.

Sutherland, John K., Millboard Works, Sunbury Common, Middlesex. Works Chemist.

Taylor, Harold W., c/o Premier Bitumen & Asphalte Co., Ltd., Stratford Market, London, E.15. Works Chemist.

Walker, George E., North Hudson Chemical Co., Albany, N.Y., U.S.A. Factory Manager.

Weinreb, Falk, 16-17, Devonshire Square, London, E.C.2. Engineer and Agent.

DEATHS

Burrell, B. A. (original member), of 8, Springfield Mount, Leeds, Analytical chemist. On July 10, 1927

Mrazsek, Dr. F. M. (elected 1905), of 31, West Cromwell Road, London, S.W., Consulting chemist. On June 29, 1927.

EDINBURGH AND EAST OF SCOTLAND SECTION

At a joint meeting of the Edinburgh and East of Scotland Sections of the Society of Chemical Industry and the Institute of Chemistry, held on March 24, 1927, Mr J. Adam Watson in the chair, a lecture on "Fire risks in industry" was given by A. M. Cameron, B.Sc., F.I.C.

The lecturer said the literature on the subject discussed in the paper was very scanty, as technical publications dealing with particular industries rarely considered the fire hazard involved in the various processes. Yet the amount of loss to the country annually through fire was extremely large, not only from the buildings and contents destroyed, but also from loss of trade during rebuilding operations. Most fires were due to preventable causes. The fact that a particular process had been carried on without untoward happenings for many years tended to obscure the fire risk, and led to neglect of precautions against it.

T. H. Gant had attempted a classification of the causes of fires as follows:—(1) Direct ignition by flame or glowing material; (2) spontaneous heating; (3) spontaneous combustion; (4) explosions; (5) electric sparks; (6) chemical reactions; (7) pressure, friction, shock, concussion; and (8) focussed rays.

The lecturer pointed out, however, that the causes of fires were so varied that anything of the nature of a complete classification was very difficult. The importance of scrupulous attention to tidiness and cleanliness was stressed. A lighted match thrown down might fall on a heap of inflammable trade waste, and might smoulder unnoticed till after closing time, and then break out into fire. The gravity of this risk was shown by the report of the Firemaster of the City of Edinburgh for 1925, which showed that out of 262 fires on industrial premises, no fewer than 59 were ascribed to lights being thrown down, and of the four six-hour periods of the 24, that between 6 p.m. and midnight showed the greatest number of fires. Apart from this risk, inflammable waste afforded fuel for a fire however started. The

cleanliness of plant and machinery was also of the greatest importance; fires were often due to plant and machinery being coated with dirt of an inflammable nature. The necessity of cleanliness and tidiness could therefore hardly be too strongly stressed, as the want of it was perhaps the most common of all causes of fires.

Taking up the question of spontaneous combustion, the lecturer remarked that perhaps the commonest causes were (1) the heating of vegetable matter due to bacterial action and slow oxidation; (2) oxygen absorption by textiles impregnated with drying and semi-drying oils; (3) ignition of carbon in a fine state of division; and (4) storage of "incompatible" substances.

Care should be taken in the storage of vegetable matter that sufficient ventilation was given. Fibrous matter was dangerous from the large air-spaces contained relative to the weight of the fibre. This caused them to retain heat for a long time, and to assist in the oxidation of drying oils if they had been absorbed by the fibre. Sacking would take up oil from oil-containing substances, and fires had been caused thereby. Sacks were also dangerous as containers of salts such as chlorates and permanganates, as friction in handling had been known to bring about spontaneous combustion; paper-lined casks should be used.

Food that had been subjected to slow charring was a source of hazard, as the carbon produced was often pyrophoric. Half-burnt fibrous textile matter, cotton etc., was also very dangerous from the low-ignition point of the carbon so produced.

Storage was then referred to, the risk of the use of straw-packing for carboys of oxidising acids being mentioned. It was pointed out that the risk of water damage should not be lost sight of, and, if possible, foodstuffs should not be stored on floors below chemicals etc.

Static electricity as a source of hazard had come into prominence of late years. Dolezalek, in 1913, had done a good deal of work on the development of current from the flow of non-conducting, or slightly conducting, liquids through pipes. He found that benzol flowing through a copper pipe at a speed of 2 metres per second gave a potential of 2000 volts; 500 to 1000 volts was, as a rule, necessary to produce a spark. Haner had recorded a case in America where ignition of petrol vapour had taken place from static produced by the running of petrol from a road tank wagon through a rubber pipe. A not dissimilar case had aroused considerable attention a few years ago at the works of the Shell-Mex Co. A spark was supposed to have jumped from a metal dip-stick on to the edge of the filling orifice of the tank, the stick being in contact with the filling tube.

Static electricity could be developed by friction, as of belts, fabrics, etc. running over pulleys. A fire at a canvas-proofing factory due to this cause was described. Static currents were not a very common cause of fires, but such cases occurred sufficiently often to render precautions against it desirable.

Inflammable vapour escaping into the atmosphere was a very frequent source of outbreaks. Apart from the fire risk, such a thing was very wasteful, and users of

processes involving the use of inflammable liquids as solvents or otherwise should consider the installation of recovery plant to avoid this loss. No process in which inflammable liquids were allowed to evaporate into the air could be considered safe.

Fires were sometimes due to ignorance of the properties of the liquids in use. Users should check the nature of solvents supplied to them from time to time. In one fire a solvent was in use that was believed to have a high flash-point; in reality it was about -10°C . It should be borne in mind that though the vapour in a work-room or plant might be insufficient to carburet the whole of the air, yet local pockets of explosive vapour might be formed. Ignition point had an important bearing on the liability of a vapour to explode when mixed with air. Moore (J., 1917, 109) had determined the ignition point of a large number of vapours. Naylor and Wheeler (Safety in Mines Research Board, Paper No. 9) had shown that the lowest ignition point did not coincide with the theoretical perfect mixture, but fell as the mixture was enriched. This might account for the ignition of vapours from upset bottles etc. at a lower temperature than usual.

The fire hazard of inflammable dust was then considered. It was pointed out that the dust of any inflammable substance could be dangerous under some conditions. Ignition of air-dust mixtures could be brought about by hot gases and naked flames, by hot bearings, by sparks from mechanical causes, by electric sparks, including frictional and static sparks. Dust explosions from overheated bearings were by no means rare in mills grinding sugar, meals, etc. The dust tended to clog up oil-cups and ways in bearings, and it was thus very important to pay attention to such matters.

Fragments of foreign matter, such as pieces of iron, stones, etc., had sometimes been the cause of explosions in mills grinding oil-seeds. Seeds from which almost all the oil had been extracted by solvents were particularly dangerous.

Electric wiring in dusty places should be periodically examined, as dust concealed faults. Fires were sometimes caused by leakage of inflammable gases. A curious instance of hydrogen being produced by the action of red-hot iron on moisture was instanced. A casting was being made in a foundry, when the mould gave way, and the molten metal forced its way into the damp sand surrounding the mould. Hydrogen was produced and found its way through fissures in the sand to the surface, where a burning gas jet caused a sharp explosion.

Carbonic oxide was produced from faulty furnaces, when the air supply was restricted by some defect. Leakages from furnaces in such a condition were a common cause of explosion.

Some instances of fires from impurities were mentioned. Bottles of volatile liquids, if isolated were not subjected to the bright rays of the sun. Flaws in windows acted as lenses, and areas of the sun occurred in corn mills from this cause, and explosions had occurred in the protection of factories was discussed. The lecturer pointed out that factories were often found where scant attention had been given to this connexion point, even fire-buckets not being always in view.

With the many devices on the market, there was no excuse for such neglect. A brief description of the various types of first-aid extinguishers was given. These could be divided into five classes, soda-acid, carbon tetrachloride, compressed carbon dioxide, foam, and dry-powder types.

Carbon tetrachloride and foam types were the most recent introductions. The former was excellent for extinguishing flare-ups of petrol etc., but owing to the toxic gases evolved in use, care was necessary in using such extinguishers in confined spaces.

Foam type extinguishers, in which a blanket of tough bubbles of carbon dioxide was projected over the burning material, were now used to a large extent. The foam was produced by mixing solutions of sodium bicarbonate and aluminium sulphate, and of some foam-producing substance, such as extract of liquorice, and now often saponin. Foam-extinguishing installations were used on a very large scale for the protection of oil tank farms.

The most important of all fire-protecting devices was the automatic sprinkler. The first cost of such installations was undoubtedly considerable, but when once installed in a building they gave a protection that no other device could give. Fire insurance companies gave large rebates in premiums in respect of buildings so fitted, in some cases as much as 70%. An adequate supply of water was necessary, and where such was not available from the public mains, elevated tanks and pumping plant were required. Sprinkler systems could be adapted to meet very varied requirements. In localities subject to severe frosts, the dry-pipe system could be used, in which the pipes throughout the building were empty of water, but immediately filled in the event of an outbreak of fire causing a head to open. Heads of non-corrosive metal or glass were in use where required. The increased use of sprinkler-installations would go far towards reducing the present large fire loss of the country.

Various types of sprinkler heads were exhibited, including the latest "Grinnell" type manufactured by Mather & Platt, of Manchester, and the paper was illustrated by numerous lantern slides which had been kindly lent to the lecturer, showing the results of fires from various sources, and the various types of fire-protection devices and fire engines, from those in use at the Great Fire of London to those of the present day.

CALENDAR OF FORTHCOMING EVENTS

Aug. 20. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS. Newcastle-upon-Tyne. Annual Meeting at 2.30 p.m.

Aug. 31. ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. 22. Annual Meeting (97th year) at Leeds.

Sept. 9. INSTITUTE OF BREWING. Research Fund Committee and General Members. Visit to hop-growing and Coopers Kent. Luncheon will be held at districts meeting. (Provisional date.) Canterbury.

Sept. 14. INSTITUTION OF SANITARY ENGINEERS. Visit to the Shipping, Engineering and Machinery Exhibition at Olympia.

CORRESPONDENCE

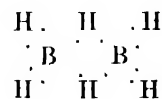
CHEMICAL COMBINATION AND THE CONSTITUTION OF BORON HYDRIDE

SIR,—A solution of the much discussed question concerning the constitution of boron hydride, B_2H_6 , has recently been proposed by Ullmann (Ber., 1927, 60, 610). According to Ullmann the hydride may be written $(BH_4)^- (BH_2)^+$. One boron atom acquires five electrons, thus completing an octet, and is associated with four positive hydrogen atoms. This group has, therefore, one unit negative charge. The other boron atom loses three electrons, thus attaining the configuration of the helium duplet, and is associated with two negative hydrogen atoms. This group has, therefore, one unit positive charge. According to this the hydride is a polar compound. This could perhaps be tested by measurements of the dielectric constant at different temperatures.

The proposal seems to stress unduly the intrinsic stability of the helium duplet and the neon octet, that is, the stability of these completed arrangements of electrons, inherent in their symmetry and independent of the magnitude of the charges on the nuclei. The greater firmness with which an actual helium atom holds its duplet in comparison with that with which the hydrogen atom holds its single electron is due chiefly to the greater nuclear charge of the former. Neon holds its octet more firmly than the neutral atoms of the same period hold their electrons for the same reason.

There does not appear to be sufficient evidence that the intrinsic stability of an octet is great enough to allow of the unsymmetrical molecule $(BH_4)^- (BH_2)^+$ being stable in comparison with some symmetrical arrangement.

It does not appear necessary to postulate quadrivalency for boron in order to explain how two BH_3 groups combine together to form a stable molecule. Possibly B_2H_6 may be represented by the symmetrical formula of



The dots in this formula represent, in a necessarily imperfect manner, the electrons revolving in orbits, or certain extended distributions of negative charge which, according to some interpretations of the quantum theory, constitute the electronic configuration. The hydrogen atoms share electrons with the boron atoms. They may perhaps be regarded as negative ions whose negative charge is greatly deformed in the direction of the boron nuclei. The outer hydrogen atoms each share two electrons with the adjacent boron atom. Each of the inner hydrogen atoms shares one electron with one boron atom and one with the other boron atom, but both electrons of either of these hydrogen atoms are under the attractive influence of both boron nuclei.

Such a combination of two BH_3 groups will contain less energy than that of the uncombined molecules even if the hydrogen existed as undeformed negative ions. The deformation of the latter will greatly increase

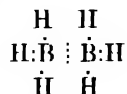
the stability of the double molecule because thereby more negative charge is drawn in between the boron nuclei.

Yours faithfully,

ANGUS F. CORE

Chemistry Department,
The University, Manchester.

P.S.—Since writing the above my attention has been directed to an article by S. Sugden in the May number of the *J.C.S.* In this, Sugden suggests for B_2H_6 the constitution



The formula represents the two boron ions B^{++} as sufficiently "electron seeking" to obtain octets by sharing with each other and with the hydrogen atoms at the expense of keeping four of the hydrogen atoms "half starved." If this is the case the arrangement will be more stable than the one proposed above.

A. F. C.

S.O.S.

SIR.—The very human character of your editorials in *CHEMISTRY AND INDUSTRY* emboldens me, with some expectation of sympathy, or at least fellow-feeling, to repeat my plea that all the paper used for the *JOURNAL*, including the Abstracts, be of the thin character employed for the *JOURNAL* proper.

If you will look along a shelf containing the *JOURNAL* from 1882 to the present time, the ever-increasing bulk of the volumes must appal you, as it does the rest of us. To what Brobdignagian proportions later volumes, including *JOURNAL*, Abstracts and Index, are to swell, one dreads to think. I have not yet had the courage to add the 1925 and 1926 volumes—the former (parcelled up in anticipation of a day of Kruschen feeling) weighs some 13 lb.—to shelves already the groaning recipients of journals from not one society alone.

Hopefully yours,

HOWARD SCENCE

Ainsdale, Southport

PERSONAL AND OTHER ITEMS

Sir John Brunner and Mr. W. J. U. Woolcock, C.B.E., have returned from Germany, where they have been taking part in the discussion between the Federation of British Industries and the corresponding German organisation, the Reichsverband.

Dr. H. H. Dale, C.B.E., F.R.S., has been appointed a member of the Advisory Board of the Trustees of the Beit Memorial Fellowships for Medical Research in the place of the late Prof. E. H. Starling.

At the annual congregation of the University of Leeds, the honorary degree of D.Sc. was conferred on Prof. A. Perkins and Mr. F. Barraclough.

Dr. E. H. Tripp has been appointed chief intelligence officer to Nitram, Ltd.

F. J. Watson, B.Sc., M.Sc., has been appointed chemist in animal nutrition to Nitram, Ltd.

Mr. W. Murray Morrison, who has been associated with the British Aluminium Company since its original formation, and who has been general manager for many years, has joined the board of that company. He has also joined the board of the North British Aluminium Company.

Mr. A. G. Loble, M.Sc., has resigned the readership in electro-chemistry in the University of Manchester on taking up a commercial appointment.

Mr. V. Bloomer, M.Sc., has been appointed demonstrator in electro-technology in the Faculty of Technology of the University of Manchester.

Amongst the appointments to Junior Beit Fellowships are the following names:—Dr. F. R. Winton, who will work on the physiology and pharmacology of urinary secretion, and will complete work in progress on the physiology of plain muscle; Mr. W. R. Wooldridge, B.Sc., will work on bacterial chemistry and immunology; Mr. W. T. J. Morgan, M.Sc., will continue the investigation of the structure of the hexose-phosphoric acids; Mr. P. Eggleton, M.Sc., will investigate the carbohydrate metabolism of contractile tissues; Mr. G. F. Marrian, M.Sc., proposes further investigation of the physiological role of vitamin B, and of the chemistry of the adrenal cortex; and Mr. A. R. Fee, B.A., will investigate the chemistry of the kidney.

We very much regret to learn that Mr. B. A. Burrell, of Leeds, who has just completed his term of office as chairman of the Yorkshire Section, died on the 10th instant. Mr. Burrell was formerly secretary of the Yorkshire Section for several years, and was an original member of the Society.

We regret to announce the death of Prof. A. Miethe, so well known for his contributions to the scientific study of photography.

The late Mr. W. C. Williams, formerly Professor of Chemistry at Sheffield University, left £56,403. Subject to certain life interests, bequests are given to the Faculty of Science at Sheffield and to the Chemical Department of Manchester University; the Chemical Society will receive £1000 for the support of its Journal and Library, and the Benevolent Fund of the Institute of Chemistry will receive £400.

Sir James Kennal, managing director of Messrs. Babcock & Wilcox, Ltd., and of other companies, left £452,726, with net personalty £138,495.

Institution of Chemical Engineers

The "Quarterly Bulletin" of the Institution announces that the programme for the forthcoming winter session is now rapidly taking shape. Although conferences extending over three days are being arranged to take place in December and March, the Institution will welcome papers of outstanding interest on chemical engineering subjects for early presentation.

For the first conference, arrangements are being made for papers to be read on refrigeration, sub-liquid combustion, refractories and the use of powdered fuel, and it is hoped to arrange for a works visit in connexion with one of the papers.

A further innovation will be introduced this year in the organisation of two public lectures. The first of these will take place on Friday, October 28, 1927, when the lecturer will be Sir William Bragg, K.B.E. It is hoped that the second lecture will be delivered early in the New Year by General Georges Patart.

The President's reception will be held during the early autumn, when members will have the first opportunity of welcoming Sir Alexander Gibb to office. Due notice will be given to members nearer the date of the reception.

Optical Society

At the meeting held on June 9, Mr. T. H. Harrison, Ph.D., B.Sc., A.Inst.P., presented a paper on "The use of photo-electric cells for the photometry of electric lamps." Mr. Harrison gave a description of apparatus and experiments designed for giving the highest accuracy and precision in the photometry of electric lamps using photo-electric cells. Although the methods adopted were not novel, yet every care had been taken to obtain the highest sensitivity in the photo-electric current measuring apparatus and to maintain the lamps at a steady accurately known voltage. It was claimed, therefore, that the results were useful in showing the maximum capabilities of photo-electric cells when used in the usual manner with a sensitive electrometer or electro-scope. The actual results were tabulated. A discussion was given of the sources of error to be expected, of the method by which they may be avoided, and of the computation of the accuracy of the results.

Papers were also presented by R. Kingslake, A.R.C.S., D.I.C., M.Sc., on "An experimental study of the best minimum wave-length for visual achromatism," and by S. K. Datta, M.Sc., A.Inst.P., on "Brewster's bands. Part II."

Professor A. G. Perkin

Prof. A. G. Perkin received the honorary degree of D.Sc. at the University of Leeds on July 4. Prof. J. W. Cobb, in presenting Prof. Perkin to the Vice-Chancellor, said "the connexion of Arthur George Perkin with this University began in the year 1881, when he became a student of the dyeing department of the Yorkshire College, and indicated the path he was to tread by producing, along with Prof. J. J. Hummel, a paper on 'Some new compounds of hematin and brazilin,' the first record of research published from the department, and the beginning of a long line of researches cumulative in usefulness and distinction. This experience had been preceded by study in London and Glasgow, and was followed by works practice at the Alizarin factory of Messrs. Hardman & Holden, of which he became manager. Returning to the Yorkshire College as Lecturer and Research Assistant in 1892, he engaged upon that systematic and continuous investigation of colouring matters which he has made his life's work, fittingly recognised by the Royal Society in electing him to the Fellowship, and afterwards acclaimed by the bestowal of the Humphrey Davy Medal.

"Extended responsibilities in teaching and administration were placed upon him when in 1916 he was appointed as Professor of Colour Chemistry and Dyeing in the University. He held for a time the Deanship of

the Faculty of Technology, and on his retirement last year was made Professor Emeritus. It is consistent with his whole career that Prof. Perkin continues to work at a bench in the laboratory which had been distinguished for so long as the scene of his labours. His record maintains a double tradition, that of his family and that of the University of Leeds, in being one of pioneering effort and achievement in the furtherance of science and of its application to the service of the community through the development of a great industry. We are proud and pleased to do him honour."

Timber Research in India

The most recent report of the Dehra Dun Forest Research Institute in India gives a good idea of the research in forest products that is being carried out at the Institute and the results so far obtained. Work is divided under several sections, such as Paper Pulp, Timber Seasoning, Timber Testing, Wood Technology, etc.

Under the Paper Pulp section the use of bamboo for the commercial manufacture of pulp has for some time been established, and the chief result of the past year's work has been the establishment of the sodium sulphate method of digestion combined with fractional treatment. With it the chemical cost of digestion and bleaching has been reduced by over 40%. As a result of this, two important projects for the manufacture of bamboo pulp in India are in process of materialising.

Under the Seasoning section, the aim is to discover the best seasoning conditions for the 70 or 80 Indian timbers which can probably be used in quantity at present. Seasoning process record guide charts are now available for many species, and during the year a process of accelerated seasoning was also carried out on fifteen more species. This work will enable railway sleepers to be manufactured from ordinary woods. Two entirely new processes of seasoning timber were tried during the year, namely (1) warm air seasoning with injection of ozone, and (2) steam and high vacuum drying. The first process proved successful with timbers containing gums and oils, but a close-grained timber split badly. The vacuum process had the reverse effect, and is expected to be of great use in connexion with sleepers that are to undergo impregnation. It is proposed to instal both plants at the Institute.

The Timber Testing section is perhaps the most important, and research thereunder is devoted to six different projects. Research under two projects serves as a reliable basis for the comparison of different species of timber, and a starting point for practically all other investigations directed towards the establishment of strength data. The principal studies during the past year related to timbers suitable for hammer-handles, picker-arms, sucker-rods, tea and rubber boxes, and tail-skids for aeroplanes.

Under the Wood Preservation section various anti-septics are kept under observation, and a large number of tests carried out to test their value under varying conditions. During the past year culture tests were made in the laboratory to determine the relative toxicity of wood tar creosote and coal tar creosote. In addition a good deal of work in connexion with the microscopic identification of timbers has been performed.

In the Wood Technology section the organisation of the various lines of research has been completed and a fairly definite programme of work has been laid out. It is still too early to report final results in most of the lines of investigation taken up, but a useful body of information has been collected, some of which is already capable of direct application.

Considerable work in regard to minor products is also in progress. Investigation into the Tuba root and the survey of the plants in Burma which yield chaumooogra oil have been undertaken.

Third Census of Production (Soap and Candle Trades)

Particulars are given below of the quantities and values of the main classes of products returned on schedules for the soap and candle trades in the years 1924 and 1907. Although the figures given in respect of 1924 relate to factories and workshops situated in Great Britain only, and those for 1907 relate to the output in the United Kingdom as a whole, the comparison is not materially affected by this circumstance.

Products	1924		1907	
	Quantity Cwt.	Selling Value £	Quantity Cwt.	Selling Value £
Glycerin:				
Crude, sold or added to stock	209,000	493,000	164,000	251,000
Distilled, do do	201,000	715,000	153,000	353,000
Total --Glycerin	410,000	1,208,000	317,000	604,000
Soap:--				
Soft	311,000	483,000	562,000	432,000
Hard:--				
Household and laundry in bars and tablets	5,047,000	12,672,000	5,657,000	6,191,000
Polishing and scouring:--				
Manufacturers'	163,000	287,000	113,000	146,000
Household	420,000	917,000		
Toilet (except shaving)	433,000	3,045,000	251,000	916,000
Shaving	14,000	212,000		
Other soaps (including soap powder)	1,301,000	3,150,000	857,000	846,000
Soap stock, produced for sale	236,000	311,000		
Total --Soap	8,825,000	21,107,000	7,440,000	8,561,000
Perfumed spirits	88,000 gall.	622,000		
Perfumery, cosmetics and toilet requisites (other than perfumed spirits and soap)		1,712,000		
Candles (including night lights)	820,000	1,871,000	946,000	1,829,000
Paraffin wax (refined)	112,000	225,000	70,000	110,000
Lubricating oils and greases	262,000	410,000		171,000
Oils, other than lubricating oils	540,000	1,301,000		241,000
Oil-seed cake and meal	590,000	226,000		
Washing and scouring materials, other than soap		598,000		23,000
Waxes (other than paraffin wax, refined and blended, and products thereof)		124,000		
Grease, tallow and stearin		388,000		387,000
All other products		801,000		289,000
Total value		30,626,000		12,218,000

As regards the manufacture of perfumed spirits and perfumery, cosmetics and toilet requisites in 1907, the firms engaged in this industry were instructed to furnish their returns on schedules for the chemical industry, and the aggregates returned on all schedules were as follows:—Perfumed spirits (111,000 gall.), £302,000, and perfumery and toilet preparations (except perfumed spirits and toilet soap), £612,000. Whilst the particulars given above in regard to the output of these products in 1924 will probably be found to cover the bulk of the trade, further amounts should be added on account of the output of firms making returns on the schedule for the chemical and other industries. The aggregates now shown should, accordingly, not be regarded as final.

The particulars given with regard to soap of all kinds and of candles are believed to cover the output of all important factories and workshops. In 1912 the quantity of soap produced in the United Kingdom was returned as 8,315,000 cwt., of which 244,000 cwt. was described as hard soap, 532,000 cwt. as soft soap, 64,000 cwt. as toilet soap, and 171,000 cwt. as polishing and scouring soap. In 1912, the output of candles totalled 1,048,000 cwt. The exports from Great Britain and Ireland in 1907 of soap, including soap stock, amounted to 1,240,000 cwt., and the net imports to 624,000 cwt. In 1924, 1,534,000 cwt. of soap manufactured in the United Kingdom was exported from Great Britain and Northern Ireland, including 172,000 cwt. to the Irish Free State and 1,362,000 cwt. to other destinations. The exports from the Irish Free State to destinations other than the United Kingdom in 1924 were negligible in amount, so that the excess of exports in 1924 over those in 1907 was 122,000 cwt., to which should be added the exports of soap stock, not separated from soap in the 1907 record, making a total increase of 308,000 cwt., or about 25%, the comparison being made for the same area, i.e., the British Isles, at both dates. The net import of soap in 1924 was 267,000 cwt., including 2000 cwt. from the Irish Free State, whilst it appears that about 16,000 cwt. of soap not of British manufacture was imported into the Irish Free State in 1924. The total import of soap and soap stock into the British Isles in 1924 was thus about 309,000 cwt., or 315,000 cwt. (50·5%) less than in 1907. From all available information it is estimated that the quantities of soap of all kinds for consumption per head of the population amounted to about 18 lb. in 1907, 17½ lb. in 1912, and 19 lb. in 1924.

The quantity of candles produced in Great Britain in 1924 was 820,000 cwt., the net import into the United Kingdom amounting to 5000 cwt. (including 2000 cwt. from the Irish Free State) and the export of British candles amounted to 171,000 cwt. (including 69,000 cwt. to the Irish Free State). The trade of the Irish Free State in candles was carried on almost exclusively with Great Britain and Northern Ireland. The amount available for consumption in Great Britain and Northern Ireland was thus 721,000 cwt., together with the amount produced in Ireland. In 1907 the production of candles in the United Kingdom was 946,000 cwt., the net import was 5000 cwt., and the export of United Kingdom products amounted to 284,000 cwt. There remained therefore in the British Isles for consumption in 1907 the balance of 667,000 cwt. A similar calculation gives the quantity available in 1912 as 787,000 cwt.

The net output of the factories and workshops engaged in these industries amounted to £11,335,000, and the net output per person was £411 in 1924 and £155 in 1907. The average number of persons employed in the soap and candle industries in 1924 was 27,599, compared with 18,718 persons in 1907. The total capacity of engines engaged in the industry in 1924 was returned as 34,468 h.p., of which nearly 31% was returned as ordinarily in reserve or idle during the year. In 1907 the equivalent figure was 16,938 h.p. The capacity of electric generators in the industry in 1924 was 18,396 kw., compared with 3837 kw. in 1907.

Third Census of Production (Ink, Gum, and Sealing Wax Trades)

Particulars are given below of the values of the outputs in 1924 and 1907 of firms whose returns were made for the ink, gum and sealing wax trades. In the figures given for 1907 are included particulars regarding small quantities produced in Ireland; those for 1924 are confined to output in Great Britain:—

	1924 Selling Value £	1907 Selling Value £
Printers' ink	1,515,000	453,000
	(266,000 cwt.)	
Printers' sundries (rollers, etc.)	163,000	34,000
Inks, other than printers' ink (i.e., writing, marking, endorser, etc., and ink powders)	406,000	231,000
Gum-mucilage, paste, etc.	226,000	50,000
Typewriter ribbons, carbons and other type-writer sundries	509,000	23,000
Sealing wax	76,000	34,000
Varnish (including litho and letterpress varnishes)	59,000	18,000
	(225,000 galls.)	
Other stationers' sundries	18,000	45,000
Other products	130,000	
Total value	3,132,000	888,000

The total value of the output in Great Britain returned for these trades in 1912 was £1,144,000. Particulars given above do not cover the whole of the output of any of the specified classes of products. The figures given in respect of varnish are supplementary to those returned for the paints, colours and varnish trades already published. The kinds of varnishes given on the above table cannot be separated from other varnishes in the returns already recorded. The quantity of printers' ink recorded on schedules for the paints, colours and varnish trades was 22,000 cwt., valued at £214,000, but separate particulars of other inks are not available. Additional returns in respect of other classes of goods specified on the above table may probably be shown in returns for the manufactured stationery and kindred trades.

The increase of over 250% in the aggregate value of the 1924 output of these products shows that, after taking account of the difference in price levels in both years, a real increase in the volume of production of the trade as a whole has taken place since 1907. In 1924 exports of printers' ink amounted to 26,700 cwt., valued at £195,000, and retained imports to 12,100 cwt., valued at £31,000, the average values per cwt. being £7 6s. 2d. in the case of exports, and £2 15s. 7d. in the case of imports. The average value at the place of production was £6 per cwt. Imports and exports were small compared with the home production, the weight of the net imports being 1 per cent., and that of the exports about 9 per cent. of that of the production. The value of writing ink and ink powder exported in 1924 was £183,000, whilst retained imports amounted to £15,000 only. The net output of the factories and work-shops covered by the foregoing statement was £1,700,000 in 1924, and the net output per person employed was, in that year, £477, compared with £289 in 1912, and £280 in 1907. The average number of persons employed during 1924 was 3567, compared with 1655 in 1907. The total capacity of engines at the factories in 1924 was 2095 h.p., of which about 24% was idle or in reserve during the year. The capacity returned in 1914, Instn. 1554 h.p., and in 1907, 2125 h.p. The average number of electric generators at factories in 1924 was 14, compared with 10 in 1914, and 7 in 1907, 39 kw.

REVIEWS

SOIL CONDITIONS AND PLANT GROWTH. By SIR E. JOHN RUSSELL, D.Sc., F.R.S. Fifth edition. Pp. viii + 516. London: Longmans, Green and Co., Ltd., 1927. Price 18s. net.

This book was established, by its first edition in 1912, as a compact reference library on soil science for the general agriculturist and as a *sine qua non* for the specialist. It is the unavoidable penalty of contributing so valuable a survey of a rapidly developing subject that new and bulkier editions are demanded of the author.

So great has been the advance in the subject since the fourth edition in 1921, and so general has been the advance in all sections of the subject, that it has been found "necessary to rewrite all except the historical portions of the book." This edition brings the account of our knowledge of the constitution of the soil, and the relation of the soil to the plant, to date, by the inclusion of the recent work on soil physics, colloidal properties, base exchange, acidity, microbiology, and plant nutrition.

It is inevitable with such a rapidly advancing subject that opinions should differ about the sequence of its presentation and the distribution of emphasis. The arrangement of the matter is doubtless a wise one for those readers whom the author has chiefly in mind, but the general agricultural student and the many who merely "consult" the book will certainly need the excellent index to guide them.

There will be some of us who will feel some regret that Sir John Russell has not given more prominence to the Russian and other recent work on soil genetics and the study of the soil profile. Even "Podsol" is not to be found in the index. The author says "it seems improbable . . . that surveying by profile would prove as helpful to ecologists and agricultural advisers in England as it is expected to prove in Continental areas," and although he adds "But it is clear that the profiles must be studied . . ." this seems like a challenge to some British workers. The soil profile is the manifestation of what is going on in the soil, and would seem to be the fundamental necessity in soil studies. It is admittedly more difficult in this land of cultivated soils to study the profile, but we are not all clear why it is less important or likely to be less useful. But however much opinions may differ as to the relative importance of profile studies, we all welcome this book as an old friend increased in stature and in knowledge. N. M. COMBER

LABORATORY EXPERIMENTS IN DAIRY CHEMISTRY. By LEROY S. PALMER, Ph.D. The Wiley Agricultural Series, edited by Dr. J. G. Lipman. Pp. xiv + 84. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 7s. 6d.

Prof. Palmer's book is intended for students who are studying biochemistry from an agricultural standpoint. It differs from many other books on practical dairy chemistry in that it is devoted to the study of the physico-chemical characters of milk and its products. If desired, however, the course outlined could be adapted easily to include quantitative estimations, as is shown by

the inclusion of a short chapter dealing with the more common estimations.

Three chapters are devoted to the study of the properties of milk, whilst butter, rennet, cheese, and milk powder are dealt with in separate chapters. Due emphasis is given to the importance of adjusting the hydrogen-ion concentration of solutions used in many of the experiments.

A feature of the book is the detailed instructions which are given for each experiment, and, whilst these will prove of great assistance to the student, they will, none the less, be of value to the demonstrator. But, in order that the student may obtain the greatest benefit from the course of practical work, it will be necessary to supplement the experiments with theoretical notes—an observation made in a few "general instructions" given by the author at the beginning of the book.

A conscientious student, after completing such a training as outlined in this course, will be in a position to appreciate the principles of physical chemistry as applied to dairy products, and should be familiar with such instruments as the ultra-microscope, viscometer, and the hydrogen-ion apparatus, now so necessary in advanced work.

In order to stimulate interest and to prevent a mechanical performance of the exercises, questions have been inserted after many of the experiments, and a good bibliography has been systematically arranged for each chapter. Useful tables are also to be found in the appendix, and the book is well indexed. This book can be confidently recommended to both student and teacher.

D. N. McARTHUR

LABORATORY MANUAL IN GENERAL MICROBIOLOGY.

Prepared by the Laboratory of Bacteriology and Hygiene. The Wiley Technical Series for Vocational and Industrial Schools, edited by J. M. JAMESON. Third edition. Pp. xxvi+472. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 17s. 6d.

As a general rule a course in biology does not find a place in the curriculum taken up by the average chemist. The result is that he approaches the subject of practical microbiology in his post student days with an inadequate equipment for the task. Mr. Giltner is aware of this difficulty, for in his preface he expresses the hope that the student will "develop powers of observation" in plodding through the exercises. In the first eighteen tasks the microbe is merely a cipher in more or less mechanical operations. It either does not appear, or, if it does appear, it is not necessary to take a direct view of it. Then he introduces the microscope, and the microbe itself assumes prominence. In the subsequent exercises in Part I various organisms are introduced, and include yeasts, moulds, bacteria, and even protozoa. We have grave doubts of the wisdom of this procedure, and consider it to be educationally unsound. It would have been better to have made an intensive study of one organism before proceeding to general exercises. In one exercise (Ex. 47. Part I) the comparison of two classes of organisms (bacteria and protozoa) is effected within the limits of one simple exercise! It cannot be done. We recommend the book to those who already

possess the fundamentals of biology, for the individual exercises are explained with a lucidity that makes us understand the reason for the popularity which has followed its publication.

In the second part of the book the author has spread his net very wide, and has framed exercises of interest to agriculturists, pharmacists and medical men, as well as to chemists. Some of the exercises dealt with in Part II, particularly those dealing with animal diseases, are far beyond the capacity of the beginner. The author is not free from his countrymen's love for elaborate technical terms. We have samples of this in pp. 152 and 153. He can hardly expect us to adopt such definitions as *coprophile* = loving barnyard manure. This seems to us to be somewhat Gilbertian.

We recommend this book to all those who are learning under guidance, and to such as desire to have at hand a manual for purposes of reference. DAVID ELLIS

A CONTRIBUTION TO THE THERMOCHEMISTRY OF ORGANIC COMPOUNDS. By Dr. ENDRE BERNER. Pp. 134. Oslo: Morten Johansens Boktrykkeri, 1926.

Dr. Berner's "Contribution to the Thermochemistry of Organic Compounds" might be supposed from internal evidence to represent a thesis from the laboratory of Professor Rüben, whose application of refractometric and dilatometric methods to the study of mutarotation is well known to English readers. Dr. Berner has discussed two applications of thermochemistry to organic compounds. In the first, following in the footsteps of Thomsen, Swientoslawski, Reinberg and Fajans, he has tried to determine the thermal value of the various linkages in organic compounds. Assuming with Fajans that the heat of dissociation of diamond is 150 kg. cal. per gram-atom, and that of hydrogen is 81.3 kg. cal. per gram-molecule, he deduces concordant values for the "absolute heats of formation" of the hydrocarbons from their atoms by postulating a value 82.0 for the C-H bond and 72.7 for the C-C bond. The former value agrees closely with the heat of dissociation of the C-H bond, whilst the latter is not far removed from Fajan's value for the heat of dissociation 75.0 of the C-C bond in diamond. For hydrocarbons containing less hydrogen he deduces the values 53.8 for each link of a triple bond and 60.8 for each link of a double bond. In rings of 2, 3, 4, 5, 6, and 7 carbon atoms the average value of each bond is 59.7, 61.9, 63.6, 71.2, 71.9, 72.6. The first number in this series is a slightly modified value for ethylene; the other members show a progressive diminution of strain as the size of the ring increases up to 5 carbon atoms, but no further increase is recorded in the 6 and 7 atom rings, or in decahydronaphthalene where the value of the bond is 72.3. These results (which are a mere recalculation of the data used by Hückel) are confirmatory of Sachse's theory of "strainless rings."

The latter part of the memoir describes the calorimetric methods used by the author, and records the values which he obtained by applying these methods to the determination of the heats of combustions of several series of isomers, namely, the methyl and ethyl esters of *d*, *dl* and *meso* tartaric acid, the ethyl esters of *dl* and *meso* dimethyl- and diphenyl-succinic acids, hydro-

benzoin and *iso*-hydrobenzoin, stilbene and *iso*-stilbene. The author's conclusion (which agrees with that reached independently by Verkade and Koops) is that "The *meso*-isomers have the greatest heats of combustion, when corrections are applied for the difference in energy between isomers in the solid state, due to the crystalline condition alone." Attention is called to the fact that the heat of solution can be used instead of the heat of fusion in correcting the heats of combustion of solid isomers.

Although the experimental results do not cover a very wide field, the memoir forms an interesting review in English of the present position of the subject.

T. M. LOWRY

ANCIENT EGYPTIAN METALLURGY. By Major H. GARLAND, O.B.E., M.C., M.Inst. Metals, and Prof. C. O. BANNISTER, M.Eng., A.R.S.M. Pp. xi + 214. London: C. Griffin & Co., Ltd., 1927. Price 12s 6d.

The valuable additions which have been made in recent years to our knowledge of the development of chemistry among the ancient civilisations have resulted largely from bibliographic and palaeographic studies and discoveries. The book under notice contains an account of researches of a type calculated to make a more direct appeal to the practical chemist, since it deals with the chemical and metallurgical examination of a large variety of ancient metal specimens. The work was undertaken by the late Major Garland, formerly Superintendent of Laboratories at the "Citadel," Cairo, whose notes and critical memoranda have been ably arranged and edited by Prof. Bannister.

A preliminary chapter on the sources of the metals concerned includes also a useful summary of Egyptian chronology, and it is followed by chapters on the bronze industry, the iron age, and the tools of ancient Egypt. A further chapter deals with the metallography of antique metals. The concluding account of the cleaning, preservation, and repair of antique metal objects will be found useful by archaeologists and collectors, especially, one may suggest, if it is read in conjunction with the reports of Dr. A. Scott's valuable investigations, conducted during recent years at the British Museum, on the cleaning and restoration of museum exhibits.

In discussing the bronze industry of ancient Egypt the author indicates a very early introduction of the "cire perdue," or waste wax process for castings, which had evidently reached a high state of development among the Egyptians some two thousand years before its introduction into Greece. The hardness of the cutting edges of the copper and bronze implements of ancient Egypt is attributed solely to the effect of cold hammering, and it is stated that Græco-Roman copper razors were finished in the same way; it is interesting that microscopical evidence does not bear out the supposition that the ancient Egyptians possessed secret processes for hardening copper and bronze. Annealing appears not to have been practised, and it is considered that there is no positive evidence of welding or brazing of copper and bronze, or of soft soldering, before late Roman times; wire drawing and metal spinning were also unknown in ancient Egypt. However, methods of working metals by hand were known to the ancient Egyptians and practised by them with great ability.

The author opposes the view, held perhaps by most archaeologists, that iron was not in common use in Egypt until about 1000 B.C. On the contrary, it is stated emphatically that metallic iron was known as early as the IVth Dynasty (2900 B.C.), seeing that copper was then being produced extensively, and that iron, in the form of hæmatite, occurred in much greater quantity than copper. Further, it is argued that in the absence of iron the only implements available for carving the diorite statues of the IVth Dynasty would have been totally unsuitable ones made of copper. It is admitted that only five iron articles dating from this period down to about 1400 B.C. have been discovered, but the paucity of such finds is attributed to the ease with which iron rusts and disintegrates in the chloridic soil of Egypt; moreover, iron was a rare and useful metal, so that worn tools were probably re-made; finally, since the metal was not used for decorative, religious, or symbolical purposes, iron articles were not placed in tombs.

The author's opinions upon various debatable matters are based largely upon evidence obtained during a study of the metallography of antique metals. This section of the book, which is illustrated by numerous photo-micrographs, is of particular interest to metallurgists, since it shows clearly the value of microscopical methods in the examination of ancient metals and alloys. From this point of view it is fortunate that the copper of ancient Egypt usually contained impurities, notably iron and arsenic. Micro-structure usually affords a trustworthy indication of the original method of manufacture of antique metal objects, since it has been established that the structural characteristics of cast, worked, or annealed specimens are permanent. No evidence was forthcoming of the occurrence at atmospheric temperatures, over periods extending to five thousands years, of annealing effects, diffusion in solid solutions, recrystallisation, or crystal growth, in metal specimens of the kind. As a result of microscopic examination it has been shown that the method of casting in moulds was used, until the period of the Roman occupation, even in making such simple objects as bronze mirrors, knives, arrow tips, chisels, and plain ring bracelets. Micro-structure is also stated to provide an unfailing criterion of the authenticity of antiques in copper, bronze, or silver: "although external corrosion patinas may be skilfully copied, no practical process can be applied to metal objects that will produce the extensive internal corrosion found in examples of genuine antique origin. It is also not improbable that, when the subject has been further studied, it will be possible to state, within reasonable limits, from the extent of the internal corrosion, the actual age of a given article."

The book is written in such terms as to appeal to the cultured layman, and it cannot fail to attract the more specialised attention of the chemist and the archaeologist. It offers a peculiar fascination to students of historical chemistry. One lays it down with the reflection that those two widely sundered branches of science, chemistry and archaeology, have met on common ground as a consequence of the scientifically controlled excavations which have been carried out during the last few years at Luxor, Giza, and elsewhere in Egypt. It is very fitting that

this striking rapprochement should have occurred in that "country of dark soil" which is reputed to have bequeathed its former name of Khem to the ancient "black art" of alchemy, and thus indirectly to the modern science of chemistry.

JOHN READ

Gmelins Handbuch der Anorganischen Chemie.

Edited by R. J. Meyer and collaborators. System number 19. *Wismut und Radioaktive Isotope*. Eighth completely new and revised edition. Pp. xxii + 229. Published by the Deutsche Chemische Gesellschaft. Berlin: Verlag Chemie, G.m.b.H., 1927. Price 33 m.

Number 19, like all the other books of this excellent series, is a most thorough compilation of chemical and physico-chemical data relative, in this instance, to the metal bismuth, its compounds, mixtures, and alloys. Brief reference is also made to the radioactive elements.

The mining, mineralogy, and metallurgical extraction of bismuth are not to any extent referred to, nor are the commercial applications of the metal dealt with at any length. Abstracts from original publications are quoted so freely in the text that the ordinary and more usual English textbook style is lacking to such an extent that the book becomes almost entirely one of reference. The number of references quoted is immense, and in fact, so far as can be ascertained, complete upon those aspects of the subject intended to be covered.

The first 104 pages deal comprehensively with the chemical, electro- and physico-chemical properties of the element bismuth itself, describing also the methods of qualitative and quantitative analysis which are regarded as standard.

A further 100 pages are taken up by classified descriptions of the compounds and alloys of bismuth with hydrogen, oxygen, nitrogen, chlorine, bromine, iodine, sulphur, selenium, tellurium, boron, carbon, silicon, phosphorus, arsenic, and antimony.

In the remaining twenty pages radium, thorium, and actinium are briefly but sufficiently discussed.

The ternary system $\text{Bi}_2\text{O}_3\text{--N}_2\text{O}_6\text{--H}_2\text{O}$, the binary systems bismuth-chlorine, bismuth-bromine, and bismuth-iodine are represented graphically, as are also the binary alloy systems bismuth-selenium, bismuth-tellurium, and bismuth-antimony. N. F. BUDGEN

MATERIE, ELEKTRIZITÄT, ENERGIE. GRUNDLAGEN UND

ERGEBNISSE DER EXPERIMENTELLEN ATOMFORSCHUNG. By Dr. W. Gerlach. Pp. xi + 291. Wissenschaftliche Forschungsberichte. Naturwissenschaftliche Reihe, edited by Dr. R. E. Liesegang. Part VII. 2nd edition. Dresden and Leipzig: T. Steinkopff, 1926. Price, paper 15 m., bound 16.50 m.

Dr. Gerlach's book gives a comprehensive though concise survey of the modern developments of atomic theory. The division of the subject matter into thirty chapters, dealing with more or less distinct phenomena, indicates the wide range of this survey.

Chemists will find of special interest chapters 19 to 28, which deal, among other things, with various aspects of photo-chemistry, X-ray analysis, and the characteristic frequencies in the infra-red of chemical radicals in crystals.

JOHN A. CRANSTON

PARLIAMENTARY NEWS

Safeguarding of Industries (Hydroquinone and Lactic Acid)

In reply to Major Sir Archibald Sinclair, Sir P. Cunliffe-Lister said that an exemption order regarding hydroquinone was issued by the Treasury on June 23. Preparations for the manufacture of B.P. lactic acid in this country were well advanced, and the conditions for exemption laid down in Section 10 (5) of the Finance Act, 1926, were not therefore satisfied.—July 5.

Morphia (Exports)

In a written reply to Mr. Campbell, Sir W. Joynson-Hicks stated that the amount of morphia, *i.e.*, alkaloid, salts and the morphia contained in medicinal preparations, exported to various countries in 1925 and 1926 respectively was 95,725.79 oz. and 73,288.762 oz. It was not possible to distinguish between British and foreign morphia, but it might be taken that practically the whole amount exported was of British manufacture. No export of morphia was licensed until the Board of Trade was satisfied that it was required for legitimate purposes.—July 6.

Exports of Vegetable Oils to Portugal

Sir P. Cunliffe-Lister informed Mr. Lunley that the exports of edible vegetable oils refined in the United Kingdom and consigned to Portugal amounted in 1924 to 53 tons, valued at £2750; in 1925 to 63 tons, valued at £3006; and in 1926 to 1007 tons, valued at £41,757.—July 7.

Imports of Motor Spirit

In reply to Lieut.-Colonel Howard-Bury, Sir P. Cunliffe-Lister said that 101 million gals. of motor spirit were imported into Great Britain and Ireland in 1913, of which 14.9 million gals. were consigned from Russia. In 1926, 562 million gals. were imported into Great Britain and Northern Ireland, of which 55.2 million gals. were consigned from the Union of Socialist Soviet Republics.—July 7.

COMPANY NEWS

NOBEL INDUSTRIES, LTD.

The report covering the year to December 31, 1926, shows a profit of £1,469,141, compared with £1,091,920 for the previous year. Debenture interest absorbs £70,389, and after again writing off one-thirtieth of debenture issue expenses, absorbing £2977, there is available, with £230,527 brought in, £1,626,302. Last year the reserve was raised to £1,000,000, with an allocation of £450,000; no transfer to that fund is now proposed, but the dividend on the ordinary capital is increased from 10% to 15%, whilst the deferred shares receive 10% against 5%, leaving £233,390 to be carried forward. The directors state that, although the home trade, more particularly in explosives, was materially affected by the prolonged stoppage in the coal industry, the decrease in revenue thus occasioned has been more than made up by the results achieved from the activities of the constituent and associate companies in other directions and by further improvement in investment income.

MOND NICKEL CO., LTD.

The thirteenth annual general meeting was held on July 8, the Rt. Hon. Sir Alfred Mond, Bt., M.P. (chairman) presiding. Reference was made to the loss sustained through the death of the Rt. Hon. Sir Ellis Griffith, who had been a director of the company for a large number of years. After reviewing the accounts (cf. *CHEM. AND IND.*, July 8, 1927, p. 620), the chairman said that in view of the general strike and the coal strike during the past year, he thought the shareholders could congratulate themselves on the fact that the financial results of the year had been maintained on such a satisfactory level. During last autumn, accompanied by the deputy-chairman and Mr. Robert Mond, the chairman visited the company's mines and smelter in Canada, and found everything working very smoothly and efficiently. A highly-trained technical staff was in charge of every one of the operating departments, and it was gratifying to observe the very marked technical advance which had been achieved, particularly in recent years, in the treatment of the Sudbury ores. The cost of matte was one of the main factors in the cost of their finished products, and it was, therefore, a cause of satisfaction that the cost of matte had now reached a figure well below any previous record, even before the war. This was a striking advance, considering that wages were nearly double pre-war rates, and that the cost of supplies had advanced by probably 66%. A visit was also paid to the various mines of the company. At the present time the company had a larger tonnage of ore in reserve than it has had at any previous period in its history. It was estimated that at the present rate of production it had from 40 to 45 years' proved ore which it could take out. This was largely due to the satisfactory results of deeper drilling at the Frood mine, where large reserves of high-grade ore have been located. Their competitors and neighbours had discovered a high-grade copper ore at a depth of 3000 ft., and as the mines adjoined, it was exceedingly likely that similar ore would be found in the company's mine. Omitting the bad effect of the coal strike, the year's operations at Clydach were satisfactory. Further improvements were being made which had resulted in economy in fuel, greater output, reduction in repairs and greater efficiency, thus reducing the cost of the final products. A visit was next made to the subsidiary company, the American Company, at Clearfield, Pennsylvania. It had been decided to change the name to "The American Mond Nickel Company," and Mr. Shipley, a well-known engineer and man of business in America, had assumed the chairmanship of the board of the company. Mr. Barclay, their chief technical expert in these matters in England, had been sent over to assist on the technical side, and it was anticipated that this business would become in time a very remunerative and important part of the company's operations. There was a greatly increasing use in America of rolled and milled goods in nickel, nickel-copper, and other nickel alloys, and the company was extending its operations in this direction. The subsidiary company in Birmingham, Messrs. Henry Wiggin & Co., had made, in spite of the coal strike, a reasonably substantial profit. Dealing with the question of

sales and deliveries of the main products of the company, the chairman said that they were large manufacturers of copper sulphate, and in spite of strong competition from the local makers in the consuming countries, they had always been able to place all that they produced. Last year, owing to their production being less than usual, as a result of the stoppage, they were somewhat short of supply. Prices, however, were considerably better than in the year before. As regards nickel, the outlook was more promising than it has been at any other time. Deliveries during the last year exceeded those of any previous year. The work of the research and development department had become increasingly essential. There was no doubt that nickel would form an essential constituent of almost every alloy which would meet the demands of designers of machinery who were looking out for additional alloys which would have the strength, combined with corrosion-resisting properties, necessary to meet the ever-insistent demands for greater speeds, higher temperatures, and increased pressures. In order to keep in touch with developments of this kind, and ascertain exactly how these alloys should be used, it was necessary to determine the main qualities of the existing alloys and the means by which they could be improved, and the research and development department was proceeding on a line of far-reaching investigation which, in the course of time, could become more and more valuable to the company. They had also been developing nickel-copper alloys, one of which, made by Messrs. Henry Wiggin & Co., was called "Silveroid," and contains 45% of nickel. Experiments were also being made with copper-nickel alloy tubes, as against brass tubes, which it was hoped would prove successful. The company was in a fortunate position with regard to the platinum metals, as they occur with the nickel-copper in the ores, and were recovered at the end of the extraction process automatically. A final dividend of 1s. 6d. per share was declared on the ordinary shares, making 12½% for the year. The retiring directors, the Rt. Hon. Sir Alfred Mond, Bart., M.P., Viscount Erleigh, Sir Robert A. Hadfield, Bart., and Mr. Robert Mathias, were re-elected.

UNITED PREMIUM OIL AND CAKE CO., LTD.

The eighth ordinary general meeting, held on July 8, was presided over by the chairman, Mr. H. Guedalla. The net profit for the year 1926 was £54,142 (£61,468 for 1925), and with £27,170 transferred from reserves to meet the preference dividend, there was an available sum of £81,312. Interest on debenture stock absorbed £21,751; Uruguay proposition written off, £3230; provision in respect of trading losses of subsidiary companies, £23,940; leaving £32,390, plus £3452 brought in. The preference dividend absorbed £34,431, leaving £1412 to be carried forward. The effect of the coal strike was to increase considerably working costs and to cause a material diminution in both the output and the revenue, the extra cost of fuel alone for the last six months of the year under review greatly exceeding the reduction in revenue as compared with the previous year. Foreign competition was also keener than ever. Taking the chief raw material in which the company dealt, the Board of Trade returns for 1926 showed there

was a reduction in imports of 20% compared with 1924, and that of their finished products, oil imported in 1926 showed an increase of 96% compared with 1924, and cake imported showed an increase of 45%. These percentages reflected very large values, and, although the increase last year may have been somewhat abnormal, the chief cause was the selling by foreign firms which have the advantage of protection in their own country. If the mills in this country had been able to manufacture these imported products there would, with their own internal competition, have been no necessity for increased selling prices, as the increased turnover would naturally reduce the cost of manufacture. Mr. Till, who has been associated with the Premier Oil Extracting Mills for many years, resigned his position as chairman and managing director of that company on December 31 last. As from January 1 of this year the services were secured of Mr. W. E. Waterhouse as general manager, in which capacity he assumed the responsibility of the management of all the subsidiary companies, with the exception of Seatons, in Hull. Since the commencement of the current year the earnings show a considerable improvement.

MIDLAND BANK, LTD.

An interim dividend has been announced for the half-year ended June 30 last at the rate of 18% per annum, less income tax, payable on July 15.

CELANESE CORPORATION OF AMERICA

A dividend of 7% has been declared, thus clearing all arrears on the preferred stock. The total dividends paid and declared on this stock now amount to 24½%.

BRYANT AND MAY, LTD.

The directors have issued a circular setting forth conditions on which an identification of interests with the Swedish Match Company is to be set up. The business of the two companies are to be unified throughout the British Empire, other than in Asia. A new company is to be formed called The Imperial Match Company, with a capital of £6,000,000 in £1 shares divided as follows: 4,189,548 to be offered to Bryant & May ordinary shareholders in exchange on the basis of 3½ new £1 shares for each £1 share held; 1,800,000 to the Swedish Match Company; 10,452 to be subscribed in cash at par by Bryant & May. The new concern will be a holding company, and Bryant & May and J. John Masters & Co., of Barking, Essex (the latter company being controlled by the Swedish Match Co.), will continue as at present, and each company will preserve its identity. The board of the new company will consist of the following:—*Bryant & May directors*—Mr. G. W. Paton (chairman and managing director), who will be chairman of the new company; Messrs. C. E. Bartholomew (deputy-chairman of Bryant & May), W. A. Fairburn, A. Hacking, A. Hepburn, C. O. Rennie, Sir Arthur Stanley, and the Rt. Hon. John W. Wilson. *Swedish Match directors*—Mr. I. Kreuger (managing director, Swedish Match Co.); Major J. W. Hills, M.P., who is also chairman of J. J. Masters & Co. *J. John Masters & Co.*—Mr. O. I. Andren and Mr. H. O. Agrell, in addition to Major J. W. Hills.

MINERALS SEPARATION, LTD.

The twenty-second annual ordinary general meeting was held on June 30. Sir Ernest M. Clarke presided in the absence of the chairman, Mr. Francis Gibbs, owing to ill-health. The coal side of the company's business in this country and in France had been disappointing, and there were no prospects of any improvement in the near future. The ovoid plant at Aberaman, owned jointly by the Powell Duffryn Steam Coal Co. and the company, was now completed, but owing to the general depression in the coal industry it had not been possible as yet to market its products. In Spain the production of coal cleaned by the company's processes had again increased, being 249,589 tons in 1926, against 227,542 tons in 1925. After reviewing activities in the Belgian Congo and Rhodesia, the chairman stated that the development work carried out to date in Southern Rhodesia by the Southern Rhodesia Base Metals Corporation on their Copper Queen and Copper King properties confirms the opinion of their importance. Large bodies of ore-carrying copper, lead and zinc of commercial grade had already been indicated, and the development programme would be accelerated during the present dry season. The company had recently participated in an option over a new process for the recovery of tin. Experiments in the laboratory and also on a larger scale in Cornwall had been very encouraging, but it was too early to say anything definite just yet.

"SANITAS" TRUST, LTD.

The first ordinary general meeting was held on June 21, Mr. N. F. Kingzett, chairman, presiding. The report, covering the period from March 11, 1926, to May 31, 1927, shows a net profit of £62,293. After providing for the fixed dividend of 10 per cent. on the preference shares, and writing off £12,600 from underwriting commission (reducing it to £7000), the balance of £684 was carried forward. The combined profits of the constituent companies for the year to March 31, 1927, amounted to £83,031. During the year the constituent companies had made considerable progress in consolidating production and distribution of their products, which, in future years, should result in substantial reduction in costs.

AMALGAMATED PHOTOGRAPHIC MANUFACTURERS, LTD.

The sixth annual general meeting was held on June 10, Mr. F. G. Thomas (chairman) presiding. The net trading profit for 1926 was £37,100, compared with £36,048 for 1925. After providing for interest and reserve for depreciation, the net profit was £21,343, against £20,977. The year's dividend on the 8% "A" preference shares absorbed £7836, leaving, with £20,977 brought in, £34,484, which was carried forward. The improvement in the profits, which they were entitled to expect for 1926 owing to the economies in manufacture and distribution, to which reference was made at the last annual meeting, was not realised owing to the decrease in the sales brought about by the strikes. The demand, especially from the export markets, for the photographic plates manufactured at the company's Southgate factory had so far exceeded its capacity that the manu-

factory of self-toning paper had been transferred to the factory at Watford, and additional plant had been installed at the Southgate factory, increasing its capacity for the manufacture of plates by over 50%. The demand for the projectors manufactured by the company had exceeded the capacity of the Kershaw factory at Leeds, and an extension to the factory had been made in order to increase the output. With regard to the current year, for the first five months the sales in each month showed an improvement over the corresponding figures for last year amounting to about 15%.

CAPE ASBESTOS CO., LTD.

The thirty-fourth ordinary general meeting was held on June 24, Mr. L. Breitmeyer, chairman, presiding. The net profit for 1926, after providing for taxation and bad and doubtful debts, and including income from the Turin branch, amounted to £36,766, an increase of £10,281 over the previous year. With the sum of £10,491 brought forward from 1925, there was an available profit of £47,257, from which was deducted the 5% preference dividend amounting to £3600, an addition to the reserve fund of £15,000, and £2500 to the staff benefit fund, leaving available £26,157. A dividend was declared of 10% on the ordinary and preference shares, absorbing £15,500, leaving £11,757 to be carried forward. There was an increasing demand for blue asbestos, and the new amosite property had also contributed to the year's results. Encouraged by the satisfactory introduction of amosite, the further opening up of the mines would be taken in hand. Plant and equipment would require a considerable expenditure, and to meet this and also to provide for the expansion of their general business, it was intended at some future date to offer the remaining unissued £20,000 ordinary and preference shares to shareholders and to propose an increase of the share capital. There was again a record turnover at the Turin factory, the gross volume of trade showing an increase of nearly 30%.

LAGUNAS NITRATE CO., LTD.

The thirtieth annual general meeting was held on July 7, Mr. R. E. Morris, chairman, presiding. A trading profit was made for 1926 of £14,327, increased to £17,473 by the receipt of interest and transfer fees, but after meeting the heavy expenses entailed by the shutting down of the oficina, the necessary administration expenses and income tax, there was a loss of £11,939. The extraction of caliche was continued until December last, but this work has now been stopped as, in view of the Chilean Government's declaration that the present duty on nitrate would be maintained until June, 1928, it will probably be impossible to resume manufacture this year. It was essential that the Chilean Government should render assistance to the industry. It was estimated that if nitrate of soda could be sold to the agriculturists at about £10 10s. per ton, a consumption of from 2,000,000 to 2,250,000 tons might be anticipated during the current nitrate year. For the year just closed the consumption was only 1,753,000 tons, compared with 2,092,000 tons for the previous year.

WELSBACH LIGHT CO., LTD.

A dividend has been recommended of 5%, less tax, being the same as for the three preceding years.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton, f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide "cryst."—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—8d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—8s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carbohc.—Crystals, 8d.—9d. per lb. Crude 60's, 2s. 4d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 4½d. per gal. Pale, 95%, 2s.—2s. 3d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 11d.—1s. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 8d.—1s. 10½d. per gal. Pure, 2s.—2s. 3½d. per gal.
 Xylol.—2s.—2s. 4d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24%, 10½d. per gal. Standard specification, 6½d.—8½d. per gal. Middle Oil, 7½d.—7½d. per gal. Heavy, 8½d.—8½d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/160, 1s. 2d.—1s. 6d. per gal. Solvent 95/160, 1s. 5d.—1s. 6d. per gal. Solvent 90/190, 11d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—82s. 6d.—85s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s. 6d.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—5 cwt. lots. Cryst. 41s. per cwt. Powder 45s. per cwt. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7½d.—1s. 10d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 3½d.—1s. 6d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £30 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—5 cwt. lots. Crystal 25s. per cwt. Powder 27s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d. per lb. Potassium.—1s. 11d. per lb. Sodium.—2s. 2d. per lb. All spot.

Calcium Lactate.—1s. 3½d. per lb.

Chloral Hydrate.—3s. 6d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Cresote Carbonate. 6s. per lb.

Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730.—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiaecol Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ½ lb., 9s. 6d. per doz.; ¼ lb., 6s. 6d. per doz.

Hydroquinone.—2s. 11d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—4d. per lb., 22s. per cwt.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 11s.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonal.—9s. 6d.—9s. 9d. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—2s. 9d.—3s. per lb.

Phenazone.—4s. 3d.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.

Potass. Citrate.—1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d. per oz. in 100 oz. tins (1000 oz. lots).

Resorcin.—3s. 9d.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—92s. 6d.—97s. 6d. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb. Crystals 5s. per cwt. extra.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—6s. 6d.—6s. 9d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.

Thymol, Puriss.—10s. 6d.—10s. 9d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.

Aubepine (ex Anethole).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. per lb.

Citronellol.—14s. 6d. per lb.

Citral.—8s. 6d. per lb.

Ethyl Cinnamate.—6s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—9s. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. 6d. per lb.—(ex Shui Oil) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safral.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanilin.—17s.—18s. per lb.

ESSENTIAL OILS

Almond.—10s. 3d. per lb. Anise.—3s. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.

Camphor.—70s. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure.—6s. per lb.

Eucalyptus, 75/80%.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%, 22s. 6d. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 18s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Sept. 3rd. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on July 21st. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

British Research Association for the Woollen & Worsted Industries, Barker, Fawcett, Hirst, and Tintometer, Ltd. Apparatus for colour estimation. 17,165. June 28. Churchill. Kilns. 17,283. June 29.

Electrolux, Ltd. Evaporators. 17,391. June 30. (Ger., 3.8.26.)
Fairlie. Furnaces. 17,500. July 1.

Gall. Optical pyrometers. 17,230. June 29.

Harter. Apparatus for carrying-out reactions between gases and vapours etc. 17,545. July 1.

I.-G. Farbenind. Production of aqueous solutions of organic compounds insoluble in water. 17,622. July 2. (Ger., 2.7.26.)

Johnson (I.-G. Farbenind.). Manufacture of highly-active adsorbents. 17,095. June 27. Purification of gases etc. 17,097. June 27.

Maschinenfabr. Beth. Bag filters. 17,009. June 27. (Ger., 11.12.26.)

Poleo Feuerlösch Apparate Ges. Fire-extinguishing compounds. 17,100. June 27. (Ger., 30.6.26.)

Robson. Heat-exchangers. 17,168. June 28.

Wood. Grinding apparatus. 17,154. June 28.

I.—Complete Specifications

8446 (1926). Silica Gel Corp. Adsorption apparatus. (255,819.)

10,000 (1926). Schucker. Apparatus for the hydrogenation of liquids. (273,045.)

15,834 (1926). Metallbank und Metallurgische Ges., and Gensecke. Working steam distillation plants. (273,092.)

16,766 (1926). Nairn. Mixing-machines. (273,101.)

17,041 (1926). Pease. Treatment of gases with liquids. (273,103.)

*19,226 (1926). Benson. Separation of mixtures of gases. (273,229.)

*14,095 (1927). Silica Gel Corp. Separation of a gas or vapour from a mixture. (273,261.)

*16,045 (1927). Brüner. Refrigerating method. (273,282.)

*16,318 (1927). Akt. Separator. Continuously treating liquids. (273,292.)

*16,395 (1927). Krupp Grusonwerk. Apparatus for expressing liquid constituents from materials. (273,294.)

*16,483 (1927). Morterud. Heating and evaporation apparatus. (273,298.)

II.—Applications

Algem. Norit Maatsch. Activated carbon. 17,657. July 2. (Holland, 3.7.26.)

Davidson and Patent Retorts, Ltd. Gasification of coal etc. 17,667. July 2.

Gessmann and Shadders. Production of low-boiling hydrocarbons. 17,441. June 30.

Goskar. Distillation of carbonaceous materials. 17,284. June 29.

I.-G. Farbenind. Manufacture of hydrocarbons. 17,092. June 27. (Ger., 26.6.26.) Manufacture of liquid products from coal etc. 17,093. June 27. (Ger., 29.6.26.)

Johnson (I.-G. Farbenind.). Treatment of exhaust gases. 17,291. June 29.

Roser. Distillation of fuel. 17,294. June 29.

Soc. Anon. Le Carbone. Cracking oils. 17,273. June 29. (Fr., 14.5.27.)

II.—Complete Specifications

5498 (1926). I.-G. Farbenind. Manufacture of hydrocarbons and derivatives from natural oils etc. (249,493.)

9862 (1926). I.-G. Farbenind. Manufacture of hydrocarbons and derivatives from coal, tars, mineral oils, etc. (251,264.)

12,835 (1926). Dempster & Sons, Ltd., and Toogood. Gas-retort plant. (273,063.)

14,142 (1926). Coppée et Cie. Coke ovens. (253,887.)

15,074 (1926). Chemical Research Synd. Cracking hydrocarbon oils. (253,562.)

15,295 (1926). Plassmann. Apparatus for distilling fuel, roasting ores, etc. (254,697.)

19,831 (1926). Allgem. Ges. f. Chem. Industrie. Purification of liquid hydrocarbons. (258,846.)

12,777 (1927). I.-G. Farbenind. Manufacture of hydrocarbons and derivatives from natural oils etc. (273,228.)

*8376 (1927). Humphreys & Glasgow, Ltd. Purification of gas. (273,250.)

*12,773 (1927). Cross. Motor fuel. (273,256.)

*17,092 (1927). I.-G. Farbenind. Manufacture of hydrocarbons from coal, tars, mineral oils, etc. (273,337.)

III.—Application

I.-G. Farbenind. 17,092—3. See II.

III.—Complete Specifications

9862 (1926). I.-G. Farbenind. See II.

19,831 (1926). Allgem. Ges. f. Chem. Ind. See II.

10,512 (1927). Cooper, Henshaw, and Holmes & Co., Ltd. Separation of water from mixtures of steam and vapours of benzene, toluene, etc. (273,224.)

*17,092 (1927). I.-G. Farbenind. See II.

IV.—Applications

Carmichael (I.-G. Farbenind.). Manufacture of carboxylic acids 17,573. July 1. Manufacture of dyestuffs. 17,574. July 1.

I.-G. Farbenind. Manufacture of benzanthrone condensation products etc. 17,293. June 29.

Imray (I. G. Farbenind.). Manufacture of derivatives of the triarylmethane series. 17,280. June 29.

Johnson (I. G. Farbenind.). Manufacture of vat dyestuffs. 17,091. June 27.

Newport Co. Preparing alkyl ethers of 3'-nitro-4'-hydroxy-orthobenzoylbenzoic acid. 17,201. June 28. (U.S., 28.6.26.)

IV.—Complete Specifications

1525 and 2774 (1926). I.-G. Farbenind. See VI.

7578 (1926). Soc. Chem. Ind. in Basle. Manufacture of dyestuff preparations. (249,549.)

9962 (1926). British Dyestuffs Corp., and Hailwood. Electrolytic desulphonation of anthraquinone sulphonic acids. (273,043.)

9922 (1927). I.-G. Farbenind. See VI.

*6306 (1927). I.-G. Farbenind. Manufacture of vat dyestuffs. (273,247.)

*16,511 (1927). I.-G. Farbenind. Manufacture of dyestuffs of the anthracene series. (273,299.)

*16,846 (1927). I.-G. Farbenind. See XX.

*17,201 (1927). Newport Co. Preparing alkyl ethers of 3'-nitro-4'-hydroxy-orthobenzoylbenzoic acid. (273,342.)

V.—Applications

Adams. Protecting textiles from heat and moisture. 17,259. June 29. British Celanese, Ltd. Manufacture of cellulose derivatives. 17,523. July 1. (U.S., 2.7.26.) Application of cellulose esters etc. 17,525. July 1. (U.S., 23.7.26.)

Clark (Agasote Millboard Co.). Sizing fibres. 17,063. July 2.

Comp. Gén. des Ind. Textiles, and Duhamel. Washing wool. 17,585. July 1. (Fr., 4.5.25.)

Kumagawa and Shimomura. Preparing cellulose material from plants etc. 17,407. June 30.

Non-Inflammable Film Co., Ltd., and Mallabar. Manufacture of cellulose ester etc. sheets. 17,045. June 27.

Steele, Steele, and Sutton. Dry-cleaning materials. 17,411. June 30.

V.—Complete Specifications

28,242 (1926). B. G. Textilwerke. Balloon material. (263,761.)

3991 (1927). Verein. Glanzstoff-fabr. Treating artificial silk produced in centrifuges. (265,996.)

*14,667 (1927). Hägglund. Treatment of black liquor obtained in manufacture of wood fibre by the soda process. (273,267.)

*15,812 (1927). Bernard. Preparation of "viscose." (273,280.)

*16,732 (1927). Scholler. Process of saccharification of cellulose etc. (273,317.)

VI.—Applications

British Celanese, Ltd. Treatment of fabrics containing threads of cellulose derivatives. 17,524. July 1. (U.S., 8.7.26.)
Turner. Dyeing-machines etc. 17,226. June 28.

VI.—Complete Specifications

1525 (1926). L.-G. Farbenind. Preparations of diazo-salts for dyeing and printing. (246,181.)
2035 (1926). Chem. Fabr. Milch, and Lindner. Dyeing and printing. (246,507.)
2774 (1926). L.-G. Farbenind. Manufacture of dry diazo-preparations. (246,870.)
7266 (1926). Dreyfus. Dyeing, printing, and stencilling products of cellulose esters or others. (272,982.)
7352 (1926). Brandwood. Apparatus for the continuous treatment of textile fibres in skein form. (258,544.)
8281 (1926). Calico Printers' Assoc., Whinfield, and Levin. Production of printed and dyed effects on artificial silk fabrics. (273,011.)
4712 (1927). Davis. Dyeing-machines. (273,207.)
9922 (1927). L.-G. Farbenind. Manufacture of diazo-salts and of preparations therefrom. (269,212.)
10,818 (1927). Chem. Fabr. Milch., and Lindner. Dyeing or printing with mordant dyestuffs. (269,917.)
*16,888 (1927). Melland. Improving products obtained from vegetable fibres. (273,327.)

VII.—Applications

Caro and Frank. Nitric acid. 17,220. June 28. (Ger., 29.6.26.)
Carpmael (L.-G. Farbenind.). Manufacture of hydrogen peroxide. 17,468. June 30.
Chloride Electrical Storage Co., Ltd., and Heap. Manufacture of lead oxide. 17,078. June 27.
Hebler. Retarding ignition of calcium phosphide etc. 17,560. July 1.
Holzverkohlungs-Ind. A.-G. Manufacture of acetic acid etc. 17,580. July 1. (Ger., 6.7.26.)
L.-G. Farbenind. Manufacture of wide porous active silica. 17,090. June 27.
Johnson (L.-G. Farbenind.). Production of ammonium phosphates. 17,292. June 29.
Leschik. Generation of oxygen from persalts. 17,088. June 27. (Ger., 5.7.26.)
Titan Co. Aktieselskabet. Dissolving titaniferous materials in acids. 17,627. July 2. (Norway, 3.8.26.) Treatment of titaniferous materials. 17,628. July 2. (Norway, 3.8.26.) Utilisation of titanium material containing iron. 17,629. July 2. (Norway, 3.8.26.) Reduction of solutions containing titanium iron etc. 17,630. July 2. (Norway, 26.10.26.)
Uhde. Synthesis of ammonia. 17,442. June 30. (Ger., 2.7.26.)

VII.—Complete Specifications

31,800 (1925). Cooper, Henshaw, and Holmes & Co., Ltd. Separating water from mixtures of ammonia and water vapour. (272,970.)
7978 (1926). Stalhane. Manufacturing cyanides. (272,996.)
15,952 (1926). Moore, Black, and Castner-Kellner Alkali Co., Ltd. Manufacture of ammonium chloride crystals. (273,093.)

VIII.—Applications

British Hartford-Fairmont Syndicate, Ltd., and Renn. Glass-annealing leers. 17,298. June 29.
British Hartford-Fairmont Syndicate, Ltd. Apparatus for annealing glassware. 17,300. June 29. (U.S., 1.7.26.)

VIII.—Complete Specifications

4555 (1926). Cloke. Treatment of clays etc. (272,976.)
10,015 (1926). Siemens & English Electric Lamp Co., Oakley, and Abington. Frosting of glass. (273,046.)

*5588 (1927). Hartford-Empire Co. Glass furnaces. (273,245.)

*13,149 (1927). Vitrefrax Co. Clay product, ceramic composition, etc. (273,258.)

*13,492 (1927). Migeot Frères et Arnould. Enamels for iron, copper, etc. (273,290.)

IX.—Applications

Johnson (Wicking'sche Portland-Cement- und Wasserkalkwerke). Manufacture of hydraulic cements etc. 17,450. June 30.
Levy. Road surfaces. 17,639. July 2. (Ger., 2.7.26.)

IX.—Complete Specifications

8231 (1926). Gunn. Composition for preserving wood etc. (273,007.)
9014 (1926). Universal Rubber Paviers, and Peachey. Bituminous emulsions. (273,031.)

X.—Applications

Breuning. Recovery of nickel. 17,046. June 27. (Ger., 10.7.26.)
Dossmann. Treatment of scrap iron. 17,317. June 29.
Georges Ville. Varnishing metals. 17,058. June 27. (Fr., 2.7.26.)
Johnson (L.-G. Farbenind.). Alloys. 17,449. June 30.
Saklatwalla. Ferrous alloys. 17,452. June 30.
Soc. Metallurgica G. Corradini, and Corradini. Manufacture of alloys. 17,579. July 1.

X.—Complete Specifications

32,338 (1925). Schmidt. Non-corrodible aluminium alloys. (272,972.)
15,295 (1926). Plassmann. See II.
31,293 (1926). Marks (Parker Rust Proof Co.) Rust-proofing iron. (273,168.)
*6984 (1927). Kabushiki Kaisha Nihon Seikoshu. Manufacture of steel. (273,248.)
*13,492 (1927). Migeot Frères et Arnould. See VII.

XI.—Applications

Levy. 17,592. See XIII.
Rennerfelt. Electric furnaces. 17,308. June 29.
Williams. 17,368. See XIV.

XI.—Complete Specifications

9962 (1926). British Dyestuffs Corp., and Hailwood. See IV.
14,891 (1926). Lloyd. Galvanic batteries. (273,080.)

XII.—Application

Bradshaw. Apparatus for extracting oil, fats, etc. 17,365. June 30.

XII.—Complete Specification

19,564 (1926). L.-G. Farbenind. Splitting fats and oils. (261,707.)

XIII.—Applications

British Research Association for the Woollen and Worsted Industries, Barker, Fawcett, Hirst, and Tintometer, Ltd. 17,165. See I.
British Thomson-Houston Co., Ltd. Resin compounds. 17,549. July 1. (U.S., 1.7.26.)
Carteret. Preparation of white pigment etc. 17,445. June 30. (Fr., 12.7.26.)
Levy. Manufacture of insulating-varnishes etc. 17,592. July 1. (Fr., 3.7.26.) Pigments. 17,571. July 1.

XIII.—Complete Specifications

1801 (1926). Barrett Co. Polymerising oils. (246,491.)
8317 (1926). Stephens, Anderson, and Cash. Production of titanium-containing pigments. (273,017.)
*16,105 (1927). Bailey and Austin. Production of white lead. (273,287.)
*16,327 (1927). British Thomson-Houston Co., Ltd. Resinous compositions. (273,290.)

XIV.—Application

Williams. Electrodeposition of rubber etc. 17,368. June 30.

XIV.—Complete Specification

8871 (1926). Villa. Manufacture of artificial indiarubber. (273,029.)

XV.—Complete Specification

*16,859 (1927). Du Pont de Nemours & Co. Leather substitute. (273,324.)

XVI.—Application

Fluck and Theil. Manufacture of fertilisers. 17,559. July 1.

XVI.—Complete Specifications

*14,825 (1927). Comp. de Prod. Chim. et Electrometallurg. Mals, Froges et Camargue. Herbicidal products. (273,268.)

*16,331 (1927). Rhenania-Kunheim Verein Chem. Fabr. Manufacture of fertilisers. (273,291.)

XVII.—Complete Specification

*16,732 (1927). Scholler. *See* V.

XVIII.—Application

Horst. Preparation of hop extract. 17,320. June 29.

XIX. Applications

Booth. Feeding-stuffs for cattle. 17,120. June 28.

Schreiber Products Corp. Food product. 17,322. June 29 (U.S. 24,227.)

XIX.—Complete Specification

6832 (1926). Internat. Oxygenum Maatsch. Treatment of meal, flour, etc. (249,139.)

XX. Applications

Carpmael (I.-G. Farbenind.). 17,573. *See* IV.

Johnson (I.-G. Farbenind.). Manufacture of unsaturated aliphatic hydrocarbons. 17,094. June 27. Manufacture of paraformaldehyde. 17,553. July 1. Production of lactic acid. 17,623. July 2.

Newport Co. 17,201. *See* IV.

Ruzicka and Shuttleworth. Manufacture of acetic anhydride etc. 17,577. July 1.

Soc. Anon. des Distilleries des Deux-Sèvres. Separation of fatty acids in dilute aqueous solutions. 17,543. July 1. (Belg., 1,726.)

XX. Complete Specifications

4589 (1926). Rath. Preparation of means for fighting bacterial diseases. (247,965.)

30,351 (1926). Chem. Fabr. vorm. Schering. Manufacture of symmetrical diarylguanidines. (262,155.)

13,124 (1927). I.-G. Farbenind. Manufacture of acid derivatives of the $\alpha\alpha'$ -dimethyl- γ -hydroxypiperidine- β -carboxylic acid esters. (271,467.)

*5555 (1927). Riedel A.-G. Manufacture of hydroaromatic di-carboxylic acids. (273,244.)

*14,211 (1927). Comp. de Bethune. Preparation of ethylsulphuric acid. (273,263.)

*15,681 (1927). Wecker. Manufacture of esters of fatty acids and of mixtures containing fatty acids. (273,276.)

*15,766 (1927). Chem. Fabr. vorm. Schering. Manufacture of mixed alkaloid salts. (273,279.)

*16,846 (1927). I.-G. Farbenind. Manufacture of cyclic ketones. (273,321.)

*17,201 (1927). Newport Co. *See* IV.

XXI.—Applications

Berthon. Films for colour photography. 17,198. June 28. (Fr., 20,726.)

Gratama and Meursing. Light-sensitive paper etc. 17,576. July 1. (Ger., 7,726.)

I.-G. Farbenind. Photographic films. 17,102. June 27. (Ger., 9,926.)

Martinez. Colour photography. 17,174. June 28.

Merejkovsky. Photographic developers. 17,254. June 29.

Soc. Civile pour l'Etude de la Photographie et de la Cinématographie en Couleurs. Photographic films etc. 17,328. June 29. (Fr., 6,527.)

XXI.—Complete Specification

7510 (1926). Thomson. Kinematograph colour films. (272,986.)

XXII.—Application

Eschbach. Igniting explosives. 17,446. June 30. (Ger., 1,926.)

XXIII.—Application

Gordon, and Gordon & Co., Ltd. (Hall). Filtration of alkaline waters. 17,215. June 28.

XXIII.—Complete Specification

7068 (1926). Hadfield. Treating residues obtained from house refuse. (272,981.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—
Australia: Hollowware, glass (1); water-tube boilers, steel (A.X. 4850); crockery (Commercial Bureau, Australia House, Strand, W.C. 2). *British India*: Galvanised wrought iron, mild steel (A. 4862). *Bulgaria*: Pig iron (A. 4871); iron (A.X. 4877). *Canada*: Steel sheets, brass and copper sheets, tinplate (4); paper (5). *Egypt*: Leather (16). *France*: Printing material (7). *Greece*: Soya bean oil (9). *Holland*: Leather (11). *South Africa*: Glass water containers (B.X. 3611); printing paper (B.X. 3612); steel plates (A.X. 4874). *Turkey*: Paper (B.X. 3609). *Uruguay*: Sanitary ware (19). *Yugoslavia*: Hides (13).

Merchandise Marks Act Enquiries

The Board of Trade have referred to the Standing Committee appointed by them under the Act applications for Orders in Council to be made requiring indications of origin to be given in the case of imported pottery. A public inquiry will be held later by the Committee, of which the secretary is Mr. E. W. Reardon, New Public Offices, Great George Street, London, S.W.1.

Petroleum Spirit (Conveyance) Regulations, 1927

In pursuance of Section 9 and the Third Schedule of the Petroleum Act, 1926, the following regulations have been made for the conveyance of petroleum spirit by road:—(1) The requirement in No. 1 of the Petroleum Spirit (Conveyance) Regulations, 1926, (a) that any vehicle on which petroleum is conveyed shall be constructed with sides and back of adequate height, shall not apply to horse-drawn vehicles if the load is securely fastened to the vehicle and all vessels of two gallons' capacity and under are packed in wooden cases. (2) Notwithstanding the requirement in No. 6 of the said Regulations that, if the capacity of the tank exceeds 1500 gals., the weight of the engine and load shall be distributed over the three axles of a six-wheeled combination vehicle (tractor and trailer), it shall be lawful to use vehicles of other types, if approved by order of the Secretary of State as suitable for the conveyance of quantities exceeding 1500 gals. (3) These Regulations may be referred to as the Petroleum Spirit (Conveyance) Regulations, 1927.

New Dyestuffs by Scottish Dyes, Ltd.

Scottish Dyes, Ltd., have issued a pattern card of four new Caledon colours—Olive 3G, Olive 2B, Grey 3G, and Grey RRH. These colours, on account of their good shades, excellent level dyeing properties, and fastness to light, fill several gaps in this part of the fast vat range. They are specially suited for cotton piece dyeing and for artificial silk, but are not recommended for goods which have to withstand a full bleach. The method of dyeing is from a hot strong caustic vat. Their level dyeing properties make them particularly suitable for shading purposes.

New B.D.C. Dyestuffs

The latest pattern card of the British Dyestuffs Corporation, Ltd., illustrates fashionable shades for autumn, 1927. The first issues of seasonal forecasts were so very successful, and the demand for copies so great, that their regular issue will be a permanent feature of the Corporation's business. The shades shown on the present pattern card represent The Drapers' Organisation forecast for autumn, 1927.

Chlorazol colours on cotton yarn is the subject of a recent pattern book issued by the British Dyestuffs Corporation, Ltd., in which illustrations of Chlorazol colours on cotton yarn are given. Information is given about the use and after-treatment of these colours, and lists are given of Chlorazol colours suitable for Celanese resist work. Tables are also given showing the fastness of the various colours to light, light washing, acids, alkali and discharge.

A new pattern card draws attention to the new B.D.C. colour for cellulose acetate silk—Duranol Blue R. Paste. This colour gives full reddish blue shades of good fastness to light and excellent fastness to washing. It possesses very good fastness to rubbing and hot pressing, and will be found suitable as a basis for royal and navy shades on all forms of cellulose acetate materials, and can be used in combination with other Duranol and Ionamine colours.

B.D.C. dyestuffs for vegetable tanned leathers are illustrated in a recent pattern card. Information is included with regard to the preparation of skins for dyeing; principal methods of leather dyeing under the headings (1) tray dyeing, (2) paddle dyeing, and (3) drum dyeing. This is followed by the dyeing process, particulars which deal with the dissolving of colours and the production of shades other than those illustrated on the pattern card. In addition to the dyestuffs illustrated, the British Dyestuffs Corporation, Ltd., have a full range of dyestuffs for the colouring of every other class of leather.

Another recent pattern card of the British Dyestuffs Corporation illustrates Thionine Blue G.O. This basic dyestuff is suitable for dyeing cotton piece on a discharged tannin mordant, and gives very good white effects. Thionine Blue G.O. withstands the action of reducing agents, and is specially adapted for the colouring of rongalite (formosul) or tin discharges on dischargeable direct dyed grounds. It is also used extensively for the production of blue resists under aniline black. In the discharge and resist styles it is distinctly superior to the methylene blues, since the shade of Thionine Blue G.O. is much less affected in the process.

A further addition to the B.D.C. range of acid colours—Naphthalene Fast Black 4B—has also been issued. This colour is of interest to wool dyers in general, particularly for the dyeing of wool hosiery yarns and material for knitting purposes generally, since it gives a full bloomy tone with good fastness to washing. It is also used in the dyeing of hat bodies, possessing good penetrating qualities and fastness to water, being, in the latter respect, superior to the average acid black. In addition, it is not affected by dyeing in copper vessels. It will prove of interest to the garment dyer, as it dyes wool and silk fairly well from a neutral dyebath.

News from Advertisements

There is a vacancy at the Dublin Corporation Main Drainage Outfall Works for an analytical chemist (p. x).

A technical chemist is required for a situation in the East (p. x).

An assistant chemist is required for a petroleum refinery in India (p. x).

A food factory in South London is advertising for a laboratory assistant (p. x).

The Royal Technical College, Glasgow, again announces particulars of the forthcoming session (p. x).

A lady analyst desires a position in London (p. x).

A second-hand Redwood viscometer and other instruments are wanted (p. x).

A technical chemist with varied industrial experience wants a progressive post (p. x).

An organic chemist is looking for a post on the commercial or research side of the chemical industry (p. x).

There are 98 firms represented under the various headings in our Buyers' Guide.

PUBLICATIONS RECEIVED

THE MAKING OF A CHEMICAL. By E. I. Lewis, M.A., B.Sc., and G. King, M.Sc., F.I.C. Pp. 288. London: Ernest Benn, Ltd., 1927. Price 12s. 6d.

CHEMICAL REFLECTIONS. By Stephen Miall. Pp. 39. London: Ernest Benn, Ltd., 1927. Price 1s.

GMEIN'S HANDBUCH DER ANORGANISCHEN CHEMIE. 8th edition, completely revised. System No. 2. Wasserstoff. Edited by the Deutsche Chemische Gesellschaft. Revised by R. J. Meyer in collaboration with F. Peters. Pp. xvi + 273. Berlin: Verlag Chemie G.m.b.H., 1927.

AFDRUKKEN VAN INDRUKKEN UIT HET HANDBOK VAN BENJAMIN FRANKLIN. By Prof. E. Cohen. II. Pp. 14. III. Pp. 17. Reprinted from the Chemisch Weekblad. Vol. XXIV., 1927.

A LABORATORY STUDY OF THE FORMATION AND STRUCTURE OF COKE. By D. J. W. Kreulen. Glückauf-Bulletin No. 2. Pp. 19. Amsterdam, Holland: Librairie Scientifique D. B. Centen, 1927.

CHEMICAL REVIEWS. Vol. IV. No. 1. May, 1927. Contributions by V. Cofman, E. Klarman, and G. M. Dyson. Pp. 165. Baltimore: The Williams & Wilkins Company, 1927. Price \$5.00.

TITANIUM. WITH SPECIAL REFERENCE TO THE ANALYSIS OF TITANIFEROUS SUBSTANCES. By William M. Thornton, jun. American Chemical Society Monograph Series. Pp. 262. New York: The Chemical Catalog Co., Inc., 1927. Price \$5.00.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW
SERIES**

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No. 29

EDITORIAL

Fuel Research

DESPITE the many physicians who have deliberated over the sickness of the coal industry, despite the surgical wisdom which has advised the removal of diseased areas, the industry can hardly be said to be in a satisfactory condition. It is, indeed, a difficult industry from the economic point of view, but it is of too vital national importance for anyone to view its troubles with indifference. Unfortunately, it seems that foreign users of British coal have been learning to do without it on account of the coal stoppage, and our neighbour across the Channel has found it necessary, faced with large accumulated stocks, to restrict importations. It is not easy to suggest remedies for economic troubles, but the Report of the Fuel Research Board, which has just been issued, shows conclusively how the weaknesses in the scientific foundations of the industry are being laid bare, how the applications of its products are being investigated with a thoroughness and a competence that is worthy of our best scientific traditions. Progress in the work of the Board was naturally delayed by the coal stoppage, but much has been done nevertheless. The organised work of the physical and chemical survey of the national coal resources is increasing in scope and value. Investigations are in progress to elucidate important problems such as those pertaining to the purification of coal, sampling and analysis, coal ash, the primary decomposition and maturing of coal, the reactivity of coke, and so on. The low-temperature carbonisation process of the Fuel Research Station has reached such a stage that Sir D. Milne Watson (as we record in the summary of the Report which we publish on another page), on the advice of his staff, selected it amongst all the processes developed in this country and on the Continent, as the one most promising for development in conjunction with a gas works. The decision to form the Fuel Production Company is recorded elsewhere in these columns, and it is gratifying to note that it will now become possible to determine the economic aspects of low-temperature carbonisation through this arrangement, which the Gas Light & Coke Company is, in effect, carrying out for the benefit of the whole industry. We learn that the Bergius process is applicable to British coals, though its economic possibilities are still unknown. They are being investigated, however, as are the possi-

bilities of the synthesis of alcohols and hydrocarbons from carbon monoxide and hydrogen. Many more matters of the greatest importance are discussed in the Report, which should be read, not only by those interested in the carbonisation industries, but by all who take thought for the future of our country.

Potash from Palestine

The importance of adequate manuring of the soil is fully realised in the modern agricultural world, but the education of the farmer has been no simple task, and many harvests have been garnered since Van Helmont watered and weighed so assiduously during his pioneer experiments in the realm of plant physiology. Lawes and Gilbert explained the fundamental requirements of the plant for nitrogenous, phosphatic and potassic fertilisers, and the artificial fertiliser industry may be said to date from the time when these notable British investigators carried out their work.

Britain has always been able to provide her own supplies of nitrogenous fertilisers—and to have an exportable surplus—and in these latter days of more intensive manuring the development of a synthetic nitrogen products industry—the history of which has been so well told by Colonel G. P. Pollitt in his recent Messel Memorial Lecture—has assured us of unlimited supplies. Further, although the British superphosphate industry has passed through troublesome times, there is no need to fear a famine in regard to home phosphate fertilisers.

We have unfortunately never had an assured supply of British or Empire potash, and it is well known that Germany held a monopoly in this field in pre-war days—although small amounts of potash salts were produced in Poland, Italy and Spain. Any considerable manufacture of potash from seaweed ceased long ago, except perhaps in Japan.

The return of Alsace-Lorraine to France by the terms of the Treaty of Versailles brought under French control potash salt beds containing an amount of potash estimated at about one fifth that of the German deposits, and it is therefore natural that production in France has been substantially increased in recent years. When the Alsace deposits were under German control a maximum amount of 58,000 tons of potash per annum was

raised. This has increased to 330,000 tons in 1926 through the stages of 195,000 tons in 1920 and 270,000 tons in 1923. As is well known, a Franco-German agreement now exists, the terms of which we need not consider at the moment.

Again, Poland is increasing her output of potash and actually mined 200,000 tons in 1926, whilst the appearance of Russia as a potash exporter is not unlikely, for she possesses extensive deposits, and has made small amounts of the material from sunflower stalks. Outside Germany and France, however, the most interesting potash producer is the United States, where, in spite of the fact that such war-time sources as cement kiln dust, blast furnace dust, seaweed and molasses have ceased supply to all intents and purposes, a large and increasing amount of potash is being recovered from natural brines. It is sufficient to recall the story of the Trona Corporation's enterprise at Searles Lake, California, as described in our columns some weeks ago by Mr. John E. Teeple. His graphic description of the success which has attended the efforts of chemists and engineers under his inspiring leadership may be condensed into the simple facts that hundreds of tons of potassium chloride are being made every week, together with borax, sodium sulphate and carbonate in large amounts.

Neither Britain nor any part of the Empire has found or developed any substantial source of potash salts with which to supply agricultural demands until quite recently, when the immense resources of the Dead Sea in Palestine claimed serious attention. The Colonial Office Committee which was appointed to investigate the possible commercial utilisation of Dead Sea brine for the manufacture of potash salts reported no insuperable difficulty from the technical point of view, and suggested a production of 100,000 tons of potash salts per annum. Major Brock, too, has estimated the potential resources of Dead Sea potash as two thousand million metric tons, that is to say, almost an illimitable amount insofar as British and Empire agriculture is concerned.

The pumping of the brine, its evaporation in natural clay-lined lagoons by solar heat and the working up of the crude residue into saleable salts—potash fertilisers, bromine salts, common salt, etc.—are matters which should be of little concern to experienced chemical engineers, but the problem of transport will demand careful attention. The nearest railway is at Jerusalem, some thirty miles away from the sunken Dead Sea, three thousand feet below the level of the railway. A historic road there is, it is true, but romance in itself will not carry potash, and considerable expense will need be involved before the crude potash salts can be made available for commercial handling. None the less, it has been conservatively reckoned that such salts could be put on board ship at Jaffa at an overall cost of under £4 per ton.

Two years ago the Colonial Office and the Palestine Government, with a sure knowledge of the possibilities, invited tenders for concessions to work the Dead Sea brines, and recently it has been announced that the Palestine Government has granted a concession to Messrs. Nowomesky and Tulloch for the manufacture of potash and other salts from Dead Sea brine. It is understood that one of the terms of the concession concerns the

building of a railway track to link up with existing services, but as yet we have seen no details.

The Pipe of Peace

When the curiosity of the chemist impels him to investigate the non-volatile acids of the strawberry or peach, the flavouring, odorous or colouring principles of the vanilla bean, the musk sac or the leaves of *indigofera tinctoria*, respectively, there may be occasionally an ulterior "mercenary motive," the detection of which we are content to leave to the keenly critical eye of an eminent professor. Frequently, however, investigations are inspired by a desire to unfold knowledge which shall be of value to mankind at large in his struggle against a self-created environment. Into this class probably fall the studies which have been carried through by Roe E. Remington in the laboratories of the Department of Biological Chemistry of the North Dakota Agricultural College, U.S.A., upon the arsenic content of tobacco. It has been found that samples of American smoking and plug tobacco contain 6 to 30 parts of arsenious oxide per million. Approximately half the arsenic in pipe tobacco is evolved in the smoke, whilst half of that in plug tobacco is soluble in water. The amounts of arsenic present in tobacco are therefore considerably higher than those permitted in foodstuffs under the legal codes of civilised countries, and higher than those found by British investigators in the innocent oyster. It is not known yet what portion of the arsenic of tobacco passes into the system of the smoker, but further investigations will be awaited with interest, especially when it is remembered that the analytical programme which followed the Manchester beer scare many years ago revealed a maximum amount of arsenic in any sample of four parts per million.

The painstaking work of Billeter and Marfurt appears to have established the fact that the human adult body contains about one-ten-millionth of its weight of arsenic. This is derived from foodstuffs which become contaminated by reason of chemical treatment during manufacture or which, as in the case of plants or certain sea products, contain arsenic originally. Often, however, the amount of arsenic found in human blood cannot be explained upon the basis of the arsenic content of foodstuffs, and it is a point of no little interest that a previously unsuspected source of arsenic in human environment has been discovered. If there should appear any sign of a tobacco scare by reason of the appearance of garbled versions of Remington's work in the daily press, we are confident that chemists will set a noble example by refusing to put out their pipes. Indeed, when Prof. Armstrong published the results of his investigations upon the carbon monoxide content of tobacco smoke in the *British Medical Journal* a few years ago, and proved to all sensible chemists that tobacco smoke contained as much of this poison gas as did the gas piped by the South Metropolitan Gas Co., we noticed no diminution in the intensity of the smoke haze which dignified subsequent scientific meetings. Worshippers at the shrine of My Lady Nicotine will be interested in, but in no wise appalled by, the discovery that tobacco contains more arsenic than do crayfish. And anyway, most of us don't chew.

THE CONTROL OF COMPONENTS FOR MAGNESIUM OXYCHLORIDE CEMENTS

By A. W. COMBER, F.I.C., Assoc.Inst. M.M.

During the past twenty years there has been a remarkable development in the use of magnesite compositions for the covering of floors and walls, particularly in the United States. As generally known, these compositions consist of a mixture of calcined magnesite with inert material, such as sawdust or wood flour for floors and sand for stucco work on walls. Preferably, there should also be a definite proportion of finely powdered quartz or silica as a filler. When moistened with a strong solution of magnesium chloride, such a mixture sets fairly rapidly, to form a hard mass of high mechanical strength.

The industry is young, and until a few years before the war, was mainly confined to Austria and Germany. One of the earliest floors of this type to attract public attention was laid in the Austrian pavilion at the Chicago World's Fair in 1893. An industry has since arisen in the United States which is now among the most important in the country. It is interesting to note that at the present time something like 75% of the magnesite used there in the form of oxychloride cements is accounted for by the requirements for stucco and plaster, the balance being for floors.

The publicity literature of some of the American firms would be a revelation to users of magnesite compositions in Britain, where, although the flooring industry has in a measure been established, the application of similar mixtures for covering walls has not yet made any progress. This has been chiefly due to lack of enterprise, but in part may be ascribed to theoretical and ill-founded objections based on the fancied unsuitability of our climate.

Perhaps this statement should be qualified by reference to a novel demonstration at the Building Exhibition in London last year. There was shown a section of one of the standard steel houses, with the plates masked externally with stucco and internally with coloured plaster, both being preparations of magnesite. In view of the aesthetic and practical advantages of these materials in such a connexion, the success of this effort would open up a field of exceptional interest and promise.

The growth of the industry in the United States is undoubtedly due to the early appreciation of the need for standardisation of materials and methods in order to secure uniformity of results. An instance of American enterprise is shown in the activities of the Dow Chemical Company, of Midland, Michigan. This firm makes magnesium chloride, and to this extent is directly interested in the technical and commercial development of the industry upon sound lines. It has therefore established well-equipped chemical and physical laboratories and even a calcining plant, where a staff of experts is engaged on research into the problems and possibilities which the extending use of magnesite preparations for structural work continually offers. The Dow series of bulletins embodying the results of this work is of inestimable value.

It is remarkable that in our own country, neither through the technical press nor the publications of the

scientific societies, has there appeared much information of importance concerning original work in a field which offers such promise. Rule of thumb methods still prevail, and the effect is not to the advantage of the industry.

It is true that many excellent and apparently permanent floors have been laid by firms of deserved reputation, but it is none the less evident that there is still a regrettable lack of certainty in obtaining consistently good results. Faults develop, either in the early stages or after considerable lapse of time. The cause is often obscure, and in many cases may be untraceable by the contractor. The trouble is not always due to bad workmanship, although there is room for improvement, not only in the composition and grading of mixes, but also in methods of manipulation. Often the blame lies with one or more of the components used, and the most important of these is the magnesite.

The term magnesite is more properly applied to the mineral, natural carbonate of magnesium, and its association with the calcined product of commerce is academically incorrect. The name, however, has come into common use as a trade description, and it is used here in the sense in which it is popularly understood.

Raw or mineral magnesite is calcined in specially designed kilns to yield, with loss of carbonic acid gas, the oxide magnesite. Calcination at a relatively low temperature produces "caustic" or cementitious magnesite. At a considerably higher temperature the product is "dead-burnt" or refractory magnesite, with which we are not at present concerned.

Existing methods of calcination are open to improvement, partly along the lines of kiln design, but chiefly in the direction of kiln control. Given a certain standard of raw magnesite, the production of satisfactory calcined material is entirely a matter of precise kiln operation, and although much of the product reaching the market is quite satisfactory for its purpose, it is a matter for some concern that calciners do not yet seem able to supply a uniformly standardised caustic magnesite. It has been established that chemical analysis of the commercial material is only of service within very narrow limits, and that conclusive information on the suitability of a calcined magnesite for cement or plaster can only be obtained by physical and mechanical tests of its behaviour under working conditions.

The value of a calcined magnesite is dependent upon the proportion of *reactive* magnesia contained in it. Exactly what chemical or physical condition causes this potential activity has not yet been demonstrated, but it may be definitely stated that a magnesite showing a content of, say, 90% magnesia, which under the present loose standard is considered to be first grade material, may actually contain a lower proportion of reactive constituent than another sample giving on analysis 80%, or even less.

Almost equally important is the form in which the lime is present in the calcined product. Calcination should be so conducted that the temperature does not reach the point of dissociation of the calcium carbonate, which is always present to some extent in the mineral. Any appreciable proportion of free lime is demonstrably harmful, but ordinary analysis does not indicate

whether the lime is present in this form, or combined as carbonate.

Because of the failure to appreciate the essential importance of such factors as these, a specification based upon chemical analysis is still the only one recognised in this country. It is possible, as things are, for a sample of calcined magnesite to be rated as inferior, or even condemned, on chemical test, but to be capable of giving much better results in practice than another which analysis alone would indicate to be of the highest quality.

The development of the magnesite flooring industry and its natural extension to the use of similar materials for covering walls must depend upon the maintenance of a consistently high standard of results, but every reputable flooring contractor realises that this is not so certain of attainment as he would wish. Many of the difficulties now experienced can undoubtedly be attributed to the uncertain quality of commercial calcined magnesite, and it is very desirable that this hazard of the market should be removed.

A standard mix should be formulated, not necessarily for use under ordinary working conditions, which are not always the same, but it should approximate to one which would meet average needs. Then this mix of the magnesite under test, together with standardised components, should be examined for qualities specified to meet an agreed schedule. These may include setting time, expansion or contraction during a stated period, resistance to abrasion and for special conditions, tensile strength and behaviour under compression. Tests for water resistance and a knowledge of behaviour under intermittent and prolonged exposure to a moist atmosphere would also be desirable.

Examples of standard mixes used in the United States for these tests are as follows:—

Flooring mix	Parts by weight
Calcined magnesite	5
Powdered quartz	5
Wood fibre	1
Talc	1
Red oxide of iron	1
Stucco mix:	
Calcined magnesite	1
Powdered quartz	2
Sand (between 20 and 30 mesh)	5

It will be evident that a knowledge of the chemical composition of the magnesite will only be of subsidiary importance. It is not, however, to be expected that every floor layer will be in a position to make these tests for himself, but it is in his interest that he should appreciate exactly what he needs for consistently good work. Nor, indeed, would it be practicable for the calciner to make such an intensive examination on every batch sent out, but it is not unreasonable to ask that he should definitely inform himself of the properties of the product offered, and so be in a position to guarantee that this will conform in grade with a fair specification of quality. Exact knowledge of the behaviour when tested on the lines indicated of a magnesite calcined under known conditions should go a long way in the effort to reach a standardisation of kiln operation with a consequent uniformity in quality of output.

Magnesite for oxychloride cements should be ground to a definite degree of fineness, and this degree should

be precisely stated by the seller. A fair standard is for not more than 5% to be retained on a 120-mesh screen, and it can, with advantage, be finer than this. It is not realised to what extent uneven or insufficient grinding is itself a cause of failure. Whether a buyer is able to insist upon a more stringent specification or not, he can at least determine if his magnesite is properly ground. He can get a suitable screen at small cost and test for himself the fineness of any product which may be offered to him.

There is not the same amount of uncertainty with the other components of a normal mix. Where wood flour or sawdust is used, this should be standardised for texture or fineness, and even for source of supply. Woods vary in their power of absorption and resistance to decay, and their possible effect, not only in the early stages, but on the ultimate life of a floor, is well worth studying, but this will take time. If the wood, in whatever form it is used, be pretreated with magnesium chloride solution, the strength of this, the extent of saturation, and both the time and the conditions of storage should be made constant factors in the operation.

Finely ground quartz or silica is often used as a filler on both theoretical and practical grounds, and it is always a desirable constituent. The principle of "voids" which underlies the successful compounding of Portland cement mortar and concrete applies with equal force to magnesite mixtures, although the actual setting processes of the two types are different. The particle size of the silica should, therefore, bear a definite relation to that of the magnesite, and it follows also that the proportionate quantities of the two components should be on a determined basis. Broadly considered, a principal object of the fine silica filling is that it should act as a retarder to moderate quick setting and consequent excessive expansion, which would result from an undiluted mix of caustic magnesite.

The use of natural colouring matters is largely a question of individual choice, but it should be remembered that, apart from acting as inert diluting agents in the mix, these may, in certain circumstances, enter into combination and so affect, probably adversely, the later behaviour of a floor. It follows, therefore, that the more concentrated these agents are in colour value the better they will be for the purpose, as the proportion of pigment in the mix should be kept to the minimum amount which will give the desired result. For instance, red oxide of iron is a better medium than ochre.

Magnesium chloride is mainly imported from Germany, and comes to the market in what is known as the "6-molecule" or hydrated form. It should contain about 46% of actual magnesium chloride, the balance being water. Commercial magnesium chlorides have been found to contain undue amounts of sulphate, and also chlorides of calcium and the alkalis. These not only detract from the working efficiency of the solution by giving a misleading figure for specific gravity, but may be the direct cause of defects, such as efflorescence on a finished surface, and in extreme cases might modify setting action to such an extent that risk of early disintegration would follow. Magnesium chloride can readily be obtained of a satisfactory degree of purity, but buyers should press for a guarantee of actual content, and also for

stated maxima of usual impurities, such as calcium chloride, magnesium sulphate, and salt.

Magnesite composition floors are already a matter of regular specification in modern building practice, and several of the more responsible contractors, with some years of experience behind them, have attained a fair measure of consistency in their results. There is still, however, an avoidable element of uncertainty. The future of the industry is practically whatever those who are interested choose to make of it, for it is certain that, with a better understanding of the technical problems involved in the initial calcination and later preparation and selection of components, of the need for precision when compounding mixes, and of the mechanical and physical factors of the setting process, the present decade will witness a very extensive development in the use of magnesite compositions, not only for floors, but also in the form of stucco and plaster, for walls.

THE REPORT OF THE FUEL RESEARCH BOARD, 1926*

In its review of the past year's work, the Fuel Research Board remarks on the more general public interest in fuel questions generally, and refers to the addition of the Fuel Section of the Society of Chemical Industry and the Institute of Fuel to the specialised organisations which now deal with the study of fuel. It is stated that the technical difficulties of the low-temperature carbonisation of coal have been largely overcome, but the difficulty is an economic one. Much consideration was given to the need for a lengthy test on a commercial scale under commercial conditions. Processes which produce the largest proportion of lump coke suitable for domestic use also produce large quantities of rich gas, and if such a process were adopted throughout the country very large quantities of gas would be produced, the full value of which would only be realised with the co-operation of the gas undertakings. It was accordingly decided by the Government that Sir D. Milne Watson, the Governor of the Gas Light & Coke Co. and the President of the National Gas Council, should be asked for his assistance, and that the matter, being a question of commercial development, should be handled by the Mines Department, with the Department of Scientific and Industrial Research as technical advisers. Sir D. Milne Watson reported that, after examination of all the processes being developed in this country and on the Continent, he considered the one developed at the Fuel Research Station was the most promising for development in conjunction with a gas works, and made certain offers of co-operation. It was finally arranged to form a subsidiary company, the "Fuel Production Co., Ltd.," the capital of which has been guaranteed under the Trades Facilities Acts. The Gas Company will act as managers for the Fuel Co., and will bear all running and management costs. At the end of 1930 the Gas Co. will have an option to purchase the plant, or they may clear the site and dispose of the plant, etc., on behalf of the Fuel Co. It is hoped that the plant will be at work during next winter. Full records will

be kept, and full details will eventually be published and be freely at the disposal of any company wishing to use the process.

Dealing with the work on the production of alcohol from cellulosic materials, it is stated that though a process for the hydrolysis of pentosans and the fermentation of pentoses has been worked out, the process could only be successful, if at all, in other parts of the Empire, and it has been decided to discontinue the work. A full report is being prepared.

THE REPORT OF THE DIRECTOR OF FUEL RESEARCH

Dr. Lander points out that, although the coal stoppage interfered with large-scale work at the Fuel Research Station, definite progress was made with the experiments on low-temperature carbonisation. Work was carried out with the new horizontal retorts, and considerable progress was made with the laboratory researches.

The work of the physical and chemical survey was delayed by the coal stoppage, but progress was made in various areas. The microscopical examination of coal seams has been continued in the Lomax Palaeobotanical Laboratories, and Mr. C. A. Seyler is further developing his microscopical method for the study of the structure of coal. A revised report on the sampling and analysis of coal has been issued. A new method to determine phosphorus in coal has been recommended, and work is to begin on the occurrence of arsenic, silica, titanium, vanadium, etc. in coal ash and their effect on the determination of phosphorus. Methods of procedure have been recommended for sampling coal, but the question of sampling large consignments is still under consideration.

Some trials with vertical retorts on the effect of greatly increased throughput were made before coal became short, and some interesting results were obtained. The gas was of higher calorific value, and the yield was higher per retort per day, but less per ton of coal, whilst the yield of tar and ammonia per ton was greater. In view of the reduction of the thermal yield of gas per ton of coal, the process would hardly be economical. The new horizontal retorts were put into commission, but, owing to the coal shortage, no regular tests were carried out; investigations are now in progress.

About 200 methods of low-temperature carbonisation have been proved to the laboratory stage: a few are being developed on sound lines, most having reached the stage of intermediate-scale plant; 5 or 6 are in the stage of trial with a full-scale unit of, say, 5 to 100 tons daily capacity; 2 or 3 are being worked on a commercial scale, but none can produce audited figures to show that actual profits have been made under normal working conditions. It is again emphasised that no one system is likely to be exclusively adopted; the type of plant adopted will depend on the object aimed at, the raw material available, and local circumstances. Emphasis is laid on the magnitude of the task of developing fuel treatment to the point at which the 30 or 40 million tons of raw coal burned annually in domestic grates is replaced by low-temperature coal. Such a replacement would involve the starting of a new industry comparable in size with the existing carbonisation industries. The cost

* Department of Scientific and Industrial Research, pp. vi + 62. H.M. Stationery Office. Price 1s. 3d.

of plant would be at least £60,000,000, and the gas made would considerably exceed the total now made by the gas undertakings, so that the co-operation of the gas undertakings will be essential for the development of low-temperature carbonisation on a national scale.

The "E" low-temperature retorts have now worked a year with considerable success, and the plant is now considered to be approaching the end of that stage of development comprising trial with a full-scale unit. The construction of the plant, which is the one chosen for trial by the Fuel Production Company, mentioned previously, is described in the report, which states that the "E" retorts, when cooled down, were found to be in excellent condition, though the lower halves had bulged somewhat. The working temperature was 625° C., and the question of providing a cast iron which will withstand a higher temperature has been investigated with the aid of Prof. H. C. H. Carpenter and the co-operation of the British Cast Iron Research Association. Two new retorts have accordingly been designed, and will replace two narrow "D" retorts.

Further exploration has been made of the possibilities of carbonising finely divided coal (*e.g.*, the McEwen & Runge process). Experiments have been made on the effect of the temperature of carbonisation on the yields of products: the work is still proceeding. Examination of the low-temperature tar from the vertical retorts has been continued, and from a comparison of the ordinary distillation method of separation with the solvent method of separation, it is considered doubtful whether any advantage can be claimed for the latter; as the two methods yielded, as regards the oils, products which did not differ greatly. Investigations on the constituents of distillates from low-temperature tar are in progress at the Chemical Research Laboratory, Teddington, and a preliminary examination of the higher phenols has been made at the Fuel Research Station.

From inquiries as to the behaviour of low-temperature coke made in the "E" retorts, it appears that the coke gave general satisfaction to purchasers. Other work relates to briquetting fine coal, the properties desirable in pitch for use as a binder, the use of "pulp" binders, and various problems of the purification of coal.

The possibilities of producing oil from coal by the Bergius process have been actively investigated. The results prove that the British coals examined are suitable for the treatment, the yields from typical bituminous coals being about: Crude oil and spirit, 50–60%; gas, 20%; partially converted organic matter, 15%; the remainder being water and inorganic matter. On distillation, 20–25% of the oil remains as pitch. These figures compare with, say, 10%, or less, oil-producing tar obtainable from similar coals by low-temperature carbonisation.

The Fuel Research Station Bergius plant, now working, is capable of treating 1 ton of coal a day. A large amount of hydrogen—about 6% by weight of the coal—is required for the process, and the possibility of obtaining the bulk, if not all, of the necessary hydrogen from the gaseous products of the process is being investigated. The Bergius process is considered to be approaching the end of the stage of trial with intermediate-scale plant as far as British coals are concerned, though it

may have entered the stage of large-scale trial in its application to other raw materials. Dr. W. R. Ormandy, with assistance from the Department, has been investigating the nature of the light spirit obtained by the hydrogenation of coal, and has developed new methods for the determination of the hydrocarbons present. Bergin spirit has been found to have considerable "anti-pinking" properties. Further work is being carried out on the catalytic synthesis of alcohols and hydrocarbons from mixtures of carbon monoxide and hydrogen (*e.g.*, water-gas), and, in this connexion, the methods of purifying water-gas are being investigated.

The study of the reactivity of coke continues actively, and plans are being made to co-ordinate the work of the local Coke Research Committees which have been formed in several districts. Prof. W. A. Bone, F.R.S., is investigating the reactions in the blast furnace, and has obtained results which have added to our fundamental knowledge of the subject, and may prove of considerable practical importance.

Other work recorded relates to internal combustion engines, to domestic heating, power alcohol (previously mentioned), laboratory investigations in progress, and to miscellaneous work such as investigations on coal ash, the primary decomposition of coal, and the maturing of coal (which is being investigated under the direction of Professor Bone).

ANNUAL REPORT ON ALKALI &c. WORKS 1926*

The Chief Inspector, Mr. T. Lewis Bailey, reports that 1152 works were registered in 1926, comprising 1867 separate processes which had to be inspected, there being a reduction of 25 works and 61 processes compared with the previous year. Visits of inspection to registered works numbered 3661, and 2068 determinations of the noxious constituents of chimney and other gases were made. Various complaints concerning non-registrable processes were also investigated. The effect of the new Smoke Abatement Act is considered, and it is pointed out that the Act authorises an inspector to enter and inspect any work likely to cause the evolution of a noxious or offensive gas, even if the Alkali etc. Works Regulation Act, 1906, does not apply to such work. Fourteen complaints—considerably fewer than during 1925—were received, four relating to non-registrable processes, and two to dust nuisances. In one nuisance alleged against a registered works, repair of a subsidiary flue was being carried out while the main process was in operation, the result being the emission of an excessive amount of sulphur dioxide.

There were 46 alkali and copper (wet process) works, a decrease of five. The Leblanc process for the manufacture of salt cake and hydrochloric acid continues to be operated steadily. The plants are carefully operated, and there is an increasing tendency to improve the efficiency of acid recovery as far as possible with the small existing margin. Low-level escapes of acid fume are fewer. The newer mechanical furnaces are still on trial. Silica ware for the condensation of hydrochloric acid is making headway to some extent. Copper (wet pro-

cess) works are still operated only to a very limited extent.

Cement works were very active until the price of fuel became prohibitive. More 250 ft. rotary kilns were brought into operation. Provision is made in the latest designs to pass the coal dust direct to the kiln by a hot-air blast, thus removing a possibly source of nuisance; the adoption of induced draught, to supplement chimney draught, is extending. No complaints of smoke or dust from registered cement works were received. In some works special means are adopted to prevent emission of dust during grinding and packing. Electrostatic methods of depositing cement dust are now being adopted.

In smelting works the average acidity of the chimney gases is steadily getting lower, and the satisfactory treatment of the gases evolved in roasting zinc blende, referred to last year, continues. It is desirable that we should be able to deal with certain calciner gases lower in sulphur dioxide content than those already being treated. The problem is difficult, but there is some sign of progress, though not beyond a partial recovery in special cases. There were two cases of high acidity of the gases from the calcination of tin ores; in one, satisfactory results were obtained by washing the gases with alkaline (lime) showers; in the other, proposals have been made which should affect improvement without undue cost. Two complaints were received against smelting works; in one, a new process was being started, and satisfactory conditions could not be attained for a while; the other related to unpleasant smells.

The operation of sulphuric-acid units gave no cause for complaint, and the few infractions noted were due to temporary disorganisation. The average total acidity of exits from these plants was 1.08 in terms of SO_3 g. per cb. ft., ranging from 2.71 to 0.28. In last year's report, after a consideration of various points relating to the lead chamber reactions, with special reference to nitre consumption, attention was drawn to the possible conditions existing in the neighbourhood of steam jets and water sprays. In this connexion it is of particular interest to record the experience of Dr. J. Fischler, Trzebinia, Poland, regarding the use of acid sprays instead of water sprays over a period of three years ("Z. f. angew. Chemie," 39, 55, 1926). The change has brought with it not only advantages as regards average concentration of the acid formed, but the average nitre consumption has fallen considerably, notwithstanding the increased output per unit of chamber space.

In extension of the laboratory work described in last year's report, it has now been possible to carry out a number of experiments on actual Gay Lussac tower exit gases. The desire was to ascertain what actually takes place under different conditions, when Gay Lussac exit gases, normal and abnormal, are subjected to scrubbing with a limited amount of water. The results are given in the report.

An experience is quoted which is of peculiar interest from a different point of view. The exit from a tower type of vitriol plant was of a particularly unpleasant character, although its total acidity was consistently under one grain, stated as SO_3 per cb. ft. Complaints were made by the occupiers of a neighbouring property.

With a view to further reducing the acidity of the gases, they were passed through a coke-packed tower fed with a limited supply of water, 25—30 gals. per hour. The acidity of the gases was thus reduced to 0.2—0.3 grain, and were no longer offensive.

There has been little demand for concentrated acid, and sulphuric acid (Class II) works have been less active than formerly. At only one works was there any cause for dissatisfaction; exit acidities were there found running too high. Fan draught was not satisfactory, and this was altered with resulting improvement, though still scarcely sufficient to make good results certain. A new scrubber is, therefore, being installed. Although electrostatic precipitation has been used for some time in connexion with oleum plants and in some concentrating plants, its possibilities in connexion with the latter do not appear to be fully realised. Results have been recorded in recent years showing that 3-grain concentrator fumes can be reduced by this means consistently to 0.2 grain, all visible fume disappearing.

Eighty chemical manure works are registered, which is 16 fewer than two years ago. Superphosphate manufacture is still on a considerably reduced scale, but where it has been carried on operations have been conducted with the usual excellent condensation of acid gases, except in one instance—a works where a new mixing plant had been provided with a fan that was much too powerful. In almost all works the acidity of the escaping gases, stated as the SO_3 equivalent of hydrofluosilicic acid, has not exceeded 0.1 grain per cb. ft. The highest percentage condensation of acid gases for any one works was 99.9, the lowest 95.9.

The relatively high cost of recovery of by-product ammonium sulphate is reflected in the considerable drop in the number of sulphate of ammonia and gas-liquor works registered in recent years. In many instances the plants still exist, so that under more favourable conditions they may again be brought into operation. The prolonged coal stoppage of 1926 had a very adverse effect on the production of sulphate. The plants that operated were conducted satisfactorily, and purifiers in general were kept in good order. The amount of ammonia products (expressed as sulphate [$25\frac{1}{2}\%$ NH_3]) manufactured in England and Wales in 1926 is given in the following table:—

From liquor produced in	1926 Tons	1925 Tons	1924 Tons
Gasworks	132,477	148,945	151,161
Other works (including coke ovens, iron works, producer-gas, synthetic, etc.)	132,215	201,667	211,010
Total	264,692	350,612	362,170

NOTE.—Of the total quantity of ammonia products, the equivalent of 24,449 tons was manufactured as concentrated ammoniacal liquor; the balance of 240,243 tons consisted of other ammonia products.

The amount of tar products manufactured in England and Wales in 1926 was as follows:—

	Gas, and coke oven works Tons	Other works Tons
Tar distilled	1,157,523	44,623
Pitch produced	272,658	2,360

As the ammonia plant effluent question has reached a stage where it was considered necessary that more

complete investigation and experiment should be carried out in the works themselves, a sub-committee was appointed by the Institution of Gas Engineers to carry on such work, and full-time chemists have now taken the matter in hand. At several works the evaporation of devil liquor in waste heat flues has been adopted, together with carefully-regulated flow of the remaining effluent liquor to the place of disposal. Substitution of an acid wash, in place of the final water-scrubbing of coal gas, is also showing signs of development. Increased attention is, moreover, being directed to the beneficial effect of the more complete separation of tar at the initial stages of coal-gas purification, together with early and complete separation of the tar from any accompanying liquor.

Further work has been done in the laboratory during the year. It has been found possible to evolve a more satisfactory method of estimating the relative contamination of effluent liquors with higher tar acids, and good results have been obtained in the removal of phenol from effluent liquors by using a trough, in a waste heat flue, instead of the isolated tower previously employed. The results of the analysis of condensates obtained at two coke-oven plants are given in detail in an appendix.

The number of chlorine works registered increased from 37 to 49 during the past two years. The use of liquid chlorine in the manufacture of various products, inorganic and organic, and for other purposes, continues to extend; this is responsible for the increased number of works of this class that have been registered. In some works quite a large number of units of chlorinating plant are in constant use. Complete absorption of any excess chlorine is essential, and can be efficiently effected by means of towers fed with soda solution, the liquor being recirculated and a useful hypochlorite thus obtained. All processes in which chlorine is used need careful supervision in every detail to ensure the absence of escape.

The conditions under which the scruff from tinplating operations is treated are now such that there is little difficulty in preserving a perfectly satisfactory atmosphere in the neighbourhood of the works, the amount of hydrochloric acid emitted being negligible.

Sulphide works have all been well conducted. Complete absorption of any sulphuretted hydrogen is not accompanied by serious difficulties; proper supervision is, however, always necessary, and it is worthy of note that supervision has been good.

There was cause for remonstrance at one Venetian Red works where copperas is roasted; this is referred to in the early portion of this report. Other Venetian Red works have all operated without offence throughout the year, the acidity of the evolved gases being satisfactorily reduced before their emission to the atmosphere.

Several complaints were made as to excessive fumes from tar works. They related, however, not to anything given off in the actual distillation process, but to offensive fumes from bitumen-mixing plants. Much depends on the type of mixer used. With a mechanical mixing arrangement there is considerably less liability to evolution of fume than with air blowing. In any case, fumes can quite well be draughted by means of

a fan to a suitable condenser. Where this has been done nuisance has ceased.

Mr. J. W. Young, Chief Inspector for Scotland, in his report for 1926 to the Scottish Board of Health, states that the number of works registered was 154, in which were operated 292 scheduled processes. Visits of inspection numbered 475, plus 27 to others not on the register; 252 chemical tests of escaping gases were performed; in no case were exceeded the limits of acidity prescribed by the Act. No legal proceedings have been taken. Three works were discovered to be operating a scheduled process, "bisulphite," without previous registration.

Complaint by the burgh surveyor of a town on the River Forth was made against a chemical works of injury, by fumes emitted, to stone-work and window glass. The corrosion of stone was irregular, some pieces, save from blackening by coal smoke, being as good as when first built in; others nearby were seriously decayed. It was evident that the stone had been improperly selected. Whether or not the chemical works had contributed to the damage previously is doubtful, but through inactivity it can have had no recent share. The window glass bore on its outward surface a permanent and iridescent bloom, not to be removed by careful cleansing and polishing. This appearance has been observed throughout Scotland, even in districts free of chemical works.

Throughout 1925 there were numerous complaints in South Fife of evil odours attributed to a registered works. Foul liquids discharged from a process, not scheduled, into tidal water were suspected; it was arranged to prolong the discharging pipe, to submerge its exit at all states of tide, and by altering methods of distribution to increase dilution. Complaint has since ceased.

By the courtesy of manufacturers, the following summary of raw materials and of products is given. It bears witness to the depressed state of trade, especially in the production of iron and of its associated industries.

	1925 Tons	1926 Tons
Pyrites, blende and spent oxide burned for sulphuric acid	100,865	79,438
Phosphates and bones dissolved for fertilisers	59,270	43,130
	Salts of ammonia Tons	Tar distilled Tons
From gas works ..	18,719	132,522
.. iron works ..	816	11,114
.. coke ovens ..	2,065	6,777
.. producer gas ..	2,405	3,217
.. shale works ..	33,805	
Total 1926	58,800	53,630
In 1925 ..	78,995	188,827
		Pitch produced Tons
		25,053
		5,418
		3,067
		1,856

The ammonia is expressed as pure sulphate; 776 tons was obtained as concentrated liquor ammonia and 323 tons as ammonium chloride. About 90,000 tons of tar was dehydrated and partially distilled for road purposes.

Except at one alkali works, idle during a long period, operations were not more restricted than in 1925. Hydrochloric acid was readily taken by other industries; saltcake was chiefly exported. The average amount of hydrochloric acid discharged into the air in chimney gases was 0.04 grain per cb. ft., the extremes being 0.10 and 0.02.

In sulphuric acid and sulphuric acid (Class II) works, production fell by another fifth, the loss being due to

diminished recovery of ammonia compounds at blast furnaces and gas works. Three works were idle throughout the year. Repairs and rebuilding of chambers have been extensive; plant suffered much in the heavy gales of autumn. Additional apparatus has been erected to supply the necessary nitrous gas by oxidation of ammonia, and has worked satisfactorily. This subsidiary process has many advantages, particularly at times of starting again to manufacture acid after interruptions. One works cut out its fourth chamber, and claims to have saved nitre without reducing yield of acid.

The tendency to burn spent oxide from gas purifiers, instead of pyrites, is increasing, partly from rather lower cost and partly from the absence of arsenic. The mechanical types of kiln continue to do good work, and are more numerous. The general average acidity in each cubic foot of residual gases discharged by sulphuric acid works was 0.47 grain of sulphuric anhydride; the highest and lowest averages for any one work were 0.76 and 0.03 respectively.

Manufacture of stronger acid by the Class II process has been busily and satisfactorily maintained, with efficient condensation of acid gases before discharge. There has been no improvement in demand for ordinary concentrated acid, so that much good plant has been idle. The general average acidity of the final gases from Class II works was 0.35 grain of sulphuric anhydride.

There was again a heavy fall in production of fertilisers, and profits must have been low or absent entirely in the effort to compete with foreign imports. Plant is highly efficient, and has been kept in good order, so that condensation of corrosive gases was excellent, varying from 96.7 up to 99.7%. The average of the total acid in each cubic foot of gases escaping finally was 0.09 grain, expressed as the SO_3 equivalent of hydrofluosilicic acid.

Recovery of ammonia has been much smaller than in recent years. Less coal has been available, and that imported has contained less nitrogen. Two cases were noted of blue salt, an old trouble almost forgotten, due to cyanogen resulting from higher temperatures within gas retorts. The blame was wrongly assigned to impurities in sulphuric acid. Several works found great advantage from improving their arrangements of cooling and condensation; plants, again, have been wholly rebuilt. In three cases it was necessary to give serious warning as to neglect of saturators and purifiers. The prospects of this industry are unattractive; cost of acid and of transport of crude liquor induce many smaller works to run it wastefully to sea. Possibly direct application to agricultural soil, or an easier conversion to urea, may be the method of the future. In common with the last section, the tar works group also has suffered, and from similar causes; a consequence noted is the increased yield of naphthalene from tar distillates, and of that obstructing gas mains. Few of the older and less efficient stills now remain. There has been no complaint.

Zinc works were long idle, wanting fuel. Conditions of manufacture remain unchanged, but no complaint was received against them during the period of operation. In a few miscellaneous works there has been great activity and increased production, though not in all. Plant has been kept in good order throughout.

CORRESPONDENCE

CHEMISTRY HOUSE

SIR,—The recent announcement that the Paris municipality has contributed 500,000 francs towards the "Maison de Chimie," the Berthelot Centenary Institute, and that a number of French chemical firms have contributed sums of 200,000 francs each may perhaps serve to revive interest in "Chemistry House."

Possibly there may be in this country some distinguished living chemist, preferably as young as possible, who would devote himself to expediting the present rate of progress of the scheme and hasten its realisation by initiating at once a campaign for ensuring that the establishment of "Chemistry House" will coincide with the celebration of his centenary (or bi-centenary). "Carpe diem quam minimum credula postero."

Yours faithfully,

A. J. V. UNDERWOOD

THE "WHITE OIL" REACTION

SIR,—Most mineral oils can by the continued action of sulphuric acid be converted into a colourless and bloomless oil. The opinion is often put forward that the action consists in removing unsaturated hydrocarbons or more easily attacked hydrocarbons, and leaving originally present, more stable compounds, usually classed as paraffins. Evidence, such as is gathered in the course of commercial manufacture of these white oils, would point fairly definitely to the conclusion that the "white oil" is a by-product of reaction, i.e., was not originally present, and is generally not a paraffin, but an *iso*-paraffin.

The slight acid treatment given to lubricating oil distillates in order to prepare them for lubricating purposes generally proceeds no further than the removal of comparatively small quantities of so-called resinous substances, asphaltic bodies, traces of nitrogenous compounds, cracked hydrocarbons, and, occasionally, sulphur-containing compounds and natural petroleum acids. The soda treatment neutralises and removes the mineral acids, naphthenic acids, sulpho-acids, etc. The tars obtained are, for the most part, insoluble in water, and evidently contain a large hydrocarbon molecule. The cracked oil tars are frequently liquid and soluble, and the basic substances present form soluble acid compounds.

When this "cleaning up" treatment is over, further treatment with acid seems to proceed along other lines, namely, that of breaking up and reforming another molecule. Most lubricating oil distilled without cracking gives evidence of being a mixture of members of a definite series varying with the nature and origin of the crude. Purely cracked oils, such as the shale oils, do not give a bloomless product, and can be treated with acid, giving general liquid tars, until nothing remains except a small quantity of actual paraffin compound. The "naphthenic" oils, such as Russian, when carefully treated with acid of such strength as to attack the oil fairly readily, yet not too strong, and so give an undue amount of secondary reaction products, yield a definite percentage of white oil product of a specific gravity having a definite relation to the original specific gravity. The reaction comes to a well-defined end; the tars produced

are soluble in water, and have a high sulphuric acid content, whereas, had the action been one of separation of high specific gravity and molecular weight constituents, hydrocarbons should be found combined with comparatively small weights of sulphuric acid. By taking the yield of white oil and its specific gravity, it is easy to calculate what must have been the specific gravity of the removed oil on a supposition of a separation reaction. A few instances may be given, but in these the final yield of white oil is purposely placed under the actual commercial yield, and is probably still further under the yield obtainable by careful laboratory treatment, in which case the figures obtained would be still more striking than those given.

A Texan oil of a specific gravity of 0.935 will yield 33% of white oil of specific gravity 0.890. The removed oil should have a specific gravity of 0.957: Russian oil of a specific gravity of 0.910 will yield 50% of white oil of specific gravity 0.885; the removed oil should, therefore, have a specific gravity of 0.935: Pennsylvanian oil of specific gravity 0.865 will yield 70% of white oil of specific gravity 0.845. The removed oil, therefore, should have a specific gravity of 0.912. Numerous other examples could be given from different crudes and from different specific gravities of the same crude. Taking the Russian oils as the best known instance, it is hardly necessary to state that components with such high specific gravities have not been detected; no amount of fractional distillation will even show a slight concentration of such heavy molecules; and no method of partial solution or precipitation gives any better evidence. A Russian distillate of specific gravity of 0.89 can be distilled without decomposition, and has been fractionated and refractionated into as many as 16 different parts without giving any further evidence of other than the usual characteristics of Russian oils. Each of these fractions will yield white oil in practically the same percentage, requiring the same amount of acid, and undergoing a characteristic reduction in specific gravity. Oils from other sources behave similarly, *i.e.*, the yield, the amount of acid required, and the drop in specific gravity are characteristic of the type, and the figures are only comparatively slightly altered over a considerable range of distillates of increasing specific gravity from the same crude. It has not been forgotten that some heavy gravity distillates can be separated by solvents, such as liquid SO_2 , into a comparatively lighter and heavier fraction, but before a white oil is obtained treatment with a high percentage of sulphuric acid is still necessary.

This particular action of sulphuric acid is so well defined that it is capable of a tolerably accurate mathematical treatment. By carefully treating a distillate with successive quantities of acid of carefully-graded strength, and noticing the reduction in specific gravity, alteration of iodine value down to zero, viscosity etc., a series of figures can be obtained for each type of crude and a curve or equation can be obtained from which it is possible to take a partially-finished oil and by a few stages of acid treatment obtain figures which by reference to the equation or curve enable the original specific gravity of the oil to be calculated, as well as that of the final product.

Incidentally, one is able in many cases to identify the crude from which the oil has been prepared. This reaction, therefore, appears to be worthy of a definite name, and the term "Albreaction" suggests itself. As to the nature of the reaction, the writer has only conjecture to offer, as the compounds involved are so complex and the possibilities so great, but evidence derived from this acid reaction and the study of the products of oxidation, namely, water, various aldehydes, acids, and asphaltic bodies, point in the direction of the lower specific gravity hydrocarbons being nearest to chain compounds with probably one polymethylene ring, while those of increasing specific gravity (for any given viscosity) would appear to have more rings with or without side chains. The reactions point to a break-up of these rings and a building together of the residues into molecules on iso-paraffin lines of construction. The positions originally occupied by the rings are probably centres which are attacked when the white oil product is oxidised. Many facts are known as to the nature of the oxidation products on the natural oil, and the resemblances and differences both as to quality and quantity of the oxidation products of the derived white oil; a careful study of these promises to throw light on the structure of the lubricating hydrocarbons.

A new explanation of "formolites" is also needed.
Silvertown. WM. LEE

July, 1927

OBITUARY B. A. BURRELL

News of the death of Mr. B. A. Burrell at his home in Leeds came as a great shock to a wide circle of friends in the city and throughout Yorkshire.

Benjamin Arthur Burrell, an original member of the Society, died on July 10 at the age of 68. He was educated at the Leeds Grammar School, and received his professional training under the late Thomas Fairley, Prof. T. E. Thorpe, and George Ward, of Leeds. After a pupillage under Mr. Fairley, Borough Analyst, he acted as his assistant for eight years, during which time he taught chemistry at the Leeds Institute. He was public analyst to the City of Cork from 1883—1890, when he rejoined Mr. Fairley at Leeds, becoming later his partner, and eventually in 1919 his successor as City Analyst. He held also at the time of his death several other offices, *viz.*, Public Analyst to the North Riding of Yorkshire and to the Borough of Scarborough, Agricultural Analyst to the North and West Ridings, Consulting Chemist to the Fire Offices Committee of London, Gas Examiner for the City of Leeds and the West Riding, Water Examiner for the City of Leeds and Harrogate, and Consulting Chemist to the Yorkshire Agricultural Society. He was the author of the "Food Testing Elementary Text Book" and many papers giving the results of his analytical experience. He served on the council of the Society of Public Analysts and of the Local Section of the Institute of Chemistry, but was probably best known as the popular secretary for many years of the Yorkshire Section of the Society of Chemical Industry, of which he was chairman for the last two years.

His interests centred chiefly round his profession, and he worked indefatigably in his laboratory. Never

robust, of late years he had to contend with much illness, accelerated by an accidental fall while attending a meeting of chemists in Leeds. A severe attack of influenza last winter was followed by pneumonia, after which he never regained his normal strength.

The funeral took place on July 13 at the Woodhouse Cemetery, Leeds, when the Society was represented by Mr. H. J. Hodsman (Chairman of the Yorkshire Section), Dr. J. P. Longstaff, and many other members.

PERSONAL AND OTHER ITEMS

The Adjudicators under the Hanbury Trust have resolved to award the Hanbury Memorial Medal to Dr. T. A. Henry, F.R.S., Director of the Wellcome Chemical Research Laboratories. The medal, which will be presented on October 5, is awarded for high excellence in the prosecution or promotion of original research in the chemistry and natural history of drugs.

Prof. J. F. Thorpe, F.R.S., will represent the Institute of Chemistry at the celebration of the centenary of Berthelot in Paris in October.

Sir William Bragg and Prof. R. Willstätter have been elected Honorary Fellows of the Royal Society of Edinburgh.

Sir Philip Magnus has been elected chairman of the council of the Royal Society of Arts for the year 1927-28. He succeeds Sir Thomas Holland.

On Saturday last Sir Daniel Hall, F.R.S., who recently resigned his position as Chief Scientific Advisor to the Ministry of Agriculture, was the guest of honour at a luncheon held by the East Kent Chamber of Agriculture, of which he was chairman in 1900.

Prof. D. Hanson, D.Sc., professor of metallurgy in the University of Birmingham, is on his way to New York.

Mr. I. V. L. Fergusson has been appointed a director of Evans Sons, Lescher and Webb, Ltd., Liverpool.

Mr. S. W. Woolley has retired from the editorship of the *Chemist and Druggist*.

Mr. Charles T. Bazell, Mr. Frank J. Farrell, and Mr. James Spence have resigned their positions as directors of the Branton Artificial Silk Company.

Mr. E. P. Barfield, managing director of Automatic & Electric Furnaces, Ltd., has sailed for New York to give a series of demonstrations on Wild-Barfield electric furnaces (already installed in American works), to a number of engineers and executives of the leading engineering firms in the United States.

A statue of the Comte de Chardonnet, the French chemist who invented one of the first processes for making artificial silk, is to be erected by the Academy of Science and Art at Besancon.

Alderman A. Cliff, J.P., chairman of the Association of Fire-Clay Industries, who died on April 22, aged 58, left estate of the gross value of £10,306, with net personalty £9140.

We regret to announce the death of Mr. E. Sanger-Shepherd, well-known for his work on colour photography and the development of instruments for photographic sensitometry.

Association of British Chemical Manufacturers

The annual dinner of the A.B.C.M. was held at the

Hotel Metropole on Thursday, the 14th inst. It was, as on former occasions, a most pleasant gathering. It is a standing rule at this dinner that there are no speeches; the rule was adhered to with customary strictness. A few of those present had the temerity, after assuaging the pangs, to carry on their conversation in tones which were audible, practically to all in the room. Mr. C. A. Hill, who presided, was the first to liberate his accumulated levity and eloquence; Sir Alfred Mond talked as he usually does, an utterance of good sense which seemed to escape him almost involuntarily and obviously without effort; easy speaking is probably preceded by hard thinking, but there was no outward and visible sign of the premeditation which must have been necessary, in other men, to so clear a statement of the British chemical industry and its problems. Mr. Shortt, Dr. M. O. Forster, Dr. Leonard, and Mr. Woolcock indulged in post-prandial back-chat which was extremely diverting. Many of the manufacturers enjoyed their company so much that a supplementary gathering was held in another place overlooking the river, and conversation was carried on until an early hour. This is the highest praise we can think of, that a dinner is so good that the diners refuse to separate, unwilling to retire though weary. Many, very many, men of distinction in the industry were present.

Chemical Associations and the British Industries Fair

All the leading associations in the chemical industry, including the Association of British Chemical Manufacturers, have received a letter from Mr. A. M. Samuel, Parliamentary Secretary to the Department of Overseas Trade, calling attention to the British Industries Fair, 1928, and particularly to the Chemical Section at White City.

"The Chemical and Allied Industries now provide one of the most important sections of the Fair, and the Section attracts greater attention each year from visitors," Mr. Samuel writes. "The success achieved in recent years, and particularly last year, moreover, has already induced a number of firms to consider participation for the first time in 1928. I am trying this year to make the Section thoroughly representative in all branches, and I ask for the co-operation of your Association, particularly in the direction of securing new participants."

It is pointed out that some applications for space in the London section of the Fair of 1927 had to be refused owing to lack of accommodation. For that reason arrangements have been made to provide 100,000 square feet of additional space for 1928, 1929 and 1930. Publicity literature and methods have been completely overhauled, and, with the help of His Majesty's Trade Commissioners, Commercial Diplomatic Officers and Consular Officers all over the world, an analytical examination has been made of lists of overseas buyers, the number of whom, consequently, should be even greater than the record total at the 1927 Fair.

"The Fair, which was instituted in a small way in 1915," Mr. Samuel concludes, "has grown from year to year, and has now established itself. With the continued support of the great commercial organisations, it will become increasingly valuable in helping the sale of British goods."

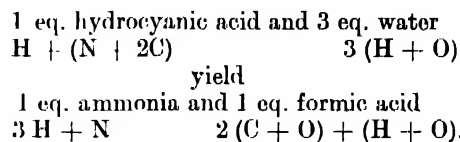
REVIEWS

STUDIEN ZUR GESCHICHTE DER CHEMIE. FESTGABE
E. O. VON LIPPMANN ZUM SEBZIGSTEN GEBURTSTAGE.
Edited by Julius Ruska. Pp. vi + 242. Berlin:
Julius Springer, 1927. Price 19.50 r.m.

This interesting collection of essays, edited by the famous Orientalist, Julius Ruska, of the University of Heidelberg, is presented to Prof. E. O. von Lippmann, the well-known writer on the history of chemistry, in commemoration of his seventieth birthday. The portrait of Prof. Lippmann shows that he is still youthful and active, and that we may hope to receive from him many more of those detailed and critical compendia which readers in the field of the history of chemistry know so well. No one except the recipient of the "Festgabe" could hope to give in short compass any adequate account of its contents, and hence the reviewer must limit himself to a bare mention of one or two of the articles which have interested him the most. A discussion of the points raised would fill a whole number of CHEMISTRY AND INDUSTRY.

Darmstaedter's article on Babylonian and Assyrian lapis lazuli, *aknu* (Gr. *αἰνιπερος*), obtained from Persia, and the symbol of heaven, provides an interesting example of the use of cobalt and lead in the preparation of ancient Assyrian blue glass found by Hilprecht at Nippur. Davy had long ago pointed out that cobalt was a constituent of ancient glass, and, although it is not common, we may be certain that its use was understood in the Assyrian period. Cobalt in Egyptian glasses has also been reported. Lagercrantz shows that Reitzenstein's emendation of Berthelot's reading of the Greek MS. of "Joannes the High Priest" is impossible. He himself proposes to re-write the passage *τῆς ἐν Εὐαγγίᾳ τοῦ Ἰωάννου* (which the reviewer can affirm so stands in the MS.) as *τῆς ἐν Νεφθαίᾳ οὐῶς*, and hence to make Joannes a Nabathaen! Lagercrantz is evidently not acquainted with Thompson's "Chemistry of the Ancient Assyrians," where the word *tutia* is put forward as Assyrian. The difficulty which von Lippmann (*Alchemie*, 71, and before him Kopp) felt, depending on the hypothesis that *tutia* was first used in the Arabic period, is thus removed without the need for such a far-fetched hypothesis as that of Lagercrantz. Ruska writes on the "Book of the Seventy," which, although referred to by Hoefer, was first published by Berthelot in 1906. The text, which is extraordinarily corrupt, was regarded by Berthelot as a translation of a work by Jabir ibn Hajjan, and Ruska has now examined two Arabic texts found at Cairo. These are the originals of the Book of the Seventy, and the latter is thus a translation of a genuine work of Jabir's. Ruska is of the opinion that the work is a "plant of native growth, in which chemistry is indissolubly connected with astrology on the one hand and medicine on the other," and is not an importation from Egypt. This seems doubtful, since the connexions mentioned suggest an Alexandrian environment. Zuretti gives the text of a Greek MS. in the Vatican which shows a very close relation to the text of the Latin Geber. The reviewer has suggested that a Greek text of this work probably existed.

Walden has an interesting article on the development of chemical symbols. He states that the present system, due to Berzelius, was only slowly brought into use, but an earlier work than the one he mentions (1835) is Turner's "Elements of Chemistry," in the fifth edition of which (1834) symbols and equations in the following form are used:—



Turner states in the preface that the use of symbols was introduced in the fourth edition of the book.

T. L. Davis gives an interesting account of Priestley's defence of the doctrine of phlogiston after his removal to America, and Speter has a very entertaining "Historio-chemisches Allerlei," in which, among many other things, the suggestion of a thermostat by Becher (1707) occurs.

J. R. P.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN.
Edited by PROF. EMIL ABDERHALDEN. Part I, Chemische Methoden, Teil II, Heft 2. Zweite Hälfte (Lieferung 211) Die Bitterstoffe. By Wilhelm Beth; and Neuere Methoden der Isolierung und des Nachweises von Porphyrinen. By Hans Fischer. Pp. 146. Berlin and Vienna: Urban & Schwarzenberg, 1926. Price 7.20 m

The "bitter principles," or, as they are more usually called in this country, the "neutral principles," form a kind of dust-bin into which are thrown all the nondescript constituents of plants that cannot be assigned to the pigments, glucosides, tannins, resins, gums, phytosterols, or any other of the large classes of non-nitrogenous substances now recognised as common constituents of plants. From time to time a chemist takes something out of the dust-bin, determines its constitution, and so assigns it to its appropriate group. The bin is, however, constantly replenished by the side-issues added to it by the chemist, primarily interested in, say, alkaloids or pigments. The value of a compilation of this kind is therefore to call the attention of chemists to the existence of the dust-bin, in the hope that some of them may be induced to lend a hand in emptying it. Few of these substances are commercial articles, but the raw materials yielding them are often easily obtained, and the substances not difficult to isolate, so teachers looking for subjects for research students might well devote some attention to them, and they will find Dr. Beth's compilation a useful guide in making a selection.

H. Fischer's contribution to this section of Abderhalden's great book concerns a subject, the porphyrins derived from blood and leaf pigments, to the chemistry of which he has made voluminous and interesting contributions. In this country we have been content to admire, and not to participate in these ingenious researches, and those chemists interested in the borderland between biology and chemistry will be glad to have this admirably clear account of this work.

T. A. HENRY

PARLIAMENTARY NEWS

Revenue from Safeguarding Duties

In reply to Mr. Harris, the Financial Secretary to the Treasury (Mr. Ronald McNeill) said that during 1926-27 the net revenue derived from the safeguarding duties on mantles for incandescent lighting was £11,031, on packing or wrapping paper £494,851, and on key industry goods £505,323. The total receipts from safeguarding duties amounted to £1,919,958.—July 18.

Pollution of Rivers

In the House of Lords, Lord Mildmay said that the voluntary Committee on River Pollution had practically exhausted its possibilities. Many streams were still being fouled through ignorance or negligence, and it was essential to create some central, inter-departmental authority for the whole of our rivers, within the limits of the need for national economy, but adequate to the importance of the task. Lord Balfour fully agreed with the necessity of the work, but was equally impressed with its difficulty. It was often necessary to choose between the purity of a river and the ruin of a factory or a new industry. For example, the effluents from low-temperature carbonisation, coke ovens, beet sugar, and artificial silk were extremely noxious. The solution was probably research into the proper method of rendering them innocuous, and the Government had already set up a special Committee of experts to co-ordinate, select, and extend the world-wide experiments being carried on in this direction. The Government had also decided to set up a special inter-departmental Advisory Committee, under Sir Horace Monro, which should explore the possibilities of more harmonious and connected control of rivers, and continue the systematic attempts to deal with certain causes of pollution, such as sewerage, for which loans totalling £5,000,000 had been made in a single year.—July 18

S. Staffordshire Mond Gas Company's Bill

The Board of Trade has offered strong support to new proposals for the development of the British chemical industry contained in a Bill promoted by the South Staffordshire Mond Gas Co. The Bill, having been through all stages of the other House, was held up by the Unopposed Bills Committee of the House of Commons recently, because of the precedent it involved, which the Committee could not see its way to establish on its own responsibility. The Bill seeks to extend the company's powers so that it may manufacture paints, preservatives, disinfectants, antiseptics, medicines for human beings and animals, and any other chemical compound or compounds of a like description. When the matter came again before the Unopposed Bills Committee in the House of Commons on July 15, a proviso was added restricting the proposed developments and experiments to the use of residuals already produced by the company or in conjunction or association with such residuals. Another clause provides that the company may manufacture and store on its lands, and may supply, sell and deal in oxygen, hydrogen, nitrogen, carbon dioxide, carbon monoxide, methane, ethylene, acetylene, sulphuric acid, hydrochloric acid, nitric acid, and acetic acid. The company was already

making a large amount of producer gas, which was the starting point for the by-products it now wanted to further develop.

COMPANY NEWS

NOBEL INDUSTRIES, LTD.

Presiding over the eighth annual general meeting, on July 15, Sir Harry McGowan, K.B.E., said that the company had every reason to congratulate themselves on the results for the year, more especially in view of the protracted coal stoppage, which had naturally affected their home trade, particularly in explosives. Apart from explosives, the return from constituent and associated companies had been well maintained. The company's general export trade had been well maintained, their Continental investments continued to do well, and highly satisfactory progress was being made by their interests in Australia, South Africa, and Canada. The splendid results achieved by the General Motors Corporation in 1925 were exceeded in 1926; the total net earnings, including equities in subsidiaries, amounted to \$178,000,000, compared with \$116,000,000 for 1925. With regard to the formation of Imperial Chemical Industries, Ltd., the Nobel Company possessed financial strength and commercial ability, but he was more than ever convinced of the wisdom of the recommendation made to the shareholders seven months ago. The merger of the various companies forming Nobel Industries, Ltd., effected in 1918, had fully justified itself. They could not, however, stand still, but must go either forward or backward, and by becoming partners in the amalgamation constituted by the formation of Imperial Chemical Industries, Ltd., the directors felt that they were forwarding not only the interests of the shareholders, but also those of the general community and of the Empire as a whole. The invitation to shareholders to exchange their shares for those of Imperial Chemical Industries, Ltd., had met with almost unanimous and immediate response, and at the present time only 1.1% of the share capital of Nobel Industries was unexchanged, and of the four participating companies over all less than 1.2% was outstanding. Of those a large proportion was represented by holdings abroad and executorship accounts, the legal formalities in connexion with which, although involving delay, were gradually being cleared up and exchanges effected. [For details of the accounts, see CHEM. AND IND., July 15, 1927, p. 649.]

BRUNNER, MOND AND CO., LTD.

An interim dividend of 2% less tax, has been declared, which compares with an interim of 3½% for each of the three preceding years on the ordinary capital, during which period the latter has been raised from £9,697,591 to £9,787,900.

DISTILLERS CO., LTD.

The fiftieth annual general meeting was held on July 15, Mr. William H. Ross, chairman, presiding. After providing for depreciation, the gross revenue amounted to £43,700 less than the previous year; but income tax required £44,000 less, and general management and office expenses were down by £5600, which made the net result £6000 better than the previous year. With

£5000 brought forward, there was an available sum of £11,000. The company were progressing with their experiments to provide an alternative motor fuel, and a field had been found in Northern Queensland where the raw material required could be obtained in considerable quantities at the minimum of cost. A distillery had been erected there which would be followed by others as soon as the first one had proved a success. The directors had acquired a 50% interest in a new distillery situated near Montreal in Quebec, which is already in operation. With regard to the alcohol distillery in Queensland, which had been erected in conjunction with members of the sugar industry, as there was no demand for molasses in such a sparsely populated country, it was now made into an alcohol fuel which was proving quite satisfactory. The supply of alcohol fuel for motor-cars was entirely a question of cheap raw material and its consumption within a reasonable distance of where it was produced, although it could not, at present, compete with the supplies of petrol provided by nature.

CASSEL CYANIDE CO., LTD.

The offer to exchange Cassel Cyanide shares for shares in Imperial Chemical Industries (cf. CHEM. AND IND., July 8, 1927, p. 620) has been accepted by over 80% of the shareholders. The offer was conditional upon 75% of the shareholders accepting.

W. AND H. M. GOULDING

This firm of chemical manure manufacturers recommends a dividend at the rate of 5½% on the preference shares and 5% per annum on the ordinary shares for the year ended June 30, 1927.

DUNLOP RUBBER CO., LTD.

The directors have entered into a provisional arrangement with the Dunlop Rubber Co. of Australasia providing for the financial association of the two companies and the closest possible technical and commercial alliance. The arrangement includes the acquisition of a share interest in the Australian Company by the Dunlop Rubber Co., and representation on the Board and the formation of a separate New Zealand Company jointly owned by the two companies.

WELSBACH LIGHT CO., LTD.

The trading profit for the year to March 31, 1927, was £10,419, after meeting expenses and advertising etc., compared with £1211 for the preceding year. After meeting repairs and depreciation, £3979 (against £3371), and providing legal expenses, directors' fees and interest on debenture stock, the net profit was £6620, compared with £3021. A dividend is proposed of 5% (same as for each of the four preceding years), leaving £1323 to be carried forward, against £10,599 brought in.

MIDLAND BANK, LTD.

The balance sheet for the year ended June 30, 1927, shows a further expansion in business and assets. Deposits, including balance of profit and loss account, now stand at £376,528,502, as against £349,460,874 a year ago, and £368,160,062 at December last. The paid-up capital amounts to £12,665,798, and the reserve fund stands at the same amount. Investments total

£37,128,551, compared with £33,469,941 at June, 1926, and £38,853,582 at December, 1926.

CHEMICAL AND METALLURGICAL CORPORATION, LTD.

The seventh report states, with reference to the acquisition of a site for the company's works on the Manchester Ship Canal, that good progress has been made in the erection of the plant, which will include apparatus for the independent production by the company of hydrochloric and sulphuric acids, which are necessary in the ore reduction processes. The experimental works at Stratford, E., have continued to operate, a great variety of complex ores having been treated successfully.

CELANESE CORPORATION OF AMERICA

At a special meeting of the holders of the first mortgage ten-year 8% convertible sterling bonds on July 18, resolutions were passed assenting to an increase in the shares of the capital stock from 1,130,000 shares, consisting of 150,000 shares of a par value of \$100 each of 7% cumulative first participating preferred stock, 100,000 shares of the par value of \$100 each of 7% cumulative second preferred stock, and 880,000 shares without par value of common stock, to 1,400,000 shares to consist of 250,000 shares of the par value of \$100 each of prior preferred stock, 150,000 shares of the par value of \$100 each of 7% cumulative first participating preferred stock, and 1,000,000 shares without par value of common stock.

ELECTROLYTIC ZINC CO. OF AUSTRALASIA

A dividend has been declared at the rate of 12% per annum for the six months ended June 30 last on the whole of the preference and ordinary shares, payable on September 1.

COURTAULDS, LTD.

The directors have decided to restore the rate of dividend to 7½% actual, free of tax, a gain of 1¼% on last year's interim, and the same as paid in the preceding year.

JOHN KNIGHT, LTD.

A dividend has been declared on the 25% cumulative preferred ordinary shares at the rate of 12½% for the half-year to May 31, 1927.

COMMERCIAL GAS CO., LTD.

The directors state that by the passing of the Companies Act, 1927, the distinction between the 4% capital stock and the 3½% capital stock no longer exists. The combined stocks will henceforth be known as ordinary stock, and the directors have declared an interim dividend on such ordinary stock for the half-year ended June 30, 1927, of 2½% (actual) less tax, payable on August 15.

BRITISH OXYGEN CO., LTD.

A final dividend has been recommended for the year ended March 31, 1927, of 5½%, less tax, making 8%, less tax, for the year.

ASSOCIATED FIRECLAY COMPANIES

An interim dividend of 5%, less tax, has been declared on the ordinary shares, payable on July 30.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 80s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 4d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 4½d. per gal. Pale, 95%, 2s.—2s. 3d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 11d.—1s. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 8d.—1s. 10½d. per gal. Pure, 2s.—2s. 3½d. per gal.
 Xylol.—2s.—2s. 4d. per gal. Pure, 2s. 6d. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—8½d. per gal. Middle Oil, 7½d.—7¾d. per gal. Heavy, 8½d.—8¾d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/100, 1s. 5d.—1s. 6d. per gal. Solvent 95/100, 1s. 5d.—1s. 6d. per gal. Solvent 90/190, 11d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—80s.—85s. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winter.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzdine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%—3s. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum 1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—5 cwt. lots. Cryst. 41s. per cwt. Powder 45s. per cwt. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 8d.—1s. 10d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 3½d.—1s. 6d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—5 cwt. lots. Crystal 25s. per cwt. Powder 27s. * per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d. per lb. Potassium.—1s. 11d. per lb. Sodium.—2s. 2d. per lb. Granulated ½d. per lb. less. All spot.
 Calcium Lactate.—1s. 3½d. per lb.
 Chloral Hydrate.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate. 6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ½ lb., 9s. 6d. per doz.; ¼ lb., 6s. 6d. per doz.
 Hydroquinone.—2s. 11d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 22s. per cwt.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 11s.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—6s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—9s. 6d.—9s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—2s. 9d.—3s. per lb.
 Phenazone.—4s. 3d.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d. per oz. in 100 oz. tins (1000 oz. lots).
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—50s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—92s. 6d.—97s. 6d. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kogs included.
 Sulphonal.—6s. 6d.—6s. 9d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
 Thymol, Puriss.—10s. 6d.—10s. 9d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.
 Aubepine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 6d. per lb.
 Ethyl Cinnamate.—6s. 6d. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol.—9s. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. 6d. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 8d. per lb. Vanilin.—17s.—18s. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.
 Camphor.—70s. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—8s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%, 22s. 6d. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 18s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Sept. 10th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on July 28th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Harter. Carrying out exothermic gas reactions. 17,750. July 4.
 Hawes. Evaporating apparatus. 18,195. July 8.
 Hermansen. Tunnel kilns. 18,101. July 7.
 Jørgensen. Producing homogeneous mixtures of pulverulent materials. 17,749. July 4. (Denmark, 2.7.26.)

Marks (Susquehanna Collieries Corp.). Separation of subdivided materials. 18,104. July 7.

Nobel. Extracting substances from solid materials. 17,695. July 4.

Pulp Economisers, Ltd., and Smith. Filtering apparatus. 18,070. July 7.

Williams. Furnaces. 18,272. July 9.

I.—Complete Specifications

12,447 (1926). Foray. Apparatus for extracting essential principles. (252,190.)

8493 (1926). Heitmann. Producing lubricants containing water. (250,562.)

9041 (1926). Amdyco Corp. Extinguishing fire. (250,924.)

17,436 (1926). Denham, and Simon, Ltd. Grinding or disintegrating machines. (273,499.)

18,633 (1926). I.-G. Farbenind. Manufacture of active adsorbent and catalytic masses. (255,904.)

26,661 (1926). Soc. L'Air Liquide. Carrying out exothermic chemical reactions under pressure and at a high temperature. (268,721.)

5694 and 5773 (1927). Deutsche Gasglühlicht Auer-Ges. Indicating the exhaustion of substances used for cleaning gases. (272,855 and 272,858.)

*14,347 (1927). Kehren. Furnaces. (273,671.)

*16,474 (1927). Krupp Grusonwerk. Apparatus for expressing liquid constituents from materials. (273,689.)

*17,622 (1927). I.-G. Farbenind. Manufacture of aqueous solutions of organic compounds insoluble in water. (273,757.)

*17,749 (1927). Jørgensen. Producing homogeneous mixtures of pulverulent materials. (273,768.)

II.—Applications

Cassel Cyanide Co., Ltd., and Ewan. Manufacture of carbon from carbon monoxide. 17,786. July 5.

Imperial Chemical Industries, Ltd., and Gordon. Production of gaseous fuels. 18,140. July 8.

Okell. Activating carbonaceous materials. 17,879. July 5.

Power Gas Corporation, Ltd., and Rambush. Water-gas plant. 17,949. July 6.

Rozinek and Szikle. Gasification of fuel. 18,234. July 8. (Ger., 9.7.26.)

Steel Bros. & Co. (Armstrong). Purification of wax residues of petroleum. 18,185. July 8.

II.—Complete Specifications

2075 and 30,519 (1926). Burmah Oil Co., Ltd. (Fraser). Refining mineral oils and/or their distillates. (273,351.)

8285 (1926). Fischer and Tropsch. Production of paraffin hydrocarbons. (255,818.)

8590 (1926). Davidson. Distillation of solid carbonaceous substances. (273,389.)

12,462 (1926). Allgem. Ges. f. Chem. Industrie. Expelling the SO₂ gases from mixtures of SO₂ gases and oil. (269,118.)

15,421 (1926). West, West, and West Gas Improvement Co., Ltd. Vertical retort. (273,474.)

22,791 (1926). Salerno, Ltd., and Salerni. Distillation or heat treatment of carbonaceous or like materials. (273,528.)

27,234 (1926). Shimamoto. Treating pulverised vegetable fuels. (273,556.)

32,019 (1926). Siemens & Halske A.-G. Improving mineral oils and tar products. (263,186.)

5694 and 5773 (1927). Deutsche Gasglühlicht Auer-Ges. See I. 11,700 (1927). Coppee & Co. Coke oven. (273,630.)

*15,926 (1927). Verein f. Chem. Industrie. Producing or reactivating active carbons. (273,683.)

*17,093 (1927). I.-G. Farbenind. Manufacture of liquid products from coal, tars, mineral oils, and the like. (273,712.)

*17,657 (1927). Algem. Norit Maatsch. Producing activated carbon. (273,761.)

III.—Complete Specifications

- 17,169 (1926). Irinyi. Producing benzene by reaction between phenolic vapours and a reducing gas. (273,493.)
 32,019 (1926). Siemens & Halske A.-G. See II.
 *15,252 (1927). Wessel. Distillation of coal tar. (273,675.)
 *17,093 (1927). I.-G. Farbenind. See II.

IV.—Applications

- Carpmael (I.-G. Farbenind.). Manufacture of tetra-kisazo dyestuffs. 17,967. July 6.
 Hoffmann-La Roche & Co. Manufacture of alkyl and aralkyl derivatives of diphenolisin. 18,150. July 8. (Switz., 9,10,26.)
 I.-G. Farbenind. Manufacture of α -anthraquinonyl ketones. 17,864. July 5. (Ger., 5,7,26.) Manufacture of cyclic ketones. 18,068. July 7. (Ger., 8,7,26.) Manufacture of naphthalene-1,4:5:8-tetracarboxylic acid. 18,184. July 8. (Ger., 9,7,26.)
 Imray (I.-G. Farbenind.). 18,199. See XX.
 Johnson (I. G. Farbenind.). Manufacture of vat dyestuffs. 18,074. July 7.

IV. Complete Specifications

- 32,603 (1925). Thomas, Drescher, and Scottish Dyes, Ltd. Dyestuff intermediates. (273,347.)
 2143 (1926). Bloxam (I.-G. Farbenind.). Manufacture of diazo-preparations. (273,352.)
 8496 (1926). I. G. Farbenind. Manufacture of halogenated benzanthrone derivatives containing sulphur. (249,890.)
 8497 (1926). I.-G. Farbenind. Manufacture of condensation products of the benzanthrone series and of vat dyestuffs containing nitrogen. (249,891.)
 17,169 (1926) Irinyi. See III.
 19,565 (1926). Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. (258,563.)
 *6307 (1927). I.-G. Farbenind. Manufacture of vat dyestuffs. (273,656.)
 *12,103 (1927). I.-G. Farbenind. Manufacture of condensation products from naphthalene and derivatives. (273,665.)
 *17,864 (1927). I.-G. Farbenind. Manufacture of α -anthraquinonyl ketones. (273,774.)

V. Applications

- Benthall, Bird & Co., Godfrey, Spencer, Tarlton, and Wheeler. Extracting cellulose etc. 17,832—3 and 18,148. (Br. India, 20,1,27 and 28,5,27.)
 Comp. Gén. des Industries Textiles, and Duhamel. Washing wool. 18,167. July 8. (Fr., 4,5,25.)
 Lescurre. Sterilising fabrics. 18,328. July 9. (Fr., 1,3,27.)
 Lilienfeld. Manufacture of artificial threads. 17,713. July 4.
 Lucas, and Vickers, Ltd. Treatment of flax etc. 17,838. July 5.
 McCaw. Treatment of textile fibres etc. 17,898. July 6.
 Rheinische Gummi- und Celluloid-Fabr. Treating celluloid scrap. 18,255. July 9. (Ger., 18,9,26.)
 Sever and Speakman. Manufacture of artificial textile fibres. 18,203. July 9.
 Silver Springs Bleaching and Dyeing Co., Ltd., and Hall. Process for treating viscose silk etc. 18,274. July 9.

V.—Complete Specifications

- 9197 (1926). Benckiser, Reimann, Reimann, and Draibach. Maintaining effectiveness of washing and bleaching powders. (273,414.)
 18,031 (1926). Courtaulds, Ltd., Hegan, and Hazeley. Manufacture of threads, filaments, etc. from viscose. (273,506.)
 8521 (1926). Courtaulds, Ltd., Glover, and Heaven. Manufacture of filaments of artificial silk etc. (273,386.)

- 8865 (1926). British Celanese, Ltd., Dickie, and Halkyard. Manufacture of fabrics. (273,406.)
 *16,585 (1926). British Celanese, Ltd., Rivat, and Cadgène. Treatment of cellulose derivatives. (273,692.)
 *10,998 (1927). Wells. Cooking vegetable fibre. (273,663.)
 *17,523 (1927). British Celanese, Ltd. Manufacture or treatment of cellulose derivatives. (273,743.)
 *17,585 (1927). Duhamel, and Comp. Gén. des Industries Textiles. Washing or cleaning wool. (273,755.)

VI. Applications

- British Dyestuffs Corp., Ltd., Lawrie, Linch, and Rodd. Dyeing cellulose esters etc. 17,847. July 5.
 Durand et Huguenin. Dyeing or printing. 18,067. July 7. (Ger., 10,7,26.)
 Gould, and Gould, Ltd. 18,327. See XV.

VI.—Complete Specifications

- 2143 (1926). Bloxam (I.-G. Farbenind.). See IV.
 9197 (1926). Benckiser, Reimann, Reimann, and Draibach. See V.
 9696 (1926). McCaig and Livingstone. Dye jigs. (273,418.)
 *16,586 (1926). British Celanese, Ltd., Rivat, and Cadgène. Dyeing cellulose derivatives. (273,693.)

VII.—Applications

- Caro and Frank. Production of compounds of nitrogen and oxygen from ammonia. 18,106. July 7. (Ger., 8,7,26.)
 Carreras. Manufacture of bismuth oxides etc. 18,088. July 7.
 Chem. Fabr. vorm. Schering. Manufacture of acetic acid. 18,082. July 7. (Ger., 7,4,27.)
 Coley. Manufacture of cyanides from nitrogen. 18,042. July 7. Manufacture of barium sulphide etc. 18,045. July 7. Reduction of carbonates or bicarbonates. 18,046. July 7. Reduction of sulphates. 18,047. July 7. Manufacture of metallic nitrides etc. 18,050. July 7.
 Johnson (I.-G. Farbenind.). Ammonium phosphates. 17,717. July 4.
 Rosenheim. 17,960. See XXIII.

VII.—Complete Specifications

- 32,489 (1925). Stoees. Extraction of gold from seawater. (273,346.)
 5823 (1926). Finkelstein. Extraction of aluminum ore. (248,746.)
 *7661 (1927). Daloze. Manufacture of lead carbonate. (273,660.)
 *12,772 (1927). I.-G. Farbenind. Production of chromates. (273,666.)
 *17,088 (1927). Leshik. Generation of oxygen from persalts. (273,711.)
 *17,220 (1927). Caro and Frank. Production of high-percent nitric acid. (273,711.)
 *17,442 (1927). Uhde. Synthetically producing ammonia. (273,735.)

VIII.—Applications

- Anderson. Glazing earthenware. 18,286. July 9.
 Russell and Thynne. Pottery etc. ovens. 17,883. July 5.

VIII.—Complete Specifications

- 8009 (1926). Wickham. Decolorising china clay etc. (273,373.)
 14,966 (1927). Quartz & Silico. Manufacture of silica articles with glazed surface. (273,636.)

IX.—Applications

- Cann and Harrap. Cementitious material. 18,102. July 7.
 Dunlevy and Johnson. Manufacture of bricks and tiles. 17,791. July 5.

IX.—Complete Specification

15,517 (1926). British Dyestuffs Corp., Baddiley, Shepherdson, and Davidson. Colouring cement, concrete etc. (273,477.)

X.—Applications

Asheroff. Metallurgy of ores etc. 18,076. July 7.
Birmingham Electric Furnaces, Ltd., and Lobley. Annealing etc. furnaces. 17,912. July 6.

Buess. Rotary melting-furnaces. 17,831. July 5. (Ger., 16.7.26.)

Coley. Manufacture of zinc. 18,041. July 7. Manufacture of alloys. 18,043. July 7. Extraction of gold from arsenical ores. 18,058. July 7. Manufacture of thorium etc. 18,049. July 7.

Jackson (New Jersey Zinc Co.). Condensing zinc vapours. 18,181. July 8. Reducing zinciferous materials. 18,186. 18,189. 18,193. 18,196.

Soc. Ital. di Elettrochimica. Production of aluminium in electric furnaces. 18,215. July 8. (Italy, 8.7.26.)

Verein. Stahlwerke. Manufacture of high-grade cast iron. 18,217. July 8. (Ger., 15.7.26.)

Watkins. Plating metal. 17,824. July 5. (U.S., 24.12.26.)

Williams. Removal of scale from metal. 18,224. July 8.

X.—Complete Specifications

9755 (1926). Corbould. Hydro-metallurgically treating oxide products of lead and zinc. (273,420.)

11,990 (1926). Harris. Refining and separation of metals. (273,440.)

14,083 and 21,781 (1926). Paton and Wood. Metallurgical furnaces. (273,457.)

5823 (1926). Finkelstein. *See* VII.

*20,208 (1926). Western Electric Co., Inc. Magnetic materials. (273,638.)

7591 (1927). General Motors Corp. Electrolytic deposition of chromium. (273,659.)

XI.—Applications

Frigaum Ges. Voltaic cells. 17,809. July 9. (Ger., 14.1.27.)

Pörschke. Galvanic cells. 18,209. July 8.

Soc. Ital. di Elettrochimica. 18,215. *See* X.

XI.—Complete Specifications

12,911 (1926). Darimont. Double-fluid cells. (263,081.)

16,281 -2 (1926). Everett. Storage batteries. (269,120—1.)

*7594 (1927). General Motors Corp. *See* X.

*8942 (1927). Vultex, Ltd. *See* XIV.

*11,458 (1927). United Products Corp. Art of galvanoplasty. (273,664.)

*14,429 (1927). Allen Electrolytic Cell Corp. Electrolytic cells. (273,672.)

*17,592 (1927). Levy. *See* XII.

XII.—Application

Bertsch, and Böhme A.-G. Obtaining sulphonation products from fats etc. 18,188. July 8. (Ger., 8.7.26.)

XII.—Complete Specifications

9197 (1926). Benekiser, Reimann, Reimann, and Draibach. *See* V.

8960 (1927). Industrial Spray-Drying Corp. Manufacture of soap powder. (269,516.)

*26,920 (1926). Mertens. Purifying raw lanolin. (273,642.)

XIII.—Applications

Anderson, Cash, and Stephens. Production of titanium-containing pigments. 17,976. July 6.

British Dyestuffs Corp., Ltd., Strafford, and Walker. Manufacture of phenolic resins. 18,055. July 7.

Carreras. Manufacture of white lead. 18,089. July

XIII.—Complete Specifications

*7661 (1927). Daloze. *See* VII.

*17,549 (1927). British Thomson-Houston Co., Ltd. Resin compositions. (273,748.)

*17,592 (1927). Levy. Manufacture of lacs, varnishes, and enamels for insulating. (273,756.)

XIV.—Complete Specification

*8942 (1927). Vultex, Ltd. Electric deposition of caoutchouc. (273,662.)

XV.—Applications

Gould, and Gould, Ltd. Dyeing leather etc. 18,327. July 9.

Jorgensen. Finishing leather etc. 17,987. July 6.

Simpson. Manufacture of imitation leather etc. 18,243. July 9.

XVI.—Complete Specification

6749 (1927). Boehringer & Soehne. Manure. (268,744.)

XVII.—Complete Specification

15,760 (1926). Nanji. Manufacture of starch. (273,481.)

XVIII.—Complete Specification

24,678 (1926). International Yeast Co. Manufacture of yeast. (259,572.)

XIX.—Applications

Bolton, Read, and Pulvo, Ltd. Preservation of eggs. 17,729. July 4.

Salerni. Manufacture of chocolate. 17,748. July 4.

Verity. Egg preservation. 18,246. July 9.

XX.—Applications

British Celanese, Ltd., Dreyfus, and Haney. Manufacture of aliphatic compounds. 18,098. July 7.

Chem. Fabr. vorm. Schering. 18,082. *See* VII.

Fodor. Preparing acid of phthalic series etc. 17,708. July 4. (Belg., 3.7.26.)

Imray (I.-G. Farbenind.). Manufacture of sulphamic acids of secondary bases. 18,199. July 8.

Johnson (I.-G. Farbenind.). Manufacture of synthetic organic compounds. 18,075. July 7. Production of ointments etc. 18,317. July 9.

XX.—Complete Specifications

181 (1926). Dehn (Lilly & Co.). Treating bacteria, toxins, and serums. (273,349.)

8543 (1926). Macdonald. Manufacture of substances for reducing arterial hypertension. (250,230.)

25,633 (1926). Binz and Rüdth. Production of iodo-pyridine. (259,977.)

*15,992 (1927). Chem. Fabr. vorm. Schering. Manufacture of condensation products from alkylated phenols and ketones. (273,684.)

*15,993 (1927). Chem. Fabr. vorm. Schering. Manufacture of alkylisopropyl-phenols and their hydrogenation products. (273,685.)

*15,994 (1927). Chem. Fabr. vorm. Schering. Manufacture of alkylisopropylene-phenols and alkylated cumaranes. (273,686.)

*17,543 (1927). Soc. Anon. des Distilleries des Deux-Sèvres. Separation of fatty acids from dilute aqueous solutions. (273,744.)

*17,622 (1927). I.-G. Farbenind. *See* I.

*17,708 (1927). Fodor. Preparing an acid of the phthalic series and derivatives. (273,765.)

XXI.—Application

Coley. Manufacture of photographic plates etc. 18,044. July 7.

XXI.—Complete Specification

1551 (1926). Soc. du Film en Couleurs Keller-Dorian. Photographic films. (246,829.)

XXII.—Application

Imperial Chemical Industries, Ltd., and McEntegart. Explosives. 17,761. July 4.

XXIII.—Applications

Hägaras-Billesholms Akt., and Nordiske Natrolith Akt. Softening etc. water. 17,895. July 6. (Sweden, 29.10.26.)
 Marks (Associated Oil Co.). Insecticides. 17,766. July 4.
 Rosenheim. Production of base-exchanging substances. 17,960. July 6. (Ger., 16.10.26.)

XXIII.—Complete Specification

102 (1926). Magrath. Softening water. (273,348.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Stationery, perfumery (20); varnish, paint enamels, (Commercial Bureau, Australia House, Strand, W.C.2, Ref. 469). *Austria*: Smelted aluminium, nickel (29). *Belgium*: Manganese ore (30). *Canada*: Coconut butter (24). *Greece*: Caustic soda (35). *Holland*: Alloy steels (36). *Morocco*: Soya oil (40). *Norway*: Tin in ingots (38). *Portugal*: Tinplate (39). *South Africa*: Red oxide paint in paste (B.X. 3627); leather belting, rubber belting (B.X. 3626); coal elevator, coal chutes (A.X. 4908).

New B.D.C. Dyestuff

The British Dyestuffs Corporation, Ltd., have issued another pattern card illustrating a new addition to their range of acid colours for leather dyeing: Chestnut brown. This colour will interest dressers of chrome, semi-chrome and vegetable-tanned leathers. It is of good solubility, and possesses excellent level dyeing properties, and serves as an excellent basis for the rich brown shades so much in demand for shoe and fancy leathers.

Bisulphide of Carbon (Conveyance) Regulations

The Home Secretary has issued draft Bisulphide of Carbon (Conveyance) Regulations in pursuance of the provisions of the Petroleum Act, 1926. The Regulations define the means and nature of the conveyance, set out the precautions to be observed in filling or emptying, and state the conditions to be observed if electric lighting is used on any tank wagon employed to convey carbon bisulphide.

News from Advertisements

There is a vacant Lectureship in Fuel Technology at the Imperial College of Science and Technology (p. x).

A Coal Research Fellowship at the Imperial College of Science and Technology is offered in connection with Sensible Heat Distillation, Ltd. (p. x).

Students will be interested in the facilities offered at the Imperial College of Science and Technology for study and research in Fuel Technology, (Chemical Engineering and Electro Chemistry (p. x).

An organic chemist requires a post on the commercial or research side of the chemical industry.

Woman B.Sc. (linguist) desires a post in London (p. x).

Chemist requires position, preferably for foods and food preservatives (p. x).

PUBLICATIONS RECEIVED

REPORT OF THE FUEL RESEARCH BOARD FOR THE YEAR 1926, WITH REPORT OF THE DIRECTOR OF FUEL RESEARCH. Department of Scientific and Industrial Research. Pp. vi + 62. H. M. Stationery Office, 1927. Price 1s. 3d.

THE CONSTITUTION OF GLASS. A Series of Papers reprinted from the Journal of the Society of Glass Technology. Edited by Prof. W. E. S. Turner, O.B.E., D.Sc., M.Sc., F.Inst.P. Pp. 191. Sheffield: Society of Glass Technology, 1927. Price 7s. 6d.

FÜHRER DURCH DIE CHEMISCHE LITERATUR FÜR WISSENSCHAFT UND PRAXIS. Compiled by Dr. Hans Bolte. Pp. 158. Hamburg: L. Friedrichsen & Co., 1927.

AMERICAN INDUSTRIAL PROGRESS THROUGH SCIENTIFIC RESEARCH. By E. R. Weidlein, Sc.D. Pp. 16. Reprinted from the Silver Anniversary Number of Chemical and Metallurgical Engineering, Vol. 34, No. 4, April, 1927.

THE BITUMINOUS SANDS OF ALBERTA. By K. A. Clark and S. M. Blair. Part I.—Occurrence. Scientific and Industrial Research Council, Report No. 18. Pp. 74. Edmonton, Alberta: W. D. McLean, 1927.

DAS KISELSAUREGEL UND DIE BLEICHERDEN. By Dr. O. Kausch. Pp. 292. Berlin: J. Springer, 1927. 129 r.m.

KUNSTSEIDE. Edited by E. A. Anke, H. Eichengrün, R. Garbel, R. O. Herzog, H. Hoffmann, Fr. Locwy, A. Oppé, W. Traube and A. v. Vajdaff. Part VII. Technologie der Textilfasern. Edited by Dr. R. O. Herzog. Pp. viii + 354. Berlin: J. Springer, 1927. Price (bound) 33 r.m.

LEIM UND GELATINE. By Dr. E. Sauer. Sonderabdruck aus der Kolloidchemischen Technologie. Edited by Dr. R. E. Liesegang. Pp. 57. Dresden and Leipzig: Th. Steinkopff, 1927. Price 3 r.m.

ABRASIVES. Products of Canada, Technology and Application. Canada Department of Mines, Mines Branch. Part II. Corundum and Diamond. By V. L. Eardley-Wilmot. No. 675. Pp. v + 51. Part III. Garnet. By V. L. Eardley-Wilmot. No. 677. Pp. 69. Ottawa: F. A. Acland, 1927. Price: Part II, 15 c.; Part III, 20 c.

THE JOHN CREER LIBRARY. Thirty-second Annual Report, for the Year 1926. Pp. 61. Chicago: The John Creer Library, 1927.

LE MANUEL DU PARFUMEUR. By Askinson. Fourth edition, revised and corrected, by R. Sornet. Pp. 141. Paris: Gauthier-Villars et Cie., 1927. Price 18 fr.

AMERICAN INDUSTRIAL PROGRESS THROUGH SCIENTIFIC RESEARCH. By E. R. Weidlein, Sc.D. Pp. 16. Reprinted from Silver Anniversary Number of Chemical and Metallurgical Engineering, Vol. 34, No. 4, April, 1927.

THE ORIGIN OF THE CHARGE ON COLLOIDAL PARTICLES. By Henry B. Oakley. Pp. 902—916. Reprinted from Vol. XXX, July, 1926, of the Journal of Physical Chemistry.

REPORT OF THE GOVERNMENT CHEMIST FOR THE YEAR 1926. SUDAN GOVERNMENT. WELLCOME TROPICAL RESEARCH LABORATORIES, KHARTOUM. CHEMICAL SECTION. Publication No. 43. Pp. 34. Khartoum: McCorquodale & Co. (Sudan), Ltd.

Afdrucken van Indrukken uit het Land van Benjamin Franklin. I. By Prof. E. Cohen. Pp. 7. Reprinted from the Chemisch Weekblad, Vol. XXIV. No. 22 (1927).

INORGANIC CHEMICAL SYNONYMS, AND OTHER USEFUL CHEMICAL DATA. By E. R. Darling. Second edition, revised and enlarged. Pp. vii + 119. New York: D. Van Nostrand Co., 1922. Price \$1.00.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY

CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW SERIES**

LONDON, JULY 29, 1927

No. 30

EDITORIAL

Catalysis

WE are glad to publish this week the first half of an important paper on catalysis by Prof. Sabatier, who has done more than anyone else to explain the mechanism of this remarkable and common chemical action and to apply it to industrial purposes. This paper is the second of the Messel Memorial Contributions, and we have every hope that the high standard of the first two members of this series will be maintained so that our readers will continue to derive both profit and pleasure from it. Catalysis is well known to us all, and the word happily expresses an idea which this word only can convey. The word is a mere symbol or idea, a label, not a description. We know perfectly well the meanings of catalysis, of analysis, and of paralysis, and we use these words in connexion with chemistry and medicine; whether our present usage resembles in the least the Greek usage is perfectly immaterial. As a matter of fact, convenient as these words are, the original distinction between them is more apparent than real; in Greek the words *καταλύω*, *ἀναλύω* and *παραλύω* mean practically the same thing: destroy, break up, disband, annul, or end; *καταλύω* has also the additional meaning of rest; an adjournment to an inn is typical of the Greek usage of catalysis. How the word came to be employed in its present sense is not quite clear to us, but it is in many ways an appropriate word. The catalyst is one who rests while others work, who encourages others to work; directors of companies, editors, organisers of all kinds, these are catalysts; some orator at the meeting at Edinburgh called them parasites, but we think this is stretching the Greek language in excess of its tensile strength and going beyond the limits of decorum. What ideas Berzelius had in his mind when he introduced the word catalysis to chemistry we cannot

imagine; perhaps he thought that the difference between breaking up and breaking down is greater in Greek than it is in English. More than a hundred years ago the catalytic action of platinum in promoting the oxidation of hydrocarbons was described both by Sir H. Davy and E. Davy, and it is nearly a hundred years since de la Rive and Marcet suggested that catalysis consisted in a rapidly alternating series of oxidations and reductions. Nearly a hundred years ago Faraday explained the catalytic action of platinum as due to the condensation of gases on the surface of the metal; many chemists of repute in France, Germany, and Great Britain increased our knowledge of catalysis during the middle of the nineteenth century, but it was the work of Sabatier and Senderens which reduced our knowledge to order, gave a rational explanation of the phenomena, and enabled catalysis to be applied to the service of man. That catalytic action has distinguishing properties of its own is perfectly plain; to what extent the chemical action of catalysis differs from any other sort of chemical action, except in degree, is perhaps more a metaphysical than a chemical question. Armstrong told us in his Messel lecture, and on a few previous occasions, and perhaps on one or two subsequent occasions, that chemical action between two pure substances is impossible, and that you must have a third substance to overcome the inertia of monotony; this disturbing element, this *tertium quid*, is a sort of catalyst. Ever since Prof. H. B. Baker, five and twenty years ago, showed how hard it is to make pure dry hydrogen combine with pure dry oxygen, all chemists have realised that pure and dry substances will behave, in several ways and perhaps from several causes, differently from the substances as we usually meet them. The whole of chemistry and of life is stirred into activity by comparatively insignificant

quantities of catalysts, enzymes, vitamins, and so on. We are told that the corrosive action of strong sulphuric acid is due to the mysterious ions, which in extremely dilute solutions play so important a part. What the percentage of ions is, in really strong acids, we have forgotten; even if the percentage is extremely small it may well be that it serves to stimulate the whole. We have for a century been accustomed to use words which come within Lodge's description of "a new name whose full meaning will require further investigation." These new names are being cleared up and defined as chemistry advances; one of them, catalysis, has been pruned and reduced to a reasonable and harmonious conception by the labours of many. To one in particular we offer our thanks not only for his important work, but also for his lucid explanation, we mean Prof. Paul Sabatier.

Fuel Research

The Fuel Research Board continues its work on old problems, and continually attacks new ones; and its reports on processes, its "Technical Papers," and its publications on the physical and chemical survey of the nation's coal resources, form already a considerable aggregate, which is rapidly increasing. Dr. King and Mr. Wilgress have begun experiments on the temperature of initial decomposition of coal (Technical Paper No. 16), which indicate that peat at 180° C. and bituminous coals at 215° to 245° C. slowly give off liquid oils for some considerable time, the temperature needed apparently being higher as the coal contains more oxygen. Along with the appearance of oil there is a rise in the rate of the evolution of water, which seems to indicate the production of water as well as oil through decomposition of the coal substance, and not simply the evolution of moisture originally held in the coal. The paper discusses previous observers' results, and contains a useful bibliographic index. The authors wisely refrain from theorising from their results, and modestly present them as a first instalment.

Mr. Burdakin, in an investigation of the "caking power," so-called, of coal (Phys. and Chem. Survey, No. 8), has done another useful piece of work in a field where much work is yet called for. Following the lead of Badarau and Tideswell, he works out the "caking power curve," by determining the resistance to compression of cokes from each coal mixed with varying amounts to anthracite previously heated to 1000° C. (it is regrettable that he should apply the verb "calcine" to this operation). With nearly all the coals examined, when the heating was rapid (7 min.), a maximum was found for mixtures with considerable proportions of anthracite, and the curves obtained thus differ fundamentally from those of Badarau and Tideswell (who used, of course, not only other coals, but electrode carbon as diluent); and the cokes obtained from some well-known coking coals were greatly swollen and of low strength. But it is the author's merit to have shown that when the rate of heating approached more nearly that in the actual coke-oven (3 to nearly 4 hrs.) the coke from the coal alone was very much stronger, and the strength fell as the proportion of anthracite was increased, the curves so obtained resembling those of

Badarau and Tideswell with a rapid rate of heating. Thus a coal with a high proportion of "agglutinating material," which will bind and coke a considerable proportion of non-coking coal, gives in actual practice a high-class coke, though in the laboratory crucible it may give a highly swollen coke destitute of strength. The details of this careful paper are well worthy of study—the results could only be roughly summarised in the space available here.

The Board has published three or four reports on particular systems of low-temperature carbonisation; and in Technical Paper No. 17 we have an account, by Dr. Lander and Captain Shaw, of the Board's own work in this direction. The paper is chiefly a description of the form of retort (a vertical retort carbonising a charge 7 in. wide at the top and 11 in. at the bottom) which the experience of the past three or four years has shown to be most economical and productive. Work on coals of different coking qualities was very seriously interfered with by the coal strike; but the results of trials of nine different varieties are tabulated in the paper, and reports from some of the 180 purchasers of coke from the retorts show that a very valuable smokeless fuel is thus produced. Presumably these retorts are to be used in the large-scale experiment which the Fuel Research Board and the Gas Light and Coke Co. are to initiate and carry on during the next three years; the results will be awaited with widespread interest.

The methods of analysis of coal contained in No. 7 of the physical and chemical survey pamphlets are those recommended by the Sampling and Analysis of Coal Committee of the Board. An interim report was published in 1923 as No. 2 of these papers, and is superseded by the present issue. It is intended that these methods shall be used consistently in the examination of coals for the National Survey, and the Board expresses the hope that they may be adopted generally by analysts throughout the country. The advantages of having standard methods of analysis for a substance like coal, of no definite composition, and valued for different purposes according to its content of ash or of "volatile matter," its calorific value or its coking power, is unquestionable—the analytical differences which give rise to disputes between buyers and sellers are reduced to a minimum, as far as one fertile cause of them is concerned, if chemists on both sides use the same methods; and the fact that these methods have only been issued after trial upon various coals by all the members of the Committee gives assurance that they are all, if not ideal, at least capable of giving concordant results in the hands of different skilled operators. The danger of standard methods, that they may become stereotyped and be adhered to even when the progress of science has developed better ones, is avoided here by the fact that the Committee is a permanent Committee of the Board, charged with the duty of watching the working of the methods and of revising them as may seem necessary or desirable.

These various evidences of the Board's activity will be welcomed by all those who have an interest, whether scientific, economic, industrial or commercial, in our coal supplies and their advantageous use.

MESSEL MEMORIAL CONTRIBUTION

THE INVERSION OF REACTIONS IN CATALYSIS

By PROF. PAUL SABATIER

1. Catalytic reactions are taking a more and more extended place in modern chemistry, and have become of great importance in the heavy chemical industry. The manufacture of sulphuric acid by the contact process, that of nitric acid by the oxidation of ammonia, that of the last-named body from its elements, the synthetic production of ordinary alcohol starting from acetylene, and more recently that of methyl alcohol, the conversion of oils into fats, etc., all depend upon catalysis and make use of catalysts of many varieties, several metals, oxides, and salts acting sometimes on gaseous systems, sometimes on liquids. The activity of powdered catalysts is generally in direct proportion to the fineness of the particles, and becomes diminished or even totally suppressed by the presence of very small quantities of certain materials which act upon the catalysts just as poisons act on living organisms. Moreover, their activity can be increased by the presence of certain substances which activate them just as numerous drugs supplied to animals in small doses increase, for a certain time, their vital activities.

The number of chemical reactions determined or accelerated by the presence of catalysts is day by day becoming greater. The nature of these reactions is very various, as also is that of the catalyst employed. The name "Catalysis," from the Greek *καταλέω*, "I break down," was introduced by Berzelius rather more than a century ago. Its name seems to imply that it will always convert complex molecules into simpler molecules. Indeed, many examples of catalysis are of this character. The addition of a small quantity of sulphuric acid to a solution of starch completely converts the very complex molecules into the smaller molecules of dextrine, and finally into glucose. A pinch of manganese dioxide thrown into hydrogen peroxide very rapidly brings about its conversion into water and oxygen. After a few moments the liquid contains no trace of the original hydrogen peroxide. But, on the other hand, many examples of catalysis are reactions in which combination or further molecular complication takes place. A few drops of sulphurous anhydride added to ordinary aldehyde cooled to below zero effect a very rapid condensation of it into solid metaldehyde.

If we mix nitromethane and formaldehyde, no reaction is visible in the homogeneous liquid, but we have only to throw in a few crystals of bicarbonate of potassium to see the liquor immediately rise in temperature, and on cooling it yields an abundant crystalline deposit of nitro-trimethylol-methane, a single molecule much more complex than the four molecules which have produced it by their union.*

2. It might be supposed that we could divide catalysts into destructive and constructive catalysts, but this distinction really cannot be made because we find that many bodies can, according to circumstances, change their function, and in turn either remove oxygen or

add it, dehydrogenate or hydrogenate, hydrate or dehydrate.

Thus, platinum-black added to hydrogen peroxide destroys it immediately by the removal of the oxygen, and as the platinum-black remains unaltered it can immediately begin a similar operation again. On the other hand, this same platinum-black in the presence of oxygen, even at the ordinary temperature, will affect the oxidation of alcohol, which is thus converted into aldehyde.

Finely divided nickel obtained by the reduction of its oxide is capable at about 180° of causing the combination of gaseous hydrogen with a considerable number of substances; for instance, it converts aldehyde into alcohol. Finely divided copper obtained in a similar way produces the same effect rather more slowly at a temperature of about 200°. On the other hand, acting at about 250° on the vapour of alcohol, it separates hydrogen from it and yields aldehyde, showing that it can act, according to the conditions, either as a catalyst of hydrogenation or of dehydrogenation. As we have already mentioned, the addition of three parts of sulphuric acid to 100 parts of an aqueous solution of starch maintained at a temperature of about 100°, enables us to effect in 2 hrs. the entire conversion of this starch into glucose. The sulphuric acid acts as a catalyst of hydration. But, on the other hand, pinacone $(\text{C}_2\text{H}_5)_2\text{C}(\text{OH})\cdot\text{C}(\text{OH})(\text{C}_2\text{H}_5)_2$ placed in contact with dilute sulphuric acid loses one molecule of water and is converted into pinacoline; that is, a dehydration accompanied by a migration of the atoms.

These changes in the rôle of the catalysts are shown very well in limited reactions where they facilitate at the same time the two inverse reactions and make it possible rapidly to obtain the limit of the reaction without otherwise modifying the degree of this limit. This is the rôle of platinum-black in the formation of hydriodic acid from the gaseous elements hydrogen and iodine vapour, a formation which is limited by the spontaneous destruction of the hydriodic gas produced. In the presence of platinum-black at 350°, the destruction of this latter substance, as also its formation, is very slow, and it is only after a few days that the limit (about 80% hydriodic acid) will be reached. In contact with platinum-black at the same temperature, the limit is reached in a very short time, the same percentage being formed. In the limited reaction which produces the direct esterification of alcohol by acetic acid, in which the limit at the ordinary temperature is not reached until after ten years, the addition of a small percentage of sulphuric acid enables us to reach the limit in less than 1 hr., because the sulphuric acid can act at the same time as a dehydrating catalyst in the reaction of esterification, and as a hydrating catalyst in the inverse reaction of saponification of the acetic ester.

3. How can we explain these inversions of the part played by catalysts? To bring some clarity to the interpretation of these phenomena, we must recall the accepted theory of the mechanism of catalysis. Although this is certainly complex in its relations with atoms and

* Louis Henry. *Compte Rendus*, 121, 210, 1895.

molecules, and obscurities remain on several points, such as the activation of catalysts due to a secondary catalyst, we must nevertheless admit that in all cases the mechanism of catalysis is associated with a rapid formation from the catalyst and some transformable substance of a temporary unstable compound which, as soon as it is formed, reacts very quickly to form the catalyst again in its primitive form, and is capable of indefinitely reproducing the same effect.*

These temporary compounds which form a step in the reaction will often be very easily detected when the conditions are favourable for their persistence. Thus the direct chlorination of organic compounds by gaseous chlorine is greatly facilitated and regularised if we dissolve a little iodine in the liquid which we wish to chlorinate. The reason is that the iodine, in contact with chlorine, forms at once iodine trichloride which is stable and can be isolated if the liquid which dissolves it is not attacked by chlorine, for instance, carbon tetrachloride. On the other hand, if, for instance, the liquid is benzene, the trichloride immediately attacks it, forming chlorobenzene, and thus it is converted into iodine monochloride, which the chlorine changes again into trichloride, and so on, so long as chlorine is added and the benzene still contains atoms of hydrogen which can be replaced. The true catalyst is therefore the iodine monochloride, the temporary combination is the trichloride.

The mechanism is equally well seen in the catalytic method for the preparation of ordinary acetone starting with acetic acid in presence of calcium carbonate, heated to 500°. If we pass acetic acid vapour over calcium carbonate heated only to about 200° to 300° we get merely the elimination of carbonic anhydride and water vapour, and the formation of acetate of calcium which is stable at these temperatures. But if we work at a temperature of at least 500°, the calcium acetate which is produced is converted at the same time into calcium carbonate and volatile acetone, the fresh acetic vapours regenerate the acetate which decomposes again into acetone and carbonate, and so on indefinitely. It is the calcium acetate, never apparent when we work at 500°, which is thus the temporary compound determining the catalysis.

4. In many cases it is true that the temporary compound which forms the basis of the catalyst cannot be isolated and remains a purely hypothetical substance, but by an inductive reasoning which appears to be perfectly legitimate we are led to admit its existence and to imagine its nature, the phenomena observed being exactly parallel to those in which the temporary compound is visible and capable of isolation.

Finely-divided copper is an excellent catalyst for the direct oxidation of organic vapours; for instance, methyl alcohol. If a current of air or of oxygen is led through a tube containing finely-divided copper, heated to about 250°, we see that it is immediately blackened by the formation of cupric oxide CuO . If we immediately pass over the oxide so produced the vapour of methyl alcohol, it is at once oxidised by the

oxide, and red copper is regenerated with the simultaneous formation of water and formaldehyde. These two operations can be continued indefinitely; the passage of the oxygen which oxidises the metal, then the alcohol which reduces the oxide, is oxidised itself, and we may thus prepare an unlimited quantity of aldehyde. It is more simple to combine these two phases by making a mixture of oxygen and methyl alcohol vapour act upon copper at 250°. The copper is oxidised, and the oxide so formed acts at once upon the alcohol, dehydrogenating it into aldehyde. The reaction becomes a catalysis where the catalyst is the copper, and the temporary compound is cupric oxide, although this is not apparent in a preparation which is well performed.

It is impossible not to compare the catalysis which I have just described with that, still more uniform, which permits of the direct oxidation of alcohols, employing as the catalyst finely-divided silver such as exists in silvered asbestos prepared by reducing by formic acid asbestos impregnated with a solution of nitrate of silver. The resemblance between these two catalysts compels us to believe that, as in the case of copper, there is produced on the surface of the particles of silver a thin deposit of oxide, which is produced very quickly in contact with oxygen, and is easily destroyed by heat, but is capable of reacting very rapidly upon alcohols so as to convert them into aldehydes.

It should be the same with finely-divided platinum employed under its various forms, sponge, black or fine filaments, of which the oxidising activity has been used catalytically for a long period in many important reactions, such as the preparation of nitrogen peroxide starting from ammonia and the preparation of sulphuric anhydride starting from sulphur dioxide.

It is this unstable oxide of silver or of platinum, whatever is its nature, which we cannot yet exactly define, which constitutes the determining cause of the catalysis, in which it takes a part in activating oxygen so as to transform molecular oxygen into atomic oxygen.

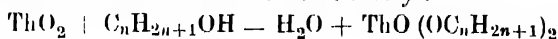
5. Allow me to recall some other examples of catalysis. Nickel, prepared by the reduction of its oxide below 700°, is, as I showed more than twenty years ago in conjunction with M. Senderens, a catalyst almost universally applicable in direct hydrogenation, and I have explained its activity by the immediate formation upon the surface of its particles, in the presence of gaseous hydrogen, of an infinitely thin layer of hydride, such as NiH_2 or Ni_2H_3 , or, by the superficial fixation of free atoms of hydrogen endowed with much greater reactivity than that of hydrogen H_2 . We can prove that such reduced nickel absorbs a very important volume of this gas. This volume (about 19 volumes at 20°) is much less than that fixed by platinum black (110 volumes), or by reduced cobalt (153 volumes), and very much less than that fixed by palladium black (850 volumes), which are nevertheless much less powerful hydrogenating catalysts. The actual existence of a definite hydride of nickel produced on the surface of this metal has been recently confirmed by the preparation of solid brown hydrides NiH_2 and NiH_3 , obtained by the

* Paul Sabatier, "La Catalyse en Chimie Organique," 2nd ed., p. 55, Paris, 1920.

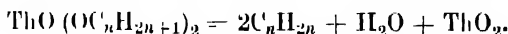
direct action of hydrogen upon a colloid solution of the metal; these have very active hydrogenating properties.

6. The primary aliphatic alcohols, when brought in the state of vapour in contact with various anhydrous catalytic oxides (alumina, thoria, blue oxide of tungsten), are easily converted at a temperature of about 350° into ethylenic hydrocarbons and water. I have attributed this to the formation on the surface of these oxides, with the elimination of water, of a thin layer of a kind of ester comparable to ethyl hydrogen sulphate; this, with ordinary alcohol, produces sulphuric acid, and, like it, is converted by heat into an ethylenic hydrocarbon and regenerated oxide.*

So with thoria we obtain successively:—



afterwards:—



The thoria so reproduced can indefinitely produce the same effect if we continue to supply it with the alcohol vapours. We have not been able to isolate by this method the intermediate compound, which is the thoriate or aluminate of alcohol (which we may also consider as an alcoholate of thorium or of aluminium) because the temperature of its formation is no doubt about the same as that of its conversion into hydrocarbon. But such compounds exist and can be prepared. Thus, by the action of aluminium amalgam on ordinary alcohol we can obtain alcoholate of aluminium (or ethyl aluminate) which, in other circumstances, in accordance with our theory, is converted by heat into alumina, ethylene and water. This conception of unstable thoriates or aluminates very quickly formed on the surface of the catalysts by the alcohol vapour enables us to predict reactions which experience verifies with startling precision. These compounds, comparable with esters, should immediately they are produced react like ethyl hydrogen sulphate and yield with ammonia, amines; with sulphuric acid, thiols; with phenols, mixed oxides; with formic acids, the esters of these acids, and I have shown, with M. Mailhe, that this is the true explanation.

7. We think that in all cases of catalysis the reality of temporary compounds should be admitted. In particular, if we consider exothermic reactions taking place with loss of energy like most of the direct oxidations or hydrogenations, we can regard these temporary compounds as intermediate stages in the lowering of the energy of the system. But we can expect also that they can act in both directions—that is to say, by lowering or raising, if the external energy tends to form the temporary compound; by the interaction of the same unstable compounds, the catalysts should act at the same time as catalysts of hydrogenation or of dehydrogenation, catalysts of oxidation or of taking away oxygen, catalysts of hydration or of dehydration. Experience verifies this in many cases, and we can establish certain facts as to the conditions of reversal of their functions. If the reaction we are considering is very exothermic and takes place spontaneously and completely on attaining a particular temperature, the

presence of the catalyst makes the action more rapid, and allows it to take place at lower temperatures. In this case the action will only take place in one direction; the inverse action cannot be realised even with the help of the catalyst unless, perhaps, at very high temperatures, when the dissociation of the molecules becomes important and permits of the reciprocal action of free atoms.

8. In the decomposition of hydrogen peroxide into water and oxygen, which tends to take place completely at all temperatures (below 100°), very slowly in the cold and very quickly at the boiling point, the presence of a little platinum-black is sufficient to set up a rapid decomposition in the cold almost immediately; the action is always complete. No equilibrium is possible in these conditions, the variations of pressure having no definite influence. Finely-divided platinum is here the deoxidation catalyst, and it acts by the very rapid formation on the surface of each particle of a sort of unstable oxide which decomposes very quickly, giving off molecular oxygen, $2\text{H}_2\text{O}_2 + 2\text{Pt} = 2\text{PtO} + 2\text{H}_2\text{O}$, and $2\text{PtO} = 2\text{Pt} + \text{O}_2$, the two reactions being extremely rapid. The first alone is very exothermic, the calorific effect of the second is probably of but little importance. It is to a similar type that the deoxidation catalysts of molten chlorate of potassium and the solutions of alkaline hypochlorites belong. Chlorate of potassium heated alone melts at 350°, and at a slightly higher temperature it decomposes into oxygen and a mixture of perchlorate and chloride. The evolution of oxygen gradually diminishes, and to obtain a complete transformation into chloride of potassium, the temperature must be raised gradually to a dull red heat. On the other hand, if platinum-black is mixed with the chlorate, the latter decomposes without melting at 270°, and the reaction is rapidly completed without the necessity of further heating. Manganese dioxide is an even more active catalyst. With equal weights of dioxide and chlorate the reaction commences at 205° and goes on so quickly that the mass may become red hot and cause an explosion. The intermediate compound is in this case no doubt a peroxide of manganese. Solutions of chloride of lime CaOCl_2 , or of an alkaline hypochlorite such as KOCl , which are normally stable, very rapidly decompose into chloride and gaseous oxygen when certain metallic oxides or the hydrates of iron, manganese, cobalt, etc. are added. It is again the formation of an unstable peroxide which enables us to explain this catalysis, which, like the preceding ones, is complete and is accelerated by a rise of temperature.

(To be continued.)

CALENDAR OF FORTHCOMING EVENTS

- Aug. 20. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, Newcastle-upon-Tyne. Annual Meeting at 2.30 p.m.
- Aug. 31. BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Annual Meeting (97th year) at Leeds.
- Sept. 9. INSTITUTE OF BREWING, Research Fund Committee and Corporate Members. Visit to hop-growing districts in Kent. Luncheon will be held at Canterbury. (Provisional date.)

* P. Sabatier and A. Mailhe, *Ann. Chim. Phys.* (8), 20, 349; 1910

THE CONVENTION OF CANADIAN CHEMISTS

The tenth annual Convention of Canadian Chemists was held at Quebec from June 6—9. The picturesqueness and beauties of the grand old capital of Canada, containing an architectural blending of old France and modern America, and the historical interest attached to the city, created an ideal place to hold the convention on the Diamond Jubilee of the Dominion.

It was particularly appropriate in that the building wherein the Confederation conference of the thirty-three representatives of the British North American colonies met and formulated the seventy-two resolutions which became the basis of the British North America Act of Confederation stood immediately adjacent to the convention hall of the Laval University. Just as the Confederation pact was accomplished in the ancient capital, the more historically inclined could not refrain from recalling that here was the cradle, not only of old Canada, but also of modern Canada, and that in this city, nearly two centuries ago, the French transferred its future control and conduct to the British. Also, those attending the meeting, at the gateway to the great Dominion, observed that here stands an impressive object lesson to newcomers and visitors, of amity among former foes and different races, in the common monuments erected to the memories of victor and vanquished—Wolfe, Montcalm and the brave men of Levis, Murray—an omen so eminently characterised in the generous courtesy and hospitality unostentatiously extended by "les Quebecois" of the present day.

Probably, the most striking feature of this meeting was the attitude of the Government of Quebec in extending official recognition and support to the Convention. This was only to be expected in view of the great interest taken by Premier Taschereau and his cabinet in the development of chemical and allied sciences and industries.

The opening session was the annual meeting of the Canadian Sections of the Society of Chemical Industry, held in the amphitheatre of Laval University, with an attendance exceeding two hundred. Dr. Alfred E. Macintyre, Chief Explosives Chemist, Ottawa, Chairman of the Canadian Council, presided.

Alex. E. MacRae, B.Sc., Patent Attorney, Ottawa, Secretary of the Council, presented the report for the year. It covered the activities of the Society in Canada and the general position and affairs of the parent

The chairman delivered an address upon "Factory location; with special reference to chemical and allied industries." He reviewed the rise, decline and decay of some former important industries of Canada, and compared the continued progressive development of similar industries abroad. The reason for the decay was attributable, in no small measure, to improper location for continued economic operation. Many of the important factors in evaluation of factory location were considered, such as: sources of raw materials, fuels and power, market for products, transportation facilities, labour, climate and living conditions, taxes and laws, site, etc. The various features in regard to these were discussed, and it was pointed out that no fixed rating could be established for any one of the factors, but that each

must be appraised, per se, in connexion with each individual industry. Examples were given of the influence, on industrial life and success, of errors of judgment in appraisal of certain factors. A number of problems connected with Canadian industry, such as decentralisation, power transportation in various forms, establishment of industries on economic and scientific bases, importance of conservation and proper utilisation of the natural resources, etc., were discussed.

Prof. P. Montpetit, University of Montreal, delivered the centenary address upon "L'Oeuvre de Marcellin Berthelot." Berthelot's activities in organic chemistry and particularly his influence on modern synthetic chemistry received attention, being followed by his pioneering researches on thermo-chemistry and explosives and other branches of the science. His political services to France as Minister of Education and Foreign Minister were discussed, and his contributions to the history of chemistry, in particular to Egyptian alchemy, were considered.

Professors F. B. Kendrick and W. H. Martin, Toronto University, gave an experimental demonstration of the fluorescence of water under the influence of light of short wave-length. Pure distilled water was shown to fluoresce.

The Bakelite Corporation of Canada presented a very interesting industrial film illustrative of the "Story of Bakelite."

A complimentary luncheon was offered to those attending the Convention at the Château Frontenac. Col. John Price, President of Price Brothers Co., Ltd., presided, and his Worship, Dr. V. Martin, Mayor of Quebec, extended a cordial welcome to the ancient capital, felicitously expressing the hope that great results would accrue from the Convention.

Dr. H. Hibbert, Professor, McGill University, delivered a very effective address on the past accomplishments of chemistry, indicating fields of future activities which would be more far-reaching in effect than any previously attained, and invaluable to the future industrial development of Canada. Research and co-operation would bring these to fruition.

At the afternoon technical meeting the chair was occupied by W. A. P. Schorman, Toronto.

S. J. Cook, B.A., Statistician of the Chemical and Mining Division, Bureau of Statistics, Ottawa, read a paper on the "Progress of chemistry in Canada since Confederation." He emphasised the fact that at Confederation (1867) Canada possessed very few chemical and allied industries, and gave statistics showing the present position.

Dr. W. Lash Miller, Professor, Toronto University, and E. M. Sparling gave an account of the progress, during the past year, of further investigation upon Bios II.

A. R. Gordon and F. M. Archibald, Toronto University, contributed an interesting paper upon "The volumes occupied by mixtures of coarse and fine sands."

Prof. Brot., Ecole de Papeterie, Grenoble, gave an address on "The dyeing and uses of artificial silk." The lecturer devoted the greater portion of his attention to acetate silk and the Continental dyestuffs employed for dyeing this material.

The report of the chairman of the committee appointed at the last convention regarding the formation of a

Canadian Chemical Association was received and, after discussion, adopted. A new committee of organisation was appointed.

A large and appreciative audience was present at the public meeting held in the Graduation Hall of Laval University at 8.30 p.m., with Monsignor C. Roy, Rector of the University, presiding. After a beautiful rendering of three "Chants Canadien-Français" by a male choir of Laval students, Dr. E. Blough, Technical Director of the Aluminum Company of America, Pittsburgh, Pa., gave an interesting and instructive address upon aluminium and its development. Commencing with the preparation of metallic aluminium by Wöhler, a century ago, the speaker traced the scientific and economic development of the metal to the discoveries of Héroult and Hall. The early stages of the commercial manufacture and application received adequate attention, followed by a very full description of the modern process of production, which was illustrated by slides. The sources of all the raw materials were indicated and the methods for their utilisation in the industry explained, including the appliances and energy necessary for production. The use of aluminium and its application for many purposes, such as bodies of automobiles, street cars, railway carriages, aeroplanes, etc., were discussed and illustrated on the screen; while the wide application of aluminium for light alloys in the various industries and mechanical appliances was elucidated very fully. The address closed with a number of experimental demonstrations specifically characteristic of the metal.

Prof. J. Watson Bain, Toronto University, presided at the morning session on June 7.

Mr. C. F. Bardorf, Montreal, gave an interesting account of investigations upon "Sugar cane wax."

Dr. G. S. Whitby, Professor, McGill University, discussed the polymerisation of hydrocarbons as applied to the possible synthesis of isoprene and rubber.

S. G. Lipsett, of McGill University, presented the results obtained by Profs. F. M. G. Johnson, G. Maass and himself of an investigation on "the heat of solution and surface energy of solids." The speaker described a new type of adiabatic calorimeter which had been developed to carry out the determinations with a degree of accuracy approaching 0.05%. The results obtained were made by determining the difference in heat of solution of the solid (in this case sodium chloride) in coarse crystalline and finely divided states.

Dr. L. V. Redman, Chairman of the American Section of the Society of Chemical Industry, gave a succinct, yet full, description of the observable properties of "synthetic resins," with an evaluation of the properties required. The various sources of these resins were considered, and the properties of each were discussed in relation to the evaluation factor. Thus, the advantages or disadvantages of the phenol, urea, thio-urea, etc. resins, were presented and their application illustrated.

In his two addresses on "The nature and properties of the carbonyl group," and "Cyclic acetal formation and its bearing on the constitution and properties of the polysaccharides," Dr. Harold Hibbert opened up a wide field in dealing with polymerisation and condensation among a large number of simple aliphatic compounds, with the formation ultimately of cyclic substances;

and in the process features developed which would account for the formation of many intermediate plant substances and ultimately the more complex polysaccharides.

Prof. Brot discussed "rayon" production in France, and cellulose from straw by the action of chlorine. He maintained that the latter method was economically feasible, producing an excellent quality of pulp and paper. The contribution of Prof. T. Thorvaldson, V. A. Vigfusson and C. R. Peaker, University of Saskatchewan, upon "The effect of steam on portland cement mortars and their resistance to sulphate action," indicated that steam under pressure had a beneficial influence on the strength of cement.

Lieut.-Col. the Hon. George E. Amyot presided at the luncheon in the Château Frontenac, and Dr. G. S. Whitby delivered an address on certain aspects of chemical development and the work of M. Berthelot.

Dr. Chas. H. Herty, New York, spoke of the rôle which chemistry should play in the future development of Canada, and touched upon the awakening of certain industrialists in the United States to the benefits arising from research. He particularly called attention to the problem of research in regard to health in the United States, where annually enormous sums were expended in medicine, hospitals, etc., all on account of human diseases.

The annual meeting of the Canadian Institute of Chemistry was held, and the various reports received and adopted. Prof. G. S. Whitby was elected president.

Spencerwood, the official residence of the Lieutenant-Governor of the Province of Quebec, was the scene of the garden party. His Excellency, Hon. N. Perroteau, as host, received and entertained the guests. The beautiful and picturesque grounds, overlooking the St. Lawrence River, Wolfe's Cove, and many points of historic interest, presented an animated picture as the party wandered about to the various vantage points.

Sir Georges Garneau presided at the banquet in the Château Frontenac. After the toast to the health of the King had been duly honoured, the Hon. N. Perroteau, Lieut.-Governor, and the Hon. Alexandre Taschereau, Premier, responded for the Province of Quebec. Abbé Alex. Vachon, Laval University, proposed "The Guests," and Dr. H. M. Tory, Chairman of the National Research Council and Principal of the University of Alberta, Dr. A. E. Macintyre, Dr. Lash Miller, Dr. G. Baril, Dr. Chas. H. Herty, Prof. Brot, and Dr. H. Houlston Morgan, London, Eng., replied on behalf of the associations which they represented.

A very interesting session was held on June 8, with Dr. Harold Hibbert presiding.

Mr. E. Price, of the Canadian Celanese, Ltd., Drummondville, Que., gave an interesting account of "Celanese" and its properties.

Prof. J. Watson Bain gave a preliminary account of the fractionation of the "lignosulphonic acids" obtained from sulphite pulp liquors, indicating that the so-called lignosulphonic acid is a very complex mixture of a considerable number of organic compounds with varying composition, particularly in relation to the sulphur content. The investigation is being continued.

The address of L. R. Thompson, Professor of Technology, McGill University, upon recent developments in fuel technology, was an excellent summary of the various methods of carbonisation, with the present status established, and the more probable commercial processes which are the subject of experimental investigation.

Mr. A. E. Plumbeck, Montreal, gave a résumé of the position of the nitrocellulose lacquers and their uses.

A number of chemists were the guests at the Rotary Club luncheon in the Château Frontenac. Dr. C. H. Herry gave an address dealing with the importance of chemistry to industrial development and public health.

The afternoon was devoted to an auto-car excursion to the Battlefields Park, Montmorency Falls (100 ft. higher than Niagara), with its power development, Ste. Anne de Beaupré (the Lourdes of America), and the new paper mill at Beaupré. The visiting chemists had an evening sail upon the St. Lawrence, extending from the Island of Orleans to the Quebec Bridge, at Cap Rouge, thus covering the course over which Wolfe's boats drifted on the eventful night preceding the capture of Quebec. The new harbour works being constructed between Cape Diamond and Sillery and other points of interest were viewed.

The Associated Committee of Chemists of the National Research Council met on June 9, with Prof. R. E. Rattan in the chair. Dr. H. M. Tory gave a full review of the activities of the various branches, and a number of interesting problems and topics were considered and discussed.

In the evening a public meeting was held in the Graduation Hall of Laval University, when Prof. Brot addressed a large audience upon "Cellulose from wood and the nitrocelluloses."

Excursions were made, by parties, to Shawinigan, Arvida, Ile Maligne and Kinogami.

THE ALKYL RESORCINOLS CASE

Mr. Justice Astbury, in the Chancery Division on July 19 concluded the hearing of an action by Sharp and Dolme, Inc., of Baltimore, U.S.A., against Boots Pure Drug Co., Ltd., Nottingham, claiming an injunction to restrain an alleged infringement of a patent (212,922 of 1923), owned by the plaintiff company for improvements in or relating to the manufacture of alkyl resorcinols.

The plaintiffs said the inventions to which the patent related were new substances prepared and produced by chemical processes and intended for medicine. They alleged that the defendants had manufactured substances of the same chemical composition and constitution as the new substances, and had thus infringed the patent. They complained of an advertisement of the defendants and of the sale of "Hexyl Resorcinal Boots," which they said was one of the new alkyl resorcinols. Defendants said the invention claimed was not novel by reason of prior publication and prior common knowledge.

Sir Arthur Colefax, K.C., and Mr. Stafford Cripps, K.C., appeared for the plaintiffs, and Mr. Whitehead, K.C., and Mr. K. Swann for the defendants.

Sir A. Colefax said the attack on this chemical patent

would be found to centre on an alleged want of subject matter. He could not remember a case in which the field of chemistry to be covered was so wide as in this case. The invention related to the production of new alkyl resorcinols which never existed before the date of the plaintiffs' specification, and they were concerned with bodies containing more than two carbon atoms in the alkyl group. He contended that the earlier documents would not avail the defendants, and although there was a paper by Johnson and Lane (J. Amer. Chem. Soc., 1921, 348-360; relating to the preparation of *n*-butyl resorcinol), he would cite Sir James Dewar's dictum that there was no provision in chemistry: there was no such thing as a general reaction in chemistry. The fact that these authors had purported to make discoveries in relation to the lower alkyl resorcinols did not justify any chemist in saying that the same methods would serve for the preparation of the higher alkyl resorcinols, or that these bodies, when prepared, would have analogous or even enhanced disinfectant properties.

His Lordship asked "Are the defendants going to say that the alkyl resorcinols, having previously been made on a general formula, the method of preparing this resorcinol body that the plaintiffs are claiming is not subject matter, because having got an alkyl resorcinol on the general formula with more than two carbon atoms, it is not invention to make it from a different base?"

Mr. Whitehead said that was one of the things they were going to say.

Mr. Horatio Ballantyne, giving evidence for the plaintiffs, stated he found nothing in the documents cited that bore on the plaintiffs' specification. Questioned in detail by Mr. Whitehead as to whether chemists recognised the applicability of generally-applicable reactions in homologous series, Mr. Ballantyne replied to the effect that chemists did not recognise any reaction as generally applicable.

Sir William Pope gave evidence in favour of the novelty of the patent.

Mr. Whitehead, in opening the case for the defence, submitted that the alleged invention as claimed in the plaintiffs' specification had been wholly anticipated. As he understood it, the invention related to a method of manufacturing alkyl resorcinols, and he did not allege that the process would not be effective for producing any alkyl resorcinol. It was part of his case that it was effective for that purpose, and that that was obvious to all chemists. Sir William Pope's evidence was designed to show that so-called general reactions broke down, but it proved that a chemist would try them with a reasonable expectation of success, even if they were not applied to homologues of the bodies with which they succeeded. It was much more likely that reactions which had proved successful for the production of the lower alkyl resorcinols should succeed with the higher homologues. He submitted that the new product could not be claimed apart from the process, and the mere novelty of the product in itself was not good enough.

In cross-examination, Dr. O. Oberlander said he considered that the mere preparation of hitherto unprepared homologues did not involve research. Prof. T.

Gray agreed as to various so-called general reactions which failed, but observed that chemists were expected to use their scientific intelligence. Reactions which applied to certain members of an homologous series did not break down suddenly, but slowed down or showed a greater tendency to begin secondary reactions. Dr. J. Marshall, research chemist to Messrs. Boots, described how he was led, from inspection of the literature, to prepare hexyl resorcinol, which was produced on the manufacturing scale within six weeks.

His Lordship, giving judgment, reviewed at great length the papers relied on as showing prior publication, and said there was no inventive step in the plaintiffs' patent at all having regard to what had been published in those documents. In his opinion the prior documents on their true construction made it impossible for a chemist subsequently to acquire a valid patent for continuing the published work of those who had gone before them on their lines, following out their directions with the bodies indicated by them for the purpose of producing the results which they had been told to expect by so doing. This would be too great a reward for merely verifying the work of others, and proving their general statements and conclusions to have been well-founded, and would, if countenanced, be a serious blow to chemical industry. The action would be dismissed, with costs.

NON-FERROUS METALS IN CANADA, 1926

Finally revised statistics on the production of various non-ferrous metals in Canada during 1926 are reported by the Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics as follows:—

Mercury.—According to the Provincial Mineralogist of British Columbia some work was carried on at a cinnabar property at Copper Creek near the north shore of Kamloops lake during 1926, and 5 flasks of quicksilver were obtained by retorting the ore obtained.

Molybdenum. Production in 1926 amounted to 25,168 lb. of molybdenum concentrates containing 20,943 lb. of molybdenum sulphide valued at \$10,472, as against 30,764 lb. of molybdenum concentrates containing 22,350 lb. of molybdenum sulphide valued at \$11,176 in 1925.

Tin. Small amounts of tin are contained in the ores of the Sullivan mine of British Columbia, but it has not been recovered commercially up to the present time.

Cobalt.—Finally revised statistics show an output for 1926 of 664,778 lb. of cobalt valued at \$1,136,014, as against 1,116,492 lb. (\$2,328,517) in 1925. This production figure includes the cobalt content of the various cobalt products sold by the south Ontario smelters and the cobalt content of the ores and residues exported for treatment in foreign smelters; the value given is the net amount received by the shippers.

The decline in production was caused by the introduction into the world's markets of cobalt from central Africa, where it occurs in association with copper in the mines operated by the Union Minière du Haut Katanga. This company now produces about 45% of the world's output, and the Canadian production makes up the remaining 55%.

No production of chromite or manganese was reported for 1926.

CORRESPONDENCE

PROCEEDINGS OF THE COAL CLEANING CONFERENCE

SIR,—The Proceedings of the Coal Cleaning Conference, held under the auspices of the Joint Committee of the Institution of Gas Engineers, the Coke Oven Managers' Association, the Fuel Section of the Society of Chemical Industry, and attended by a number of mining engineers, are being published as a separate volume, including a verbatim report of the discussion.

This procedure has been arranged as a result of suggestions received from many quarters, and the whole will be published in a paper cover at a cost of 2s. 6d. post free. Copies can be obtained from the

General Secretary,
Society of Chemical Industry,
Central House, Finsbury Square,
London, E.C. 2.

As only a limited number of copies are being published, we should be glad to learn whether you would like us to reserve any for your members.

Yours truly,

(Signed) E. W. SMITH.

Hon. Secretary,

Fuel Section of the Society
of Chemical Industry
Central House,
Finsbury Square,
London, E.C.2.

THE REFINING OF MINERAL OILS

SIR.—The views expressed by Mr. Lee in your issue of July 22, concerning the changes which mineral oils undergo during the sulphuric acid refining process appear to receive some support from recorded facts relating to the oxidation of insulating oils.

The official adoption of the "sludge value" test for these oils has led to drastic refining whereby colourless oils are obtained which have practically zero iodine values and do not produce "sludge" upon oxidation. Such oils are, however, by no means stable, and their oxidation results in the formation of water and acids having a marked odour.

It has been suggested that the resin-like substances present in the partially refined oils, while being responsible for the formation of "sludge," afford protection to the hydrocarbons, and that thorough refining leaves the latter unprotected. Mr. Lee's suggestion that refining brings about a change from cyclic compounds to *iso*-paraffins seems to offer a more reasonable explanation of the phenomenon, as the liability of poorly refined oils to give rise to asphaltic substances may be ascribed to the presence of complex cyclic compounds (particularly those containing double bonds) and the instability of the "non-sludging" oils is more easily understood if, as Mr. Lee suggests, they contain *iso*-paraffins.

I am, Sir, etc.,

CECIL O. HARVEY

PERSONAL AND OTHER ITEMS

Sir Alfred Mond has been elected President of the Chemical and Allied Employers' Federation. Sir Alfred and Lady Mond are now on the Continent, where they will remain for about a month.

Lord Colwyn has been elected to the board of Imperial Chemical Industries, Ltd.

On July 20 Mr. S. A. Courtauld laid the foundation stone of the Institute of Biochemistry at the Middlesex Hospital, for the provision of which he has given £40,000. The professor of biochemistry in the new institute is Dr. E. C. Dodds.

Dr. J. Gordon Parker, principal of the Leathersellers' Technical College, has resigned from his post. Dr. Parker, who was one of the founders of the International Association of Leather Chemists, has been associated with the Leathersellers' Company for 31 years.

The following appointments in the University of Manchester have been made: Lecturer in electrometallurgy, Mr. E. O. Jones, B.Sc., assistant lecturer in chemistry, Mr. W. S. McGinness, B.A.

Dr. W. H. Linnell has been appointed University Reader in pharmaceutical chemistry in the London University.

The degree of D.Sc. in chemistry of the University of London has been conferred upon Messrs. P. B. Ganguli, E. S. Hedges and S. J. Lewis.

A Senior Studentship for 1927 has been awarded by the Royal Commissioners for the Exhibition of 1851 to Mr. R. Hill, for research in biochemistry.

The Priestley Scholarships in chemistry, at the Birmingham University, were won this year by Harold G. Bott, Horace A. Hampton, and Robert S. Tipson.

Dr. G. W. Thompson, chief chemist of the National Lead Company, delivered the graduation address at the Armour Institute commencement exercises in Chicago, on Thursday, June 9, and received the honorary degree of D.Sc. Dr. Thompson was born in 1865, and has been chief chemist and a director of the National Lead Company since 1892. He is also a director and vice-president of the Wm. Harvey Co., director of the Titanium Pigment Co., director and vice-president of the United Lead Co., director and treasurer of the Metallurgical and Chemical Corp., a member of the Society of Chemical Industry, the American Chemical Society and other scientific bodies, and a past president of the American Society of Chemical Engineers.

Beit Fellowships at the Imperial College of Science and Technology have been awarded to: Mr. I. Vogel, M.Sc., who will continue his studies on ring formation, and to Mr. K. V. Themann, who will investigate the effect of electrical currents on proteins. An extension for a second year has been granted to the Beit Fellowship held by Mr. J. Topping for research on the mechanical equilibrium of crystal lattices, and to that held by Mr. J. W. Maccoll for studies in the motion of viscous fluids.

We record with regret the death of Mr. W. G. Richards, Grad.I.Chem.E., who since 1919 had been resident in Brazil. He had carried out much research work in connexion with ore-dressing and concentration, and had just secured an important new appointment when he succumbed to typhoid fever shortly before his 27th birthday.

The death is announced of Hans Blücher, the author of the well-known "Auskunftsbuch für die Chemische Industrie," now in its 12th edition, and several other technical books. Herr Blücher, who had been a member of the editorial staff of the *Chemiker-Zeitung*, had specialised in plastic materials, and was the discoverer, with E. Krause, of "ernolith," a plastic material made from yeast.

Prof. V. Lenher, of the University of Wisconsin, has died, aged 54. He had carried out important work on selenium and tellurium, and was the first to note the unusual solvent properties of selenium oxychloride.

The late Prof. E. H. Starling, Foulerton Research Professor of the Royal Society, left £14,310.

The late Mr. A. B. Reckitt, joint managing director of Reckitt & Sons, Ltd., starch and blue manufacturers, left £548,516.

Sir Alfred Mond on the Future of Industry

In an interview published in the *Evening Standard* of July 25, Sir Alfred Mond made some interesting comments on the future of British industry and the great power of the Empire as an economic unit. After reaffirming his conviction that the future of British industry is bound up with the progress of chemical and scientific research, Sir Alfred Mond said Great Britain must become independent as far as possible of imported raw materials. Through the high-pressure nitrogen industry, they could see the lines along which that could be done. Production at Billingham was on a large scale, and would be enlarged. They were carrying out tests of a new system of rotational grazing of grass treated with combined nitrogen at 80 farms, and he believed that during the next five years, as a result of chemical research, a new era would have dawned for British agriculture. Within the next five years we should be making large quantities of oil from coal by the I.-G. process, and there would be great developments towards the production of synthetic alcohol and vitamins. The co-operation of labour in industry was essential, and they were now formulating a labour policy for Imperial Chemical Industries, Ltd., based upon the principles of profit-sharing, works councils, welfare schemes, workers' shares, and co-operation in every possible direction.

Fuel Conference, 1928

The technical programme for the Fuel Conference to be held at the Imperial Institute, South Kensington, from September 24 to October 6, 1928, has now been issued. Lord Balfour has accepted the Hon. Presidentship and Sir Alfred Mond the Presidentship of the Fuel Conference, and the chief participating industries, namely, coal, oil, gas and chemicals, are strongly represented on the Fuel Conference Committee and the Technical Committee. Dr. H. Levinstein represents the Society of Chemical Industry, and Dr. E. W. Smith is a joint technical secretary to the Conference. Representatives of additional interested organisations will be added to the Fuel Conference Committee later. The member countries of the World Power Conference are arranging to participate in the Fuel Conference to the fullest possible extent by the presentation of papers under the various headings of the Technical Programme and by the attendance of

fully representative delegations. In order to shorten the proceedings and to focus the attention of the Conference on the most important aspects of the subjects to be covered, apart from exceptional cases, only authoritative reports from representative bodies in each participating country will be accepted.

Further announcements regarding the Conference will be published later.

Chemical Society's Library

The Library of the Chemical Society will be closed for stocktaking from Monday, August 1, until Saturday, August 13 inclusive, and will close each evening at 5 o'clock from August 15 to September 10.

Statistics

Perhaps one of the most striking of post-war developments has been the increasing recognition of the importance of statistics in all branches of activity in the organisation and management of commercial and industrial enterprises, as well as in the investigation of social and economic problems. Government publications are the most important of all sources of statistics in the United Kingdom from the point of view both of their scope and of their authority. The complaint used to be, however, that this valuable material was unknown and inaccessible except to the few who had specialised in the study of official publications. The introduction of the annual Guide to Current Official Statistics, the 1926 volume of which has just been issued by the Permanent Consultative Committee on Official Statistics (H.M. Stationery Office, pp. 273. Price 1s. net, post free 1s. 4d), has removed all difficulties that may in the past have stood in the way of those who wished to avail themselves of this indispensable source of information. The Guide is much more than a mere catalogue of publications. Its central feature is an index on novel lines, which not only directs the enquirer to those volumes which contain statistics bearing on his subject, but also indicates their scope and degree of detail. To trace all the statistics on the varied subjects dealt with in Government publications is a matter of a few minutes with the aid of the Guide, which should prove a handy work of reference for the business man, writer, librarian, student of public or social matters, and professional worker.

Chemistry as a Career

A "Careers" pamphlet issued by the Faculty of Science of the University of Birmingham states that "on the whole" the tendency at present is to divert those students who have put their names down for chemistry and physics towards other branches of science, chemistry in particular being in danger of becoming a congested subject, unable to provide a living for all men who are being trained in it. Only the very best, it is pointed out, may feel sure of obtaining a place after graduating; both industrially and commercially the market for chemists would seem to be overstocked.

The Title "Chemist"

According to the "Journal" of the Institute of Chemistry, the Legislative Council of the Zanzibar Protectorate has passed a decree to regulate the dispensing and sale of drugs and poisons, in which only the word "druggist" is used to define a person who mixes, compounds, prepares, dispenses or sells any

drug or poison. By motion of the Director of Agriculture, Mr. V. H. Kirkham, who is Hon. Corresponding Secretary to the Institute, the word "chemist" was deleted from the decree.

Dinitrophenol and the Explosives Act

By Order in Council, dated June 27, dinitrophenol is declared to be an explosive within the meaning of the Explosives Act, 1875, unless it contains water in the proportion of not less than 15 parts by weight to 85 parts of dinitrophenol, or, if less water is present, the substance is packed, in quantities not exceeding 5 lb., in sealed packages in the construction of which, except for nails or similar parts, no metal other than aluminium or a 90% alloy of it is used. Dinitrophenolates and mixtures of dinitrophenol with other substances are also regarded as explosives unless (a) a dinitrophenolate is mixed with not less than half its weight of water and is kept or conveyed in watertight packages, and (b) dinitrophenol is mixed with not less than three times its weight of anhydrous sodium sulphate, crystallised sodium sulphate, or potash alum.

National Research Laboratories for Canada

The Canadian Government has decided to establish National Research Laboratories at Ottawa under control of the Honorary Advisory Council for Scientific and Industrial Research. The functions of the Laboratories are to comprise standardisation work, similar to that carried out by the National Physical Laboratory in England, and research for private companies, who would pay for the facilities offered.

Empire Mining and Metallurgical Congress

In connexion with the Empire Mining and Metallurgical Congress which meets in Canada in August, the Federal Department of Mines, Ottawa, is kindly offering its services to members who wish to obtain information about mining districts in which they are interested and which they will visit on the tours that will be made after the session at Montreal. For those attending the Congress the Department is preparing a handbook entitled "Canada—Geology, Mines and Metallurgical Industries." Intending delegates from this country can obtain information regarding the mineral industry of Canada from the Natural Resources and Industrial Information Branch of the Office of the High Commissioner for Canada, The Canadian Building, Trafalgar Square, London, S.W.1.

Nickel in Canada in 1926

Finally revised statistics on nickel production in Canada during 1926 as reported by the Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics show an output of 65,714,294 lb. valued at \$14,374,163, compared with 73,857,114 lb. (\$15,946,672) in 1925. These figures include the nickel in matte exported by the Mond Nickel Co., Ltd., and the International Nickel Co. of Canada, Ltd., at 18 cents per lb.; refined and electrolytic nickel produced at Port Colborne at the value obtained for such products sold during the year; nickel in nickel oxide and nickel salts sold from south Ontario smelters and from Port Colborne at its total selling value as oxide or salts; nickel metal sold from south Ontario smelters; and nickel contained in speiss residues exported, valued at 18 cents per lb. The greater part of Canada's nickel is produced by the Inter-

national Nickel Co., and the Mond Nickel Co. Smaller amounts are also recovered by the Deloro Smelting & Refining Co., Deloro, Ontario, from the silver-cobalt-nickel ores of the Cobalt district.

The Explosibility of Lead Bromate

A serious explosion, which caused two deaths and considerable material damage, took place some time ago in Germany in an industrial laboratory during the preparation of about 1 kg. of lead bromate from solutions of potassium bromate and lead acetate. The difficultly soluble lead bromate had been separated and dried, and was being ground up for further purification, when the explosion occurred. Inquiry showed that pure lead bromate would not detonate, except when, as in the present instance, it contained an oxidisable organic substance such as acetic acid. The compound which caused the explosion was found to be diplumbo-diaceto bromate.

Vitamin E in Cod-liver Oil

In the course of some recent work on the food-value of cod-liver oil, as tested by the biological method (*Ind & Eng. Chem.*, July, 1927), Nelson, Jones, Adams and Anderegg have shown that a synthetic diet containing casein, salts, yeast, dextrin, and cod-liver oil as the sole source of fat-soluble vitamins suffices for normal growth and reproduction. The results obtained with cod-liver oil depended upon the manner in which the oil was fed. More favourable results were obtained when the oil was mixed in the ration daily, than when mixed in kilogram quantities of the ration.

Synthetic Fuel in France

A company has been formed, the Cie. des Carburants Makhonine, with a capital of 12 million fr., to exploit the Makhonine patents for the transformation of heavy fuels, tars, coals and the like into motor fuels.

Chemical Industry in France

The directors of the Société Chimique des Usines du Rhône and of the Établissements Poulenc Frères have accepted a scheme for the amalgamation of the two companies.

The capital of the Société l'Ammoniaque Synthétique Procédés G. Claude is to be increased from 20 to 45 million francs.

At present France is producing 100,000 tons of synthetic ammonium sulphate annually, according to M. C. Moureau, president of the "Commission de Défense Nationale pour les Industries Chimiques." To this total should be added 50,000 t. yearly from the cyanide factories and 50 t. a day from the State plant at Toulouse. In a year, it is estimated, France will be producing an output of fixed nitrogen, including synthetic and by-product material, equivalent to 500,000 t. of ammonium sulphate a year, of which the State plant will contribute 150,000 t.

Committee of French Chemical Industries

The chemical companies which recently formed the Committee of Chemical Industries for France, represent a total capital of 857,500,000 francs. The capital (in million francs) of the participating companies is:—Alais, Froges et Camargue, 208; Établissements Kuhlmann, 190; St. Gobain, 161; Electro-Chimie d'Ugine,

80; L'Air Liquide, 60; Bozel-Malettra, 52.5; Grande Paroisse, 50; Usines du Rhône, 27; Coignet, 12; Société Ammonia, 12; and Comptoir des Textiles Artificiels, 5.

The Work of the Government Laboratory, Siam

From the Third Report of the Government Laboratory (Ministry of Commerce and Communications, Bangkok, Siam), for the year ending March 31, 1926, we learn that during the period reviewed, 1025 analyses of a general nature and 1601 assays of silver for the mint were carried out. The investigation of materials submitted by the Botanical Section, with a view to their commercial utilisation, forms also an important section of the Laboratory's work. The erection and equipment of an additional building for work on a semi-technical scale, on investigations of vegetable products, was completed in April, 1925. Provision has also been made in the equipment for the preparation on the large scale of ethyl esters of hydnocarpus oil and vitamin extract, for the treatment of leprosy and beri-beri respectively. The report gives details of the building and of the equipment (which had been selected by Dr. R. Lessing, of London). The demand for hydnocarpus preparations continued to rise, and 107.3 litres were prepared from the oil of *Hydnocarpus anthelmintica*, which occurs in abundance in Siam. It was found that treatment gave an improvement in 71.1% of the cases, and a marked improvement in 22.7% of the total cases (357 patients). Analytical data for the oil of *Hydnocarpus anthelmintica* and its mixed ethyl esters are given in the report.

From work done on the chemistry of opium smoking, it appears that the physiological effects of opium smoking must be largely due to volatile decomposition products of the constituents of prepared opium. Opium smoke only contains traces of alkaloids; the smoke from 5 g. opium yielded 5 mg. of crude morphine and 5 mg. of crude alkaloids other than morphine. Taking 1.25 g. of opium as a normal smoke, this would yield only 0.0025 g. total crude alkaloids in the smoke. A study of the subject should take into account the processes which raw opium undergoes before entering the pipe.

During the period under review 41 articles were examined by the Laboratory, and 17 (41%) were found to contain poisonous principles, varying from arsenic, strychnine, atropine, and mercury to glucosides. The chemico-legal work of the Laboratory also included the examination of stains for human blood. Many (118) drugs were examined for prohibited or restricted alkaloids.

Two hundred and eight samples were received from firms and private individuals for analysis, for which the fees collected were 2316 ticals. The fees received for preparations, chiefly hydnocarpus esters, amounted to 401.75 ticals. A consignment of seeds of *Combretum quadrangulare* (Sakê), collected by the Botanical Section, were sent to the Wellcome Research Laboratories, London, who have undertaken its investigation with a view to its use as an anthelmintic. The report also includes analyses of materials of general interest, such as the fruit of *Dipterocarpus obtusifolius* and seeds of *Strychnos roborans*.

REVIEWS

A SYSTEMATIC QUALITATIVE CHEMICAL ANALYSIS.—A THEORETICAL AND PRACTICAL STUDY OF ANALYTICAL REACTIONS OF THE MORE COMMON IONS OF INORGANIC SUBSTANCES. By GEO. W. SEARS, Ph.D. Second edition, revised. Pp. x + 165. New York: John Wiley & Sons, Inc.; London: Chapman and Hall, Ltd., 1926. Price 10s.

This book consists of four parts with an Appendix and Index. Part I consists of Theoretical Introduction and Laboratory Suggestions; Part II contains the reactions of the metallic ions; Part III those of the acidic ions, and Part IV the Systematic Analysis with Tables of Separation. In each part there are suggestive questions, and discussions of the reactions, which are valuable. The methods of analysis follow the usual lines with a few exceptions. Bismuth and antimony are provided for in Group I in case they are precipitated as oxychlorides. This may occur when ammonium chloride is used as the group reagent, but with dilute hydrochloric acid, which may be used in excess, these precipitates will not remain permanently, and it is a pity to complicate Group I with their presence. Group III is divided into aluminum and iron divisions, the aluminium division containing aluminium, chromium and zinc, whose hydroxides are soluble in sodium hydroxide together with peroxide. That the separation is not very satisfactory in the case of zinc, which may appear in the iron precipitate is, however, recognised by the author. If phosphate is present, the phosphates of the alkaline earth metals and magnesium may be precipitated with iron, and the usual method for their detection, after this precipitation, is adopted; but it is better to regard the phosphate radicle as a disturber of the normal course of analysis, and to eliminate it in acetic acid solution, so that alkaline-earth and other metals which would otherwise form insoluble phosphates, may remain to be precipitated in their proper place, and need not be looked for twice over.

The book calls for no other comment. It is scientific and systematic, as it claims to be; also it is excellently printed. There is no doubt, therefore, that many will find it a valuable guide to qualitative analysis.

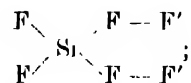
R. M. CAVEN

COURS DE CHIMIE INORGANIQUE. By Prof. F. SWARTS. Fourth edition, revised and enlarged. Pp. 786. Bruxelles: Maurice Lamertin; Paris: Librairie Scientifique J. Hermann, 1926. Price 72 frs. Belges.

This is a comprehensive work, including fundamental chemical theory and physical chemistry, interspersed with descriptions of the elements and their principal compounds, as well as of the chief manufacturing processes given in brief outline. The physical chemistry includes osmotic pressure, theory of ionisation, phase rule, constitution of alloys, colloids, thermochemistry, thermodynamics and Nernst's heat theorem, electrochemistry, radioactivity, and the constitution of the atom.

The treatment is on orthodox lines, and the conventional graphic formulæ are used. For example, sulphuric acid is represented as $\text{SO}_2(\text{OH})_2$ (p. 264), although in

connexion with an account of Werner's theory (p. 752) it is admitted that the four oxygen atoms in the sulphate ion may be regarded as similarly related to the sulphur atom. Also the fluosilicate ion is represented (p. 421) thus:



although it is stated (p. 719) that, according to the work of Bragg, the six atoms of fluorine in this ion occupy the angular points of a regular octahedron, with the silicon atom in the centre.

Valency and atomicity are with this author equivalent terms (p. 67); celtium is preferred to hafnium (pp. 24 and 502); heats of formation are tabulated at the ends of some of the chapters. An interesting and rather unusual division of the *semi-metals* (*métalloïdes*) is into the following families: "halogenes, sulfurides, azotides, carbonides, argonides."

The book is well printed; but it is a pity that the proof-reading was not more carefully done, so that the very long list of errata printed on a separate sheet could have been avoided.

Considering the entire book, one may express astonishment that so much information is contained in a single volume of moderate size. Undoubtedly the work justifies its title, for it gives an adequate account of inorganic chemistry on its descriptive side, and combines with this sufficient physical chemistry to round off the whole, and make it scientific in the best sense.

R. M. CAVEN

A TEXT-BOOK OF PHARMACY. By A. O. BENTLEY, Ph.C. With a section on Some Biological Aspects of Pharmacy. By Dr. H. S. HOLDEN. Pp. x + 540. London: Baillière, Tindall and Cox, 1926. Price 15s.

This book is intended for pharmaceutical students, and treats of the processes used for the manufacture of medicinal preparations, dealing principally with the drugs of the British Pharmacopœia. It is divided into three parts, the first of which deals with the drying and comminution of crude drugs, processes of precipitation, crystallisation, evaporation, distillation and sublimation, and the manufacture of extracts, decoctions, infusions, tinctures, and so on. Illustrations of modern apparatus, as used in the manufacturing laboratory, are included.

Part II deals with the preparations of the Pharmacopœia divided into sections, such as confections, pills, effervescent preparations, spirits, solutions, acids, mucilages, liniments, lotions, ointments, plasters, suppositories, infusions, extracts, tinctures, and wines. Explanatory notes on the official directions indicate the chemical reactions involved and the reasons for the *modus operandi*. The names of the ingredients for each official preparation are given, but the proportions are omitted. The alkaloidal assay processes are given in detail, and biochemical tests recently adopted by the Pharmacological Laboratories of the Pharmaceutical Society are also referred to. A useful feature consists of a set of practical exercises at the end of each section for students in practical pharmacy.

The last section, entitled "Some biological aspects of pharmacy," by Dr. Holden, is a new departure in a text-book of pharmacy. This deals with the preparation of vaccines and sera, sterilisation, and the preparation of surgical dressings, concluding with a chapter on enzymes. Tables of strengths, doses, and solubilities are given in an appendix.

This book well fulfils the requirements of pharmaceutical students, and should prove of great assistance to teachers of pharmacy, being of a somewhat different type from that of previously published works on the subject. It is based on the Pharmacopœia of 1914, and will require revision when a new edition (now overdue) is published. The general principles are clearly outlined and concise, and the volume should have a good reception.

(C. T. BENNETT)

LES IONS D'HYDROGÈNE. By W. KOPACZEWSKI. Pp. x + 322. Paris: Gauthier-Villars et Cie., 1926. Price 40 fr.

The aim of this book is stated to be "practical, critical, and didactic." The didactic part forms the main text in large print: details of experimental manipulation, historical notes, and criticisms of theory and some experimental methods are given in small print. Some of the information is, strictly speaking, irrelevant in a "didactic" text-book written for experimenters; e.g., the diagrams of the structure of some atoms (in which circular orbits only are shown), the estimated radii of the ions Li^+ , Rb^+ , I^- , &c., and the solution pressures of some metals. On account of these and other reasons the book has largely the character of a critical monograph.

The first two chapters, on "Electrolytic equilibria," follow the usual lines, but are rather narrow in scope. Thus there is no adequate account of amphoteric electrolytes or of dibasic acids. Here and there some curious statements are found, e.g., that $\text{N}/_{10} \text{NaCl}$ is 1% hydrolysed. The dissociation constant of aniline is given in one place as 0.0000046 and in another as 4.6×10^{-10} . In the chapters on the measurement of "acidité réelle" hydron concentration—a great variety of instruments and electrical connections is described in an admirable manner. English apparatus is under-represented. The selection of indicators is somewhat meagre. The chapter on "Buffers" is sufficient for the needs of the practical worker. There are chapters on medical and biological application, and some useful tables at the end.

The book is written in a critical and truly scientific spirit, and will serve as a useful corrective to a too implicit reliance upon theories many of which are only rough, if convenient, working hypotheses.

E. B. R. PRIDEAUX

A CATALOGUE OF BRITISH SCIENTIFIC AND TECHNICAL BOOKS. Supplement, 1925. Arranged by DAPHNE SHAW. Pp. viii + 166. London: British Science Guild, 1926. Price 2s. 6d.

The British Science Guild has already published two large catalogues of British scientific and technical books, the last, dated 1925, covering publications up to the end

of 1924. It has now been decided—wisely—to keep the catalogue up to date, however, by the issue of a supplement which, if sufficient support is forthcoming, will be published yearly.

The first supplement covers the year 1925, its appearance having been delayed by "national and other causes." In the previous volumes the subjects were grouped together and sub-headings were provided. This convenient arrangement has been abandoned in the supplement, the subjects having been arranged alphabetically and the use of subheadings discontinued. The system of classification is not one that would provoke an expert librarian to enthusiasm, but there is a good author index, and one soon learns that chemical engineering books must be sought for under chemical industry, which also includes chemical technology; that physical chemistry is included under chemistry, and that, for example, the section on "Photography" must be supplemented by search under both "Physics" and "Chemistry" for certain books on the subject. The supplement is published at the extremely modest price of half-a-crown, it is remarkably complete, and many will like to obtain it to keep their catalogues up to date.

TRAITÉ GÉNÉRAL DE LA FABRICATION DES COLLES, DES GLUTINANTS ET MATIÈRES D'APPRÊTS. By MAURICE DE KEGHEL. Bibliothèque des Actualités Industrielles. Pp. 714. Paris: Gauthier-Villars et Cie., 1926.

This work is a comprehensive treatise dealing with the manufacture, properties and applications of practically every adhesive of animal, vegetable, or mineral origin. The first 298 pages are concerned with the manufacture of glue, fish glue, and gelatin. This is described well, and such recent inventions as the clarification of gelatin liquors by ultrafiltration are fully treated. The second section deals with the properties of gelatin. The work of Procter and others is referred to adequately, and the relation between p_H and the hydrolysis of gelatin is discussed. The methods of analysis given are somewhat deficient from the point of view of the chemist, but physical tests are described very fully, including that by means of the Bloom gelometer. No less than 36 pages are devoted to the preparation of various adhesives and their uses. This forms an important feature of the book, similar information being given for every kind of adhesive, making it a veritable encyclopædia of useful information. It is not stated clearly, in all cases, whether the preparations are protected by patents. Casein, albumin, and isinglass glues are allotted 40 pages, making 402 in all devoted to animal products.

The second part of the book deals with all kinds of vegetable adhesives and gums in a similar manner, whilst the remaining section (40 pages) treats of waterglass, plaster of Paris, and other mineral adhesives and cements. The index is extensive, but the absence of a table of contents makes it rather difficult to find a particular subject quickly. The book contains a great deal of information both scientific and utilitarian, and will be very useful to all concerned in the manufacture of adhesives or the preparation of proprietary adhesive mixtures.

S. R. TROTMAN

PARLIAMENTARY NEWS.

Beet-Sugar Subsidy

In a written answer to Mr. A. V. Alexander, Mr. Guinness stated that the total amount of subsidy paid to the fourteen sugar-beet factories in respect of sugar and molasses in each financial year since the introduction of the subsidy was £492,040 4s. 7d. for 1924—25; £1,066,089 19s. for 1925—26; £3,225,858 15s. 1d. for 1926—27; £152,916 8s. 8d. for 1927—28 to July 16, 1927. The aggregate capitalisation to date of all the subsidised beet-sugar companies amounted to £6,118,756. Individual guarantees were made to six companies under the Trade Facilities Act totalling £2,215,000.—July 20.

Food Preservatives Regulations (Cream)

Replying to Mr. Lamb, Mr. Chamberlain said it was not necessary to introduce legislation to prohibit the reconstitution of cream so as to give the public the same protection as they now enjoy in the case of milk, as the existing provisions of the Sale of Food and Drugs Acts would prevent the sale of reconstituted cream as cream. The Preservatives Regulations will apply to the substitute equally as to genuine cream.—July 21.

Merchandise Marks Act

In reply to Mr. E. Brown, Sir P. Cunliffe-Lister said that inquiries, under Section 2 of the Merchandise Marks Act, 1926, had been held by the Standing Committee appointed by the Board of Trade, and two by the Standing Committee appointed by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department and the Secretary of State for Scotland. No Orders had yet been made, but an Order was laid in draft before the House on July 20 relating to certain descriptions of iron and steel, gold and silver leaf, and woven labels of textile materials.—July 21.

Safeguarding of Industries Act

In a written answer to Mr. E. Brown, Sir P. Cunliffe-Lister stated that since January, 1926, four applications had been referred to committees for inquiries to be held in accordance with the White Paper on Safeguarding of Industries. One of these applications related to certain articles of pottery, and the Finance Bill makes provision for an import duty of 28s. per cwt. on certain tableware of translucent or vitrified pottery.—July 22.

COMPANY NEWS

GAS LIGHT AND COKE CO., LTD.

Dividends have been declared for the half-year ended June 30 last, as follows:—On the 4% consolidated preference stock at the rate of £4% per annum; on the 3½% maximum stock at the rate of £3 10s. per annum, and on the ordinary stock at the rate of £5% per annum. Last year's interim payment on the ordinary stock was at the rate of £5 1s. 4d. % per annum.

SOUTH SUBURBAN GAS CO., LTD.

An interim dividend has been declared at the rate of 6½% per annum, less tax, on the ordinary stock.

CHEMICAL AND METALLURGICAL CORPORATION, LTD.

The seventh ordinary general meeting, held on July 25, was presided over by the chairman and managing director, Sir Frederick Mills, Bt., who stated that during the year research work had been carried on for discovering and

perfecting the best manner by which the platinoids, at present being produced in South Africa, might be most cheaply and advantageously recovered for the purpose of the refiners. This was a useful adjunct to the company's process, as it would work in very well with their main process. After the extraction of the platinoids they would retain and have for disposal the copper, nickel and precious metals, which would have cost very little to produce. Reverting to the main process, the operations at Stratford had now ceased as nothing remained to be discovered on the details of the process. The chairman was confident that within a very few months of starting the process the demand for expansion would be irresistible. With reasonable weather during the next three or four months, the whole of the buildings at Astmoor should be erected and substantial progress made. It was estimated that these works, which were now occupying about 15 acres, would be occupying probably more than 100 acres as years went by.

BRITISH OXYGEN CO., LTD.

The forty-first ordinary general meeting was held on July 14, Mr. K. S. Murray (chairman and managing director) presiding. Taking into consideration the fact that the company's business had been conducted for practically eight out of the twelve months of the financial year under the blight of the worst strikes the country had ever experienced; the shareholders might congratulate themselves on the fact that the same dividend as last year was possible. Since the termination of the coal strike there had been a steady increase in the output of oxygen. On several occasions recently their weekly sales of oxygen had considerably exceeded the highest previously recorded output. The chairman pointed out the analogy between oxygen supply factories and electric power stations, and claimed that prevailing conditions confirmed the wisdom of the company in establishing district oxygen factories of their own. These, he considered, would continue to be the main source of the company's revenue, although they were not neglecting the business of supplying private plants to customers. For the current year the prospects on the engineering side, as well as the oxygen side of the company's business, were distinctly encouraging. Among other work, they had completed several oxygen plants for the Government and private firms at home and abroad, whilst they had other contracts of a similar nature in hand. A total dividend of 8% was declared for the year, of which 2½% had been paid in December last, leaving £145,147 to be carried forward, compared with £172,374 brought in.

INVERESK PAPER CO., LTD.

In order to enable this company to acquire the preference shares of the International Pulp and Chemical Company, the directors propose to increase the capital by £1,000,000 to £2,200,000, by the creation of 400,000 ordinary and 600,000 6½% "B" preference shares of £1 each. Of these, 120,000 of the ordinary and the whole of the preference will be issued in exchange for the International Company's preference. The balance of 280,000 ordinary shares are being created in connexion with other profitable business into which the Board has recently entered.

NATIONAL SMELTING CO., LTD.

The net profit for 1926 was £330,752, compared with £99,261 for 1925. The sum of £100,000 has been transferred to reserve (against nil), and £27,820 (against nil) has been set aside for depreciation of plant, whilst £10,000 (against nil) has been appropriated to staff funds. The ordinary dividend is 10%, compared with 5%, involving an additional 2% to the preference holders, making their total dividend 10%. The sum of £18,582 has been carried forward, compared with £20,650 brought in. This company, which owns extensive works at Avonmouth and Swansea, and is also a large shareholder in the Burma Corporation, was formed with the co-operation of the British Government to increase the British production of zinc.

TANGANYIKA CONCESSIONS

The gross revenue of this company, which is largely interested in the big copper-producing company, the Union Minière du Haut-Katanga, amounted to £608,672, against £825,593 for 1925. The net profit, after meeting all charges and £77,025 written off shares and debtors, was £462,163, compared with £727,877. It is proposed to pay a final dividend on the ordinary shares of 2½%, making 7½% (same), leaving £455,575 to be carried forward, against £130,759 brought in.

MATHER AND PLATT, LTD.

An interim dividend has been declared of 5% on the ordinary shares, free of tax.

CANADA CEMENT CO., LTD.

The total profits for 1926, after providing for depreciation, amounted to \$2,274,007, and after deducting bond interest and reserves there was \$1,580,147. Dividends on preference stock absorbed \$735,000, and on ordinary stock \$810,000, leaving \$35,148, which, added to the amount brought in gives \$1,391,574. The profits for 1925 totalled \$2,314,006. The report states that there was a marked improvement in Canada's purchasing power during 1926 over 1925, which, with the decreased selling price of cement, resulted in the total consumption of cement in Canada for the year showing a substantial increase, and enabled the company's mills to operate to about 57% of their capacity. Export business showed a satisfactory and steady growth.

ENGLISH CHINA CLAYS, LTD.

An interim dividend has been declared on the cumulative preference shares at the rate of 7% per annum for the half-year ended June 30, 1927, payable on August 2 to shareholders registered on July 26.

HOME GROWN SUGAR, LTD.

At the seventh annual general meeting, held on June 15, Sir Ernest Jardine (Chairman and Hon. Managing Director), who presided, said that the Kelham factory performance had exceeded the previous year's excellent record. During the last season 83,654 tons of beet had been worked, compared with 36,757 tons in 1925, an increase of 128%. Their throughput had averaged 775 tons of beet per day. Beet grown on 9840 acres supplied by 2665 growers had been received, as against last year's figures of 1514 growers and 5844 acres. The average sugar content of

beets received was 17.62%, against 16.20% in 1925. In the year under review £240,496 was paid to growers, or an average price of 59s. 4d. per net ton, compared with £102,410 and 55s. 9d. respectively for 1925.

Under the agreement with the English Beet Sugar Corporation, Ltd., the company's share of the trading profit from the working of the Kelham factory was £159,011, compared with £42,115 in 1925, which had been used to discharge its liabilities. £39,791 had been applied to the cancellation in full of the profit notes held by the Government, a liability payable from surplus profits of amounts advanced by the Government in the past to pay the guaranteed dividend of 5% when no profits were available. The directors felt that no further call upon the Government guarantee, which expires on April 1, 1930, would be necessary. In addition to the above repayment the whole of the balance of the first and second mortgages, which originally stood at £75,000 and £40,000 respectively, had been discharged, thus giving the Government mortgage priority of charge over the company's factory and other fixed assets. Further, the Government mortgage, which stood at £125,000, had been reduced to £100,000, and any future available profits would be applied, subject to the 5% dividend to the shareholders under the articles of association, to the further reduction of that liability. The success of the company during the last few years being due largely to the partnership arrangement with the English Beet Sugar Corporation, Ltd., an extension of this partnership had been arranged with the corporation for a further seven years on terms satisfactory to the company. The profit on the estate and farm was £4787, compared with £1961 for the previous year; gross receipts from the cultivation of 272 acres of sugar beet upon the estate amounted to £8806, or over £32 an acre. The average yield was 12 tons 13 cwt. per acre, and the average sugar content 17.9%. During the year certain portions of the Kelham estate had been sold and the moneys applied to mortgage repayment.

NEW TAMARUGAL NITRATE CO., LTD.

The gross profit for the year to July 31, 1926, was £100,145, which includes the profit earned by the London Nitrate Co. for July, compared with £203,908 for 1925. The sum of £50,000 has been credited to maintenance of plant, buildings, etc. fund, and with £66,037 brought forward, and the undivided balance of the London Nitrate Company's profit at July 1, 1926, of £4,720, there was an available total of £105,056, which was reduced to £97,101 by interest and amortisation of the Income bonds. An interim dividend of 5% was paid last September. For 1925 the full dividend was 35%. It is proposed to allocate £17,306 to reserve fund, and to carry forward £69,805. During the year the capital was raised from £277,000 to £550,000. At July 1 last an agreement was made to buy the assets of the London Nitrate Company, and to effect the purchase the capital was raised to £1,000,000.

TARAPACA AND TOCOPILLA NITRATE CO., LTD.

Owing to the unsatisfactory position of the nitrate industry and the uncertainty of its future, the directors have decided not to recommend the distribution of any dividend for 1926.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—0s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoneac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/85.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 4½d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 4½d. per gal. Pale, 95%, 2s.—2s. 3d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 11d.—1s. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 8d.—1s. 10½d. per gal. Pure, 2s.—2s. 3½d. per gal.
 Xylol.—2s.—2s. 4d. per gal. Pure, 2s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—8½d. per gal. Middle Oil, 7½d.—7¾d. per gal. Heavy, 8¾d.—8½d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/160, 1s. 2d.—1s. 6d. per gal. Solvent 95/160, 1s. 5d.—1s. 6d. per gal. Solvent 90/190, 11d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—80s.—87s. 6d. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis. d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—2s. 7½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—5 cwt. lots Cryst. 41s. per cwt. Powder 45s. per cwt. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7½d.—1s. 10d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 3d.—1s. 6d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. per lb.
 Benzophenanthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—5 cwt. lots, Crystal 25s. per cwt. Powder 27s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d. per lb. Potassium.—1s. 11d. per lb. Sodium.—2s. 2d. per lb. Granulated ½d. per lb. less. All spot.
 Calcium Lactate.—1s. 3½d. per lb.
 Chloral Hydrate.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Crocote Carbonate. 6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively;
 730.—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamino.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ½ lb., 9s. 6d. per doz.; ¼ lb., 6s. 6d. per doz.
 Hydroquinone.—2s. 11d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 22s. per cwt.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 11s.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—9s. 6d.—9s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—2s. 9d.—3s. per lb.
 Phenazone.—4s. 3d.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferriyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d. per oz. in 100 oz. tins (1000 oz. lots).
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.
 Sod. Potassa. Tartrate (Rochelle Salt).—90s.—97s. 6d. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb.
 Sod. Sulphide.—Pure reocryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—6s. 6d.—6s. 9d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
 Thymol, Puriss.—10s. 6d.—10s. 9d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.
 Aubepine (*ex Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 6d. per lb.
 Ethyl Cinnamate.—6s. 6d. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol.—9s. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. 6d. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—17s.—18s. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.
 Camphor.—70s. per cwt. Cananga, Java, 26s. per lb.
 Cassia, 80/85%.—7s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%, 22s. 6d. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb.
 Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 18s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Sept. 17th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on August 4th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Barrs and Barrs. Recovery of suspended matter from liquors. 18,711. July 14.
 British Dyestuffs Corp., Ltd., Saunders, and Williams. Decomposition of substances by rapid heating. 18,942. July 16.

Cuker and Romers. Diffusion process and apparatus. 18,462. July 11. (Czecho-Slovakia, 10.7.26.)
 Gowshall. Filter-presses for extracting liquids from viscous substances. 18,479. July 12.
 Hartstoff-Metall A.-G., and Kramer. Pulverising mills. 18,454. July 11.
 Henkel et Cie. Purifying chemicals. 18,494. July 12. (Ger., 24.12.26.)
 I.-G. Farbenind. Feeding materials into high-pressure vessels. 18,386. July 11. (Ger., 10.7.26.)
 Kock and Quitt. Evaporating-apparatus. 18,775. July 15.
 Maschinenfabrik Buckau, and Michaelis. Drying-apparatus. 18,830. July 15.
 Menzel A.-G., and Menzel. Heat-exchange devices. July 14.
 Nivling. Viscosimeters. 18,645. July 13. (U.S., 13.7.26.)
 Prior. Mixing-machines. 18,923. July 16.
 Rosenheim. Absorbing agent. 18,523—4. July 12. (Ger., 30.7.26 and 27.4.27.)
 Smith and Smith. Mixing apparatus. 18,872. July 16.
 Wade (Silica Gel Corp.). Catalysing gaseous reactions. 18,549. July 12.

I.—Complete Specifications

335 (1926). Gilchrist & Co. Separating solids and gases from liquids. (245,476.)
 9492 (1926). Soc. Anon. Manuf. des Glaces et Prod. Chem. de Saint-Gobain. Grading solid substances contained in liquids. (252,683.)
 9911 (1926). Poole. Vapour-pressure thermometers. (273,838.)
 15,156 (1926). Young, and Metropolitan-Vickers Electrical Co. Heat-exchangers. (273,886.)
 8073 (1927). British Furnaces, Ltd., and Smith (Surface Combustion Co.). Heating furnaces. (274,003.)
 *14,101 (1927). I.-G. Farbenind. Continuously carrying out exothermic reactions. (274,048.)
 *18,386 (1927). I.-G. Farbenind. Feeding materials into high-pressure vessels. (274,122.)
 *18,462 (1927). Komers and Cuker. Diffusion process and apparatus. (274,131.)

II.—Applications

Brown, and Simon-Carves, Ltd. Coke ovens. 18,651. July 14.
 Cooper, Henshaw, and Holmes & Co. Treatment of coal gases etc. 18,844. July 15.
 Feige. Low-temperature distillation etc. of coal. 18,439. July 11. (Ger., 16.7.26.)
 Haynes. 18,824. See VII.
 Johnson (I.-G. Farbenind.). Production of gaseous hydrocarbons. 18,597. July 13.
 Koppers Co. Purification of gases etc. 18,724 and 18,934. July 14 and 16. (U.S., 5.11.26 and 7.3.27.)
 Liesens. Composition fuel. 18,366. July 11.
 Perl and Smith. Treating heavy hydrocarbons. 18,542. July 12.
 Soc. Internat. des Proc. Prudhomme-Houdry. Manufacture of synthetic liquid fuels. 18,491. July 12. (Fr., 3.8.26.)

II.—Complete Specifications

8101 (1926). Petroleum Chemical Corp., and Stevenson. Cracking of petroleum oils and the carburetting of water-gas. (273,781.)
 18,634 (1926). I.-G. Farbenind. Purification of hydrocarbons. (255,905.)
 23,429 (1926). Simpson. Low-temperature carbonisation. (273,935.)
 5165 (1927). Wiberg. Reducing to carbon monoxide the carbonic acid gas content in gases. (266,729.)
 6880 (1927). Allgem. Ges. f. Chem. Ind. Converting high-boiling hydrocarbons into low-boiling hydrocarbons. (273,999.)

*13,980 (1927). Wetherbee, Grant, and Hanna. Production of artificial fuel. (274,046.)

*18,234 (1927). Szikla and Rozinek. Gasification of fuel. (274,110.)

IV.—Applications

British Dyestuffs Corp., Ltd., and Thornley. Vat dyes. 18,828. July 15.

British Dyestuffs Corp., Ltd., and Walker. Manufacture of condensation products of phenols. 18,829. July 15.

British Dyestuffs Corp., Ltd., Baddiley, Shepherdson, and Thornley. Manufacture of vat dyes. 18,943. July 16.

Carmichael (I.-G. Farbenind.). Manufacture of amino-anthraquinones. 18,435. July 11. Manufacture of water-soluble anthraquinone glycosides. 18,746. July 14.

Haller and Kappeler. Manufacture of condensation products of arylamines. 18,936. July 16. (Switz., 16.7.26.)

I.-G. Farbenind. Manufacture of azo-dyestuffs. 18,430. July 11. (Ger., 9.7.26.)

I.-G. Farbenind., and Thaus. Manufacture of non-dyeing thio derivatives of phenols. 18,436. July 11.

Imray (I.-G. Farbenind.). Manufacture of vat-dyestuffs. 18,545. July 12.

Johnson (I.-G. Farbenind.). 18,595. See XX. Production of condensation products from phenols etc. 18,715. July 14.

Scottish Dyes, Ltd., Harris, Thomes, and Wylam. Dyes etc. 18,606. July 13.

Soc. of Chem. Ind. in Basle. Manufacture of dyestuffs. 18,432. July 11. (Switz., 10.7.26.)

IV.—Complete Specifications

6920 (1926). I.-G. Farbenind. Manufacture of halogen-dibenzopyrenequinones. (219,147.)

8780 (1926). Soc. Chem. Ind. in Basle. Manufacture of vat-dyestuff preparations. (250,251.)

20,956 (1926). British Dyestuffs Corp., Everatt, and Rodd. Preparing aromatic amines and derivatives thereof. (273,923.)

*16,752 (1927). I.-G. Farbenind. Manufacture of new amino-alkylamino derivatives of aromatic amino-oxy and polyamino compounds. (274,058.)

*18,068 (1927). I.-G. Farbenind. See XX.

*18,184 (1927). I.-G. Farbenind. Manufacture of naphthalene-1:4:5:8-tetracarboxylic acid. (274,103.)

*18,430 (1927). I.-G. Farbenind. Manufacture of azo-dyestuffs. (274,128.)

*18,432 (1927). Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. (274,130.)

V.—Applications

Benthall, Bird & Co., Cable, Godfrey, Spencer, Tarlton, and Wheeler. Extraction of cellulose. 18,740. July 14. (Br. India, 28.5.27.)

Brysilk, Ltd., and Schubert. Manufacture of artificial silk. 18,769—70. July 15.

Ruzicka and Shuttleworth. Manufacture of cellulose esters. 18,753. July 14.

V.—Complete Specifications

747 (1926). Dreaper. Manufacture of artificial silk etc. (273,354.)

9621 (1926). Calico Printers' Assoc., Lantz, and Keyworth. Treatment of cotton fabrics containing artificial silk. (273,830.)

*16,500 (1927). Wolff & Co., Czapke, and Weingand. See VI.

*18,167 (1927). Duhamel, and Comp. Gén. des Ind. Textiles. Washing or cleaning wool. (274,100.)

VI.—Complete Specifications

9503—4 (1926). British Celanese, Ltd., and Ellis. Dyeing, printing, or stencilling cellulose acetate. (273,819—20.)

16,414 (1926). Galvin. Preparation for sizing textiles. (254,720.)

30,160 (1926). Heberlein & Co. Chemically varying vegetable or artificial fibres. (272,165.)

*16,500 (1927). Wolff & Co., Czapke, and Weingand. Imparting a silk lustre to bodies produced from viscose etc. (274,054.)

*17,524 (1927). British Celanese, Ltd. Treating fabrics or articles containing fibres or threads of organic derivatives of cellulose. (270,074.)

*18,067 (1927). Durand & Huguenin. Dyeing or printing with vat-dyestuffs. (274,094.)

VII.—Applications

British Dyestuffs Corp., Ltd., Payman, and Piggott. Removal of free chlorine etc. from fluid mixtures. 18,403. July 11.

Carmichael (I.-G. Farbenind.). Manufacture of finely-divided iron oxide. 18,747. July 14.

Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler. Production of alkali hydride. 18,850. July 15. (Ger., 23.8.26.)

Haynes. Manufacture of carbon dioxide. 18,824. July 15. (U.S., 27.9.26.)

I.-G. Farbenind. Treatment of nitrate earths. 18,716. July 14.

Oesterreichische Chem. Werke. Manufacture of stable solutions of peroxides etc. 18,023. July 13. (Austria, 16.9.26.)

Siemens & Halske A.-G. Generation of ozone. 18,838. July 15. (Ger., 26.8.26.)

Soc. Internat. des Proc. Prudhomme-Houdry. Treatment of metallic etc. compounds by gaseous agents. 18,490. July 12. (Fr., 23.7.26.)

VII.—Complete Specifications

10,086 (1926). Salzwirk Heilbronn, Lichtenberger, and Flor. Obtaining sulphur from the sulphates of earth alkalis. (273,841.)

14,859 (1926). Hart, Harris, Hart & Co., Ltd., and Refiners, Ltd. Manufacture of ferric sulphate. (273,883.)

28,388 (1926). Rhenania-Kunheim Verein Chem. Fabr. Production of solid ammonium carbonate. (262,408.)

9035 (1927). I.-G. Farbenind. Manufacture of alkali bisulphate. (268,817.)

*1173 (1927). Soc. d'Études Minières & Indus. Manufacture of ammonia. (274,023.)

*18,106 (1927). Caro and Frank. Production of compounds of nitrogen and oxygen from ammonia. (274,099.)

IX.—Complete Specifications

4101 (1927). Abrey. Manufacture of artificial stone. (273,989.)

10,047 (1927). Portland-Cementwerk Balingen. Manufacturing acidproof hydraulic binding-agents. (269,549.)

X.—Applications

Bosse, Lauch, Richter, and Siegelberg & Koch. Metallising process. 18,425. July 11.

Brook, Brook, and Brook. Solders for aluminium etc. 18,763. July 15.

Gofmann and Racheff. Welding metals etc. 18,706. July 14. (Fr., 15.7.26.)

Picard and Sulman. Extraction of tin etc. from ores etc. 18,548. July 12.

Sobek. Blast furnaces. 18,807. July 15.

Soc. Internat. des Proc. Prudhomme-Houdry. 18,490. See VII.

Sundberg. Electrodeposition of copper etc. 18,635. July 13. (Sweden, 13.7.26.)

Twynam. Recovery of tin from tin scrap. 18,348. July 11.

Verein Stahlwerke. Manufacture of steel. 18,688. July 14. (Ger., 13.5.27.)

X.—Complete Specifications

6246 (1926). Talbot. Metallurgical furnace plant. (273,779.)

8853 (1926). Jarotzky. Imparting a close texture to metals. (273,788.)

10,046 (1926). Chromium Products Corp. Electroplating with chromium. (258,219.)

11,292 (1926). Hadfield. Manufacture of steel products. (273,855.)

23,376 (1926). Roitzheim and Remy. Furnaces for treatment of zinc ores. (261,344.)

30,069 (1926). Pacz. Production of coatings on aluminium and its alloys. (273,956.)

153 (1927). Krupp Grusonwerk. Working-up complex ores etc. (265,162.)

1737 (1927). Internat. General Electric Co. Electrode operation in electric arc furnaces. (264,851.)

1821 (1927). Mond (Metallbank und Metallurgische Ges.). Roasting fine sulphide ores etc. (273,976.)

*20,677 (1926). Western Electric Co., Inc. Magnetic materials. (274,136.)

*21,622 (1926). Krupp A.-G. Treating low-carbon steel and iron. (274,016.)

*7535 (1927). Krupp A.-G. Unmagnetic or weakly-magnetic cast iron. (274,035.)

*17,046 (1927). Breunig. Recovery of nickel. (274,064.)

*18,215 (1927). Soc. Ital. di Elettrochimica. Production of aluminium in electric furnaces. (274,108.)

XI.—Applications.

Almeida Accumulators, Ltd., and Almeida. Secondary electric batteries. 18,607. July 13.

Almeida Accumulators, Ltd., and Levy. Galvanic batteries. 18,733. July 14.

Elektrochem. Fabr. F. Spitzer, and Panisch. Electric battery. 18,737. July 14. (Ger., 14.7.26.)

Fullilove and Haddon. Electrical accumulators. 18,817. July 15.

Siemens & Halske A.-G. 18,838. See VII.

Sundberg. 18,635. See X.

XI.—Complete Specifications.

318 (1926). Harrison. Electrolytic process and apparatus. (252,320.)

8890 (1926). Heil. Galvanic cells. (250,266.)

9886 (1926). Carpenter, Bacon, and Edison Swan Electric Co. Electric cells. (273,837.)

10,046 (1926). Chromium Products Corp. See X.

11,162—3 (1927). Electric Furnace Co., Ltd. (Northrup). Electric induction furnaces. (274,007—8.)

*18,215 (1927). Soc. Ital. di Elettrochimica. See X.

XII.—Application

Bradshaw and Jackson. Apparatus for extracting oils, fats, etc. 18,781. July 15.

XII.—Complete Specification

18,188 (1927). Bohme A.-G., and Bertsch. Obtaining sulphonation products from fats, oils, or their acids. (274,104.)

XIII.—Application

Marks (Bakelite Corp.). Phthalic anhydride glycerol resins etc. 18,416. July 11.

XIII.—Complete Specifications

10,501 and 12,683 (1926). Heyl. Fibrous paint material. (273,848.)

*17,445 (1927). Carteret. Preparation of a white pigment. (274,072.)

XV.—Application

Hönsch. Preparing cold glue powder. 18,758. June 14. (Ger., 16.7.26.)

XVIII.—Application

Schmidt Serumwerk, and Schmidt. Cultivating micro-organisms. 18,461. July 11.

XVIII.—Complete Specification

25,801 (1926). International Yeast Co. Preservation of yeast. (262,063.)

XIX.—Complete Specification

16,185 (1927). Miles and Reilly. Preparation of vegetable food. (274,051.)

XX.—Applications

British Celanese, Ltd., Dreyfus, and Haney. Manufacture of aliphatic compounds. 18,661 and 18,799. July 14 and 15.

Chem. Fabr. vorm. Schering. Manufacture of iodine substituted benzonitriles. 18,924. July 16. (Ger., 2.8.26.)

Compagnie de Bethune. Catalysts for synthesis of alcohols. 18,797. July 15. (Fr., 17.7.26.)

Johnson (L.-G. Farbenind.). Production of formaldehyde. 18,595. July 13. Production of organic liquids. 18,596. July 13.

Port. Removing nicotine from tobacco products. 18,932. July 16.

Silesia Verein Chem. Fabr. Oxidation of alkyl-aryl-substituted dithiocarbamic acids. 18,422. July 11. (Ger., 30.10.26.)

Soc. Anon. Distilleries des Deux-Sèvres. Manufacture of crotonic aldehyde etc. 18,713. July 14. (Belg., 14.7.26.)

Soc. Anon. Distilleries des Deux-Sèvres. Manufacture of crotonic aldehyde etc. 18,713. July 14. (Belg., 14.7.26.)

XX.—Complete Specifications

5309 (1926). Silberrad. Manufacture of aldol and croton aldehyde from acetaldehyde. (273,776.)

8920 (1926). Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler. Production of heterocyclical arsenic compounds. (250,577.)

9758 (1926). Ramage. Ozonides of hydrocarbons. (273,832.)

18,766 (1926). L.-G. Farbenind. Manufacture of 3:4-benziminazolon-arsenic acid. (256,243.)

115 (1927). L.-G. Farbenind. Catalytic dehydrogenations. (263,877.)

*16,752 (1927). L.-G. Farbenind. See IV.

*17,580 (1927). Holzverkohlungs-Ind. A.-G. Manufacture of concentrated acetic acid or of acetic anhydride. (274,076.)

*18,068 (1927). L.-G. Farbenind. Cyclic ketones. (274,095.)

XXI.—Application

Hummel and Langguth. Producing photographs in natural colours. 18,431. July 11.

XXI.—Complete Specifications

8891 (1926). Polygraphische Ges. Sensitised photographic papers. (250,267.)

*17,576 (1927). Meursing and Gratama. Light-sensitive paper etc. (274,075.)

*18,431 (1927). Langguth and Hummel. Producing photographs in natural colours. (274,129.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Austria*: Leather, artificial resin, casein, non-inflammable celluloid (55). *Canada*: Raw materials for the paint, paper, varnish, polish industries (45); raw materials for the rubber, paint industries [except lithopone, ground barytes, whiting and dry colours] (48). *China*: Glass, glassware, chinaware, paint, varnish, soaps, perfumery, medicines (68). *Germany*: Crepe and sheet rubber (56); leather (57); crude metals and metal waste (60). *Greece*: Pharmaceutical products (62). *Holland*: Artificial silk (63). *Italy*: Sulphate of ammonia (66). *New Zealand*: Steel, iron, concrete (51).

British Industries Fair

Within five weeks of the despatch of application forms 100,000 sq. ft. of space—twice the figure for the same

period last year—was booked in the White City, and the Department of Overseas Trade has now sent a letter to manufacturers who have not yet applied reminding them that space cannot be guaranteed after July 30. The Fair will be held simultaneously in London and Birmingham from February 20 to March 2, 1928.

Change of Address

Messrs. Geoffrey Martin & Taylor, Ltd., have removed their offices from Broad Street Avenue to Cecil Chambers, Strand, W.C.2.

Fine Chemicals

The British Drug Houses, Ltd., has published a new issue of the Catalogue of B.D.H. fine chemical products. The list is divided into convenient sections embracing organic and inorganic chemicals; analytical reagents A.R.; volumetric solutions and a variety of essential products for the laboratory; a wide range of indicators, in addition to the B.D.H. Capillator, Comparator, and soil testing outfit; staining and other microscopic requisites; aniline dyes; and minerals. As with previous issues of the catalogue, this new one will be indispensable for laboratories of every kind.

News from Advertisements

There is a vacant lectureship in fuel technology at the Imperial College of Science and Technology (p. vi).

A Coal Research Fellowship at the Imperial College of Science and Technology is offered in connection with Sensible Heat Distillation, Ltd. (p. vi).

Students will be interested in the facilities offered at the Imperial College of Science and Technology for study and research in fuel technology, chemical engineering and electro-chemistry (p. vi).

An organic chemist requires a post on the commercial or research side of the chemical industry (p. vi).

Chemist requires position, preferably for foods and food preservatives (p. vi).

Chemical engineer requires situation in Europe or Overseas (p. vi).

There are 105 firms represented under the various headings in our Buyers' Guide.

New B.D.C. Dyestuff

The latest pattern card of the British Dyestuffs Corporation, Ltd., draws attention to an addition to the B.D.C. range of sulphur colours Thionol Brown G. This colour gives a bright yellowish brown shade, and is applicable to all types of cotton materials where fastness to washing is of primary importance, whilst its very good fastness to cross dyeing makes it of particular interest for dyeing cotton warps, such as are used for the production of mohair linings and union gaberdines. It is also of interest for dyeing cotton materials which are subsequently to be rubber proofed, as it is fast to the "cold cure" vulcanising process.

PUBLICATIONS RECEIVED

THE SCIENCE OF ROADMAKING. By J. W. Green, M.Inst.M. & Cy.E., and C. N. Ridley, B.Sc., with a foreword by Prof. I. Masson, M.B.E., D.Sc. Pp. xv + 138. London: Crosby Lockwood & Son, 1927. Price 10s. 6d.

THE SCIENTIFIC WORK OF THE LATE SPENCER PICKERING, F.R.S. By Prof. T. M. Lowry, F.R.S., and Sir John Russell, F.R.S., with a biographical notice by Prof. A. Harden, F.R.S. Pp. ix + 247. London: Printed for The Royal Society and sold by Harrison & Sons, Ltd., 1927. Price 4s.

TRANSACTIONS OF THE INSTITUTION OF CHEMICAL ENGINEERS.* Vol. IV. Pp. 209. London: Institution of Chemical Engineers, 1926.

THE DETERMINATION OF SULPHUR DIOXIDE IN FOODS. By G. W. Monier-Williams, O.B.E., M.A., Ph.D. Reports on Public Health and Medical Subjects. No. 43. Pp. v + 56. Ministry of Health. H.M. Stationery Office, 1927. Price 1s. 3d.

LIME AND LIME MORTARS. By A. D. Cowper, M.Sc., A.I.C. Building Research Special Report No. 9. Department of Scientific and Industrial Research. Pp. v + 81. H.M. Stationery Office, 1927. Price 1s. 9d.

BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION. SEVENTH ANNUAL REPORT FOR THE YEAR ENDING DECEMBER 31, 1926. Pp. 36. Birmingham: Office of the Association, 71, Temple Row, 1927.

THE MOISTURE EQUIVALENT OF HEAVY SOILS. II. By A. F. Joseph. Pp. 12—20. ORGANTO MATTER IN HEAVY ALKALINE SOILS. By A. F. Joseph and B. W. Whitfield. Pp. 11. From the Journal of Agricultural Science, Vol. XVII, Part I, January, 1927. Cambridge: The University Press.

THE ELEMENTS OF CHEMISTRY. By W. Foster, A.M., Ph.D. Second Printing—Corrected. Pp. xviii + 576. New York: D. Van Nostrand Co., 1926. Price \$2.00.

EXAMINATION OF THE SOILS OF THE SUDAN. By Dr. A. F. Joseph. Pp. 7. RECENT STUDIES IN HEAVY ALKALINE SOILS. By Dr. A. F. Joseph. Pp. 5. Fourth International Soil Science Conference. IVth Committee. Rome: International Society of Soil Science, 1926.

ANNUAL REPORT OF THE EXPLOSIVES DIVISION OF THE DEPARTMENT OF MINES FOR THE CALENDAR YEAR 1926. CANADA DEPARTMENT OF MINES, EXPLOSIVES DIVISION. No. 21. Pp. 23. Ottawa: F. A. Acland, 1927.

LEHRBUCH DER ENZYME: CHEMIE, PHYSIKALISCHE CHEMIE UND BIOLOGIE. By Prof. C. Oppenheimer, with the collaboration of Dr. Richard Kuhn. Pp. ix + 600. Leipzig: Georg Thieme, 1927. Price, paper 33 m.; bound 36 m.

RECHERCHES EXPÉRIMENTALES D'ANALYSE SPECTRALE QUANTITATIVE SUR LES ALLIAGES MÉTALLIQUES. By T. Negresco. Pp. 120. Paris: Les Presses Universitaires de France, 1927.

DIE RAFFINATION DER ÖLE UND FETTE. By Direktor Paul Pollatschek. Monographien aus dem Gebiete der Fett-Chemie. Edited by Prof. Dr. K. H. Bauer. Vol. IX. Pp. 112. Stuttgart: Wissenschaftliche Verlagsgesellschaft m.b.H., 1927. Price, bound, 9 m.

WÄRMETECHNISCHE GRUNDLAGEN DER INDUSTRIEÖFEN. EINE EINFÜHRUNG IN DIE WARMELEHRE UND GEDRÄNGTE ÜBERSICHT ÜBER DIE VERSCHIEDENEN ARTEN VON BRENNSTOFFEN UND IHRE VERWERTUNG. By Prof. Hans v. Jüptner. Part I. Der Industrieofen in Einzelarstellungen. Edited by L. Litinsky. Pp. viii + 260. Leipzig: Otto Spamer, 1927. Price, paper, 20 r.m., bound, 23 r.m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers' of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 **NEW
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No. 31

EDITORIAL

The Institution of Chemical Engineers

THIS Institution has just published its fourth volume of Transactions, those for the year 1926. They are, like the previous volumes, well printed and well got up, and contain papers of considerable importance. A sound knowledge of the principles of chemical engineering and of the places where exact information on matters of detail may be found is essential to modern industrial chemistry. It is the foundation on which economy and prosperity can be built up. Where men build on false grounds, the more they build, the greater is the ruin; we, therefore, attach the utmost importance to careful and methodical investigations of chemical engineering and welcome their publication, whether they appear in the Transactions of the Institute or in the JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY, or in the volumes issued by any group or section of the Society. The papers included in this latest volume of Transactions are mainly records of accurate observations and the grouping of these into laws of wide applicability: there is nothing imaginative about them: they are warranted to drive solid bolts of fact through the thickest skulls, as one of our great controversialists wrote some years ago. Sir Frederic Nathan's Presidential Address, including his shrewd observations on labour, the cost of materials, and general charges, we have already praised in this journal. The other papers include one on "Filtration," by Mr. A. J. V. Underwood, two on "Corrosion," by Mr. U. R. Evans and Mr. P. Parrish, respectively, two on "Chemically-resistant steels," by Dr. W. H. Hatfield and by Messrs. T. G. Elliott and G. B. Willey, and a paper on "Sugar from wood," by Dr. Ormandy. In some of these papers mathematics play an important part. The methods of algebra and the calculus are powerful and rigid, and when the data are accurate, and the methods of treating them are also accurate, we should expect valuable deductions. But when we remember that algebra enables us to prove that $2 \log 2 = \log 2$ and that the calculus enables us to prove that $\frac{1}{2}\pi = -\frac{1}{2}\pi$, we are comforted if the mathe-

matical results square with a reasonable explanation. We are never quite so confident with the mere differentiation of curves representing slightly inaccurate experimental observations. There are other important papers on the "Extraction of fats," by Prof. J. W. Hinchley and Mr. L. J. Simon and on "Air chlorination," by Dr. Geoffrey Martin; but, really, all the papers appear to us to be of the type which should appear in the transactions of a learned Institution. We congratulate the Institution on publishing this volume more promptly than in the past, and on improving it by the addition of an index.

A National Gas Supply

We are all more or less familiar with the State-controlled scheme for the centralisation of the generation of electricity in huge stations, with the object of eliminating inefficient producers and cheapening the cost of electricity. When the scheme was first put forward, many people wondered what would be the attitude of the gas industry, and much discussion naturally followed. We are not at all sure if the suggestion was then put forward that gas could be distributed nationally just as conveniently as electricity, but the suggestion is now progressing towards actual accomplishment, though not in this country. Some time ago we announced the initiation of a scheme for the supply of heat and power for the whole of Germany from the Ruhr coalfields. The scheme, we now learn, is to be carried out by the A.-G. für Kohlenverwertung, and it appears likely that Germany will eventually obtain its gas supply from one area. Pipe lines are to be laid to cover the whole country, and will be fed from various cokeries, whilst stations will be erected to purify the gas, control its quality and pump it over long distances. It is claimed that the transmission of gas over long distances has the virtues of economy and efficiency. According to *The Times* the average consumption of gas per head of population in Germany is less than a third of that in this country, but enormous sources of supply still await exploitation in the Ruhr. It will

be interesting to see how the scheme progresses, particularly as it may affect the northern German market for British coal, and will certainly have an important bearing on the grading of coal and other mining questions.

The Thermionic Valve

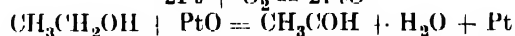
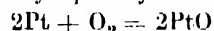
It is not very long since we made brief mention in these columns of some of the applications which the thermionic valve, or three electrode vacuum tube, might have in chemistry. At that time we were not aware that the thermionic valve had been used to any other than a small extent in some of the more obvious physico-chemical work, such as the determination of the electrical conductivity of electrolytes or of hydrogen-ion concentration, the analysis of gases, and so on. But anyone who considers the use of the valve in the detection and amplification of broadcast signals cannot fail to realise that in it we have a tool which offers very interesting possibilities, not only for chemistry, but for chemical industry at large. We remember a demonstration in London a year or two ago, when the valve was used in an appropriate manner to indicate audibly when the washing of a particular product was finished; its properties, utilised in an oscillating circuit, have been employed to prevent the pitting of small metal parts from a factory; and we are even promised that, by its aid, the mere approach of a crackman to a safe will be announced by a clamorous uproar. It was remarked recently in the United States that burglaries were becoming difficult to detect as the burglars had begun to take correspondence courses in chemistry; and now, we suppose, their equipment will need completion by further courses in physics. From a paper read by Mr. H. C. Weber before a recent meeting of the American Institute of Chemical Engineers, we find that the number of industrial applications is growing rapidly. The wireless valve is being used to measure velocities of gases when the velocity is too low for the Pitot tube to be used; for the measurement of pressures, particularly high pressures which are suddenly developed, as in work with explosives; and for the measurement of small distances of the order of magnitude of less than one hundred millionth of an inch. Already the vacuum tube is used industrially to follow the changes in rubber during vulcanisation, to maintain a constant thickness of rubber on cloth in the manufacture of rubber-coated goods, and to maintain a constant amount of moisture in paper pulp during its passage over the rolls of pulp-drying machines. Measurements of conductivity with the aid of the valve are used by the sugar refiner to control the ash content of sugar solutions. An interesting example of the extremely small measurements which are made possible and easy of accomplishment by the vacuum tube was recently given in this country, when an oak table made of wood, an inch and a half thick, was found to bend when an ordinary penny piece was placed upon it. Such a tool should appeal to the chemical engineer, with his demands for accurate measurement, but efficient as the thermionic valve is in respect of the work which can be accomplished with it, we can hardly think that its efficiency in terms of current consumed will meet with his entire approval even though its demands are rated in fractions of watts rather than in kilowatts.

THE INVERSION OF REACTIONS IN CATALYSIS

By M. PAUL SABATIER

(Concluded.)

9. These different bodies, metals or oxides, which are deoxidation catalysts, thanks to their aptitude to fix oxygen for a short time and form unstable compounds, will be, for the same reason, oxidation catalysts. Platinum black at the ordinary temperature produces the direct oxidation of ethyl alcohol by the oxygen of the air. Without a catalyst, at normal temperature, such oxidation is negligible. With platinum, we have successively and very speedily these reactions:--

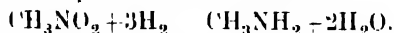


and an identical effect is very vigorously produced at about 200° by the oxides of manganese, iron, cobalt, nickel, etc. The action is, moreover, complete because the catalysts are unable to start the inverse reaction of aldehyde on water vapour. More complex than this is the mechanism of the catalyst in the industrial preparation of nitric acid by the oxidation of ammonia gas in the presence of filaments or thin plates of platinum at about 1000°; the reaction $2\text{NH}_3 + 5\text{O} = 2\text{NO} + 3\text{H}_2\text{O}$ is very exothermic and not reversible. It is almost complete, and in certain works can give a yield of 96%, a small loss being, nevertheless, caused by the side reaction in which nitric oxide is destroyed under the influence of the incandescent platinum. When the two contrary reactions of oxidation and deoxidation are possible under the same physical conditions, thus giving rise to an equilibrium, the same catalysts act to speed up both reactions and rapidly lead to the limit. This takes place in the industrial preparation of sulphuric anhydride by the contact process. Platinised asbestos or ferric oxide simultaneously catalyse the two inverse reactions: $\text{SO}_2 + \text{O} = \text{SO}_3$, which gives off a good deal of heat, and $\text{SO}_3 = \text{SO}_2 + \text{O}$, which is caused by the rise in temperature and becomes of greater importance as the temperature rises. The yield of anhydride is greater when the temperature is lower, but the speed of the reaction diminishes at the same time. In practice, the most favourable temperature is 550° with platinum and 650° with ferric oxide. The production is favoured by the presence of an excess of oxygen, and in accordance with the principle of the displacement of equilibrium, since the formation of anhydride corresponds to a diminution of the volume, an increase of the pressure should increase the yield.

10. Many instances of the hydrogenating activity of finely-divided platinum (platinum black or sponge) have been recorded, but I have shown, in conjunction with M. Senderens (1899—1905), that finely divided nickel, prepared by reducing the oxide, is an incomparably more powerful hydrogenating catalyst of almost universal efficacy. Cobalt, iron and copper, obtained by the reduction of their oxides, possess a similar catalytic power, but to a lesser and not so general a degree. As I have already indicated above, this common property of these different metals—nickel, cobalt, platinum, iron, and copper—can be explained by the immediate formation on the surface of the particles in the presence of

gaseous hydrogen of a thin layer of hydrides capable of giving off very quickly atomic hydrogen to materials capable of making use of it. But these unstable hydrides, instead of being produced from gaseous hydrogen, can also be produced by means of hydrogen furnished by various compounds, and so assist in the dehydrogenation of these. This dehydrogenating power has been long known to be a property of certain metals. Ammonia gas is rapidly decomposed into its elements when it is led through a tube heated to red-heat, filled with iron or copper turnings, and it has been found that the metal is modified in its structure and becomes brittle, which seems to indicate that it has been in temporary combination with one of the gaseous constituents of the system. Many of the hydrogenations effected by the aid of metallic catalysts, whether they correspond to the simple addition of hydrogen to a molecule or whether they take place in compounds of oxygen, produce at the same time water vapour, give out a good deal of heat, and are practically complete and not reversible. This is what happens when ethylene or acetylene are treated in the presence of finely-divided nickel with an excess of hydrogen. At the ordinary temperature they are completely transformed into ethane. It is only at higher temperatures that the reaction is interfered with by dehydrogenating actions and decomposition, which the metal tends to bring about with these hydrocarbons.

The reduction of oxides of nitrogen and of organic nitro-derivatives by means of nickel or copper catalysts is not limited by the inverse reaction :



There is no contrary reaction of methylamine on water vapour. The same thing appears in the hydrogenation of carbon monoxide with the aid of nickel at about 180°. There is complete production of methane alone according to the formula $\text{CO} + 3\text{H}_2 \rightarrow \text{CH}_4 + \text{H}_2\text{O}$. But above 235° a complication is introduced by the special action which carbonic oxide exerts on the metal $2\text{CO} \rightarrow \text{C} + \text{CO}_2$; the carbon thus separated being able in turn to act on the water vapour and the carbonic anhydride being itself hydrogenated to form methane, thus giving rise to a complicated equilibrium.

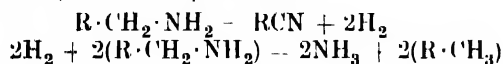
11. The conditions are quite different when the hydrogenation reaction is limited by the simultaneous existence of the inverse reaction. In this case there is the possibility, by choosing suitable conditions in which to work, of carrying out either hydrogenation or dehydrogenation. As we have already pointed out above, the formation of hydriodic acid starting from iodine vapour and hydrogen is a limited reaction. The combination of these two bodies mixed in equal volumes begins very gently at above 200°, rather more quickly at 350°. At these same temperatures, hydriodic acid is slowly destroyed, and the result is a limit corresponding to about 80% of the hydriodic acid formed, a limit which is not reached until after a long period, over 200 hrs. at 350°. The presence of a catalyst such as finely-divided platinum enormously accelerates both these opposing reactions, and so the limit, which in other respects is identical with that obtained without a catalyst, is reached almost immediately. In the reactions which give rise to but little heat and do not produce a change in

the volume of gas, the law of displacement of the equilibrium shows that the limit will scarcely be modified by a rise in temperature or by an increase of pressure, but the proportion of iodine combined will increase if we increase the proportion of hydrogen in the mixture. In the presence of an excess of hydrogen a small quantity of iodine should be almost entirely taken up. The conditions are more favourable in most cases of hydrogenation by addition, usually accomplished with an important production of heat and with diminution of the volume of gas: for instance, the hydrogenation of aldehydes or acetones into alcohols, and the hydrogenation of aromatic compounds into cyclohexane compounds. Thus, in the case of the aldehydes, the positive reaction $\text{R}\cdot\text{COH} + \text{H}_2 \rightarrow \text{R}\cdot\text{CH}_2\text{OH}$, carried out in the presence of nickel, is at temperatures below 180° and under ordinary pressure almost complete except in the presence of an excess of hydrogen. This makes, in practice, an excellent means of preparing the primary alcohols, starting from aldehydes, the product condensed beyond the mouth of the catalyst tube containing only a very small proportion of unchanged aldehyde. Copper obtained by reduction also effects the same catalysis, but less quickly and with not so high a yield, though this is improved if the pressure is increased, according to the law of displacement of the equilibrium. In accordance with the same principle, raising the temperature would be unfavourable, and, in fact, it is found that at about 250° to 300° the inverse reaction, the break-down of alcohol to form aldehyde, $\text{R}\cdot\text{CH}_2\text{OH} \rightarrow \text{H}_2 + \text{R}\cdot\text{COH}$, would tend to predominate, and under ordinary pressure, with reduced copper, makes a good method of preparing aldehydes. The proportion of alcohol in the condensate is small, and is still smaller if, as Bouveault* has shown, we work with a reduced pressure. A greater elevation of the temperature which at first sight might appear to be advantageous would, on the contrary, be unfavourable, because it introduces the destructive action of the metal on the aldehyde, $\text{R}\cdot\text{COH} \rightarrow \text{RH} + \text{CO}$, an action which, in the case of copper, begins to be noticeable above 260° in the case of methanol, but which is less noticeable below 350° for the other aliphatic aldehydes. With nickel, the decomposition of the aldehydes is much more important; this metal, acting even at 180° on alcohol vapour without hydrogen, begins to decompose the aldehyde immediately the alcohol is dehydrogenated. Nickel is used with great advantage in the hydrogenation of aldehydes, but, on the contrary, is unsuitable for their preparation from the primary alcohols.

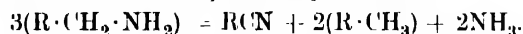
12. Reduced nickel, acting below 250° on benzene, or its homologues, toluene, xylene, cumene, cymene, etc., or on the phenols, aniline and its homologues, assists in the direct fixation of three molecules of hydrogen on the aromatic molecule. The temperature of 180° is particularly suitable, because at this temperature, under ordinary pressure, the fixation is sufficiently rapid and the inverse reaction does not take place to any appreciable extent. We can thus obtain a total transformation of benzene into cyclohexane, there being no attack by the sulphonitric mixture. But if we conduct the operation above 240°, for instance at 300°.

* Bull. Soc. Chim. (4), 3, 50 and 119, 1908.

the inverse reaction $C_6H_{12} \rightleftharpoons C_6H_6 + 3H_2$ takes place to an extent which increases as the temperature rises. At 300° there is therefore a limited reaction, the system involving the simultaneous presence of benzene, cyclohexane, and hydrogen; the proportion of benzene increases, as the temperature rises, to about 30% at 400° . The action of nickel on the vapour of pure cyclohexane produces a similar mixture. In a current of hydrogen the stability of cyclohexane is found to increase; the same effect is produced by an increase of pressure. The direct hydrogenation of phenol gives rise to similar results. In presence of reduced nickel in a current of hydrogen, which is kept in excess, below 170° , the phenol is entirely converted into cyclohexanol, but if the temperature is raised above 200° the inverse reaction, dehydrogenation of the cyclohexanol, gradually commences. At about 230° roughly one quarter is decomposed into phenol, even in a current of hydrogen; at 360° the hydrogenation of the phenol is practically nil, and, on the contrary, the dehydrogenation of the cyclohexanol would be complete at ordinary pressure, but an increase of pressure would make this compound stable. Quite similar results are found in the direct hydrogenation of toluene, xylenes, etc.; working with nickel below 200° , their transformation into cyclohexane hydrocarbons is practically complete; above 250° it is limited because they are dehydrogenated by the metal to an extent which increases as the temperature is raised. In the hydrogenation of aniline at about 190° , the production of cyclohexylamine and dicyclohexylamine (which is always produced) is limited by the tendency of the inverse action towards aniline and diphenylamine. When naphthalene, in the presence of nickel below 175° , is treated directly with an excess of hydrogen, it is practically completely converted into decahydride (decalin), but even at 200° this latter dissociates into tetrahydride (tetralin), and at 300° this latter in its turn is almost completely decomposed into naphthalene. Anthracene gives rise to similar conditions, because the perhydride $C_{14}H_{24}$ is dehydrogenated in contact with nickel at 200° into octohydride, at 260° into tetrahydride, and at 300° into anthracene. Another remarkable inversion of catalysis is found in the direct hydrogenation of the nitriles, which easily and completely takes place at 200° with divided nickel in an excess of hydrogen, producing the corresponding amine $R \cdot CN + 2H_2 = R \cdot CH_2 \cdot NH_2$. But at 300° , in the absence of hydrogen, the amine $R \cdot CH_2 \cdot NH_2$ in contact with nickel is, on the other hand, dehydrogenated into nitrile and free hydrogen which immediately acts upon a portion of the amine to produce ammonia gas and a hydrocarbon:



so that the reaction practically becomes



13. The different examples which we have just quoted show that in the majority of cases hydrogenation catalysts can reverse their functions and become dehydrogenators. As the fixation of hydrogen is generally exothermic, and corresponds with a diminution in the number of the molecules, we see that it will be best to effect

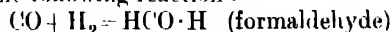
fixation at as low a temperature as possible, and it would be advantageous to carry out the operation with an increase of pressure. A rise in temperature and a diminution of the pressure should, on the contrary, assist the exclusive character of the dehydrogenation reaction. From the aptitude of a catalyst for dehydrogenation we may be permitted to assume its aptitude for hydrogenation. In studying with M. Mailhe the catalytic decomposition of the vapours of ordinary alcohol at about 350° I have been led to distinguish three kinds of catalysts:—

Dehydrogenating catalysts, resulting in the formation of aldehyde with the separation of hydrogen; these are the finely divided metals, and also, although much less active, manganese dioxide:

Dehydrating catalysts, producing ethylene with the elimination of water; these are alumina, thoria, and blue oxide of tungsten:

Mixed catalysts, yielding at the same time both products, but generally with one action predominating. Thus, chromium sesquioxide is especially a dehydrator, whilst zinc oxide is especially a dehydrogenator (it yields a gas containing 95% by volume of hydrogen and only 5% of ethylene).

14. We might suppose that these oxides which we have classed as dehydrogenators, oxide of manganese and oxide of zinc, could also be employed as hydrogenating catalysts, analogous to reduced copper, but much less active. Under similar experimental conditions working at 310° with ethyl alcohol, using similar volumes of catalysts, reduced copper liberated 110 c.c. of hydrogen per minute, zinc oxide 5.5, and manganese oxide 3.5. I have recently determined the hydrogenating capacity of manganese dioxide in relation to nitrobenzene, which only at temperatures exceeding 400° yielded aniline, which, under these conditions, was partially transformed into benzene and ammonia. The application of this oxide or of zinc oxide as a catalyst of only moderate activity would be useful in the hydrogenation of easily decomposed molecules if we could only compensate for their feeble activity by a sufficient increase of pressure in those reactions which result in a diminution of volume. A method of this nature was recently employed in the industrial synthesis of methyl alcohol starting from water-gas. When I had established, with M. Senderens, the remarkable activity which nickel, prepared by reducing the oxide, possesses at 180° as a catalyst to fill with hydrogen the vacant positions in organic molecules, we thought of applying this to carbonic oxide, a bivalent molecule, which can be completed by 1 atom of oxygen, 1 atom of sulphur, 2 atoms of chlorine. We hoped to obtain the following reaction:—



and it might be expected that the formaldehyde so produced would combine with an excess of hydrogen to yield methyl alcohol $H \cdot CH_2OH$. But the nickel catalyst, being too active, goes beyond this point and yields water and methane CH_4 . We thought the nickel might be replaced by reduced copper, a catalyst much less active, but this had no effect below 450° on a mixture of carbonic oxide and hydrogen at ordinary pressure, and at that time (1902) we had not tried the catalytic

action of the metallic oxides, the use of which as hydrogenators did not occur to us until later, when M. Mailhe and I had shown the dehydrogenating activity of several of them in conjunction with the primary and secondary alcohols (1910). The use of high temperatures at ordinary pressure would not give us the desired result, for at 100° methyl alcohol and its aldehyde are not stable in the presence of hydrogen, and decompose completely into carbonic oxide and hydrogen.* On the other hand, the use of high pressures, which stabilise the methyl alcohol and aldehyde, should solve this problem, and at the present time methyl alcohol is prepared by working with copper or with zinc oxide at 400—450° at a pressure of 150–250 atmospheres.

15. It has been known for a long time that the same catalysts can induce hydration reactions. Examples of this are numerous and even classical in organic chemistry, sulphuric acid with a greater or less addition of water being frequently employed for this purpose. If we leave in the cold an aqueous solution of acetic ether, the water causes a slow reaction, regenerating alcohol and free acetic acid, but this hydrating action is limited by the inverse reaction of esterification. At the end of two or three days the proportion of free acid, easily determined by titration, hardly exceeds 1%; the limit would not be reached until after several years. If to such a solution we add a few cubic centimetres of sulphuric acid, the hydration of the ether becomes very rapid; less than a day suffices to reach the limit. On the other hand if we mix equal molecules of alcohol and acetic acid and distil the homogeneous liquid thus obtained, we find that the proportion of acetic ether formed does not exceed 1%. If we add to this liquid a few per cent. of concentrated sulphuric acid, acetic ether is produced with extreme rapidity. This is another instance of a temporary compound formed and decomposed very rapidly, ethyl hydrogen sulphate. It is useful to consider this in these two inverse cases as being the cause of the catalysis. These reactions do not alter the number of molecules, and the heat yielded or absorbed being unimportant, we should expect that the pressure would be without influence on the limit, and that variation of temperature would only modify this very slightly. This is in accordance with what has been found by experience.

16. Solid dehydrating catalysts such as alumina and thoria can also reverse their functions and be employed as hydrating catalysts. Thus, thoria acting on phenol at about 450° converts this into phenyl oxide with separation of water; but I have shown that the vapours of phenyl oxide mixed with water vapour and led over thoria at 450° is partially reconverted into phenol. The dehydrating activity of alumina or of thoria in respect of the aliphatic alcohols is used in practice to transform these into ethylenic hydrocarbons:



This reaction is strictly endothermic. In the conversion of ordinary alcohol into ethylene it absorbs about 17 Calories. It has been supposed to be a complete transformation, but in fact it appears from a number of experiments made in my laboratory by one of my pupils.

* P. Sabatier et Senderous, *Ann. Chim. Phys.*, (8), 4, 463, 1905.

M. Marecek, that it is limited to a small extent by the inverse reaction in which the hydrocarbon is hydrated. This latter reaction, which causes a reduction of the gaseous volume by one half, ought to be assisted by an increase of pressure, and it appears probable that under higher pressures the direct hydrogenation of ethylenic hydrocarbons by water vapour in the presence of alumina or of thoria should enable these to be converted into alcohols in the same way that sulphuric acid of a suitable strength enables this to be done in a liquid medium.

The use of high pressures, which is already a current procedure in laboratories and in the heavy chemical industry, and has enabled us to effect so well the catalytic synthesis of ammonia, enables us, by stabilising the molecules which result from a condensation reaction to utilise, in a useful manner, the reversible activity of various catalysts.

CANADIAN NOTES

Platinum Metals.—The metals of the platinum group were produced in 1926 only in the provinces of British Columbia and Ontario. Canada, however, stands third in the world's production, larger amounts coming from Russia and Colombia. In British Columbia small quantities are found in placer deposits with alluvial gold and black sands; in Ontario these rare metals occur with the nickel-copper-sulphide ores of the Sudbury district. Copper-nickel matte containing the precious metals is made at Coniston by the Mond Nickel Company and at Copper Cliff by the International Nickel Company. The Mond matte is shipped to Clydach, Wales, for refining. International matte is shipped either to the United States, for the manufacture into Monel metal, or to Port Colborne, Ontario, for refining. When the copper and nickel are removed, the residues are further refined for the recovery of gold, silver, platinum, and palladium with smaller amounts of rhodium and iridium. The Canadian production of platinum metals in 1925 and 1926 is as follows:—

	1925		1926	
	Platinum	Palladium, Rhodium, etc.	Platinum	Palladium, Rhodium, etc.
Produced by Canadian, United States and British Refractories from Canadian mattes and residues				
Fine oz	8,692	8	9,471	10,024
Value \$	1,027,477	648	919,349	640,178
British Columbia placers				
Fine oz	6	—	50	—
Value \$	715	—	4,258	—
Total				
Fine oz	8,698	8,288	9,521	10,024
Value \$	1,028,192	648,969	923,607	640,178

Antimony.—1,596 lb. valued at \$281 was reported as being contained in lead-silver-bismuth bullion exported from south Ontario smelters. The Consolidated Mining and Smelting Company of Trail, B.C., have made arrangements for the collection of antimony as a by-product from their refinery, but no production was reported by that company in 1926.

Bismuth.—This metal occurs in the silver-cobalt ores in small quantities, and in their treatment it is allowed to build up in the lead and silver bullion until it reaches a marketable percentage. Shipments amounted to 6440 lb. valued at \$6440.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, will be available about the middle of August. The reprints will be in Journal format, with paper cover, and the price will be 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent at once to the General Secretary at the Society's Offices, Central House, Finsbury Square, London E.C.2

CHEMICAL SOCIETY'S LIBRARY

The Library of the Chemical Society is closed for stocktaking from Monday, August 1, until Saturday, August 13, inclusive, and will close each evening at 5 o'clock from August 15 to September 10

CALENDAR OF FORTHCOMING EVENTS

Aug. 20. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, Newcastle-upon-Tyne. Annual Meeting at 2.30 p.m.

Sept. 6 to 9. INSTITUTE OF METALS. Autumn Meeting to be held at Derby. On September 6, at 8 p.m., the Sixth Autumn Lecture on "Non-ferrous metals in modern transport," will be delivered by Dr. L. Aitchison, in the Municipal Technical College. On September 7, a general meeting of members will be held at 10 a.m., and in the afternoon, at 2.30 p.m., visits will be paid to the Carriage and Wagon or Locomotive Works of the London, Midland and Scottish Railway Company, or Derby Crown China Works. On September 8, at 2.30 p.m., visits will be paid to the works of Messrs. Rolls-Royce, Ltd., or Messrs. Leys Malleable Castings, Ltd., or to Messrs. W. Benrose & Sons, Ltd. (printing works). During the meeting the following papers will be read at the different sessions: "Copper-magnesium alloys. Part II," by W. T. Cook and W. R. D. Jones; "Researches on intermetallic compounds. VI. The reaction between solid magnesium and liquid tin," by W. Hume-Rothery. "Age-hardening tests with elektron alloys," by K. L. Meissner. "Equilibrium diagram of copper-tin alloys containing from 10 to 25% of tin," by A. R. Raper. "Note on cathodic disintegration as a method of etching specimens for metallography," by C. S. Smith. "Protection of aluminium and its alloys against corrosion," by H. Sutton and A. J. Sidery. "Nature of the film produced by anodic oxidation of aluminium," by H. Sutton and J. W. W. Willstrop. "Grain growth in compressed metal powder," by C. J. Smithells, W. R. Pitkin and J. W. Avery. "The undercooling of some aluminium alloys," by Marie L. V. Gayler. "Constitution of alloys of aluminium with silicon and iron," by A. G. C. Gwyer and H. W. L. Phillips. "Effect of work and annealing on the lead-tin eutectic," by F. Hargreaves. "The system magnesium-cadmium," by W. Hume-Rothery and S. W. Rowell. "Constitution and physical properties of some of the alloys of copper, zinc and cadmium," by C. H. M. Jenkins.

PERSONAL AND OTHER ITEMS

Sir Josiah Stamp has been elected to succeed Sir Guy Granet as chairman of the London, Midland & Scottish Railway.

On the occasion of the meeting of the British Association in Leeds, the University of Leeds will confer the honorary degree of D.Sc. upon Dr. J. S. Haldane, Dr. N. V. Sidgwick, Dr. F. O. Bower, and Prof. R. A. Millikan (California Institute of Technology, Pasadena).

Mr. G. E. O'Riordan, principal of the Leicester College of Technology since 1924, has been appointed principal of the Battersea Polytechnic in succession to Dr. R. H. Pickard, F.R.S., now Director of Research for the British Cotton Industry Research Association.

The President of the Board of Trade has appointed Mr. A. E. Faulkner, C.B., C.B.E., director of sea transport, to succeed Sir Ernest Gowers, K.B.E., C.B., as acting Permanent Under-Secretary for Mines. Mr. E. J. Foley, C.B., Assistant Under-Secretary for Mines, succeeds Mr. Faulkner as director of sea transport.

Mr. I. E. Emerson, chairman of the board of the Emerson Drug Company, has given the University of Maryland two fellowships, one in support of a professorship in biological testing, yielding \$1,000 annually, and the other, yielding \$1,500, to maintain a fellow in pharmacology in the School of Medicine.

The following awards for the year 1927-28 have been made by the Salters' Institute of Industrial Chemistry and approved by the Court of the Company:—

Fellowships have been renewed to: Mr. R. M. Downes, University of Oxford, at the Ramsay Department of Chemical Engineering, University College London (Fellow, 1926-27); Mr. H. B. Spalding, University of Oxford, at the Massachusetts Institute of Technology (Fellow, 1926-27).

Fellowships have also been awarded to: Mr. C. G. Akhurst, Imperial College of Science and Technology, London; Mr. A. Caress, University of Cambridge; Mr. I. G. Nixon, University of Cambridge; Mr. D. R. Pryde, University College, Bangor; Mr. J. Muir Smith, Armstrong College, Newcastle, and Mr. F. Witt, Imperial College of Science and Technology, London.

The Salters' Institute has also awarded fifty Grants-in-Aid to young men employed in chemical works to facilitate their further studies.

Dr. H. P. Talbot, Dean of the Massachusetts Institute of Technology, and one of the leading chemists in the United States, has died, aged 63.

The death is announced of Prof. C. F. Mabery, aged 77, a noted American authority on the chemistry of petroleum. His first work related to the constitution and derivatives of furfural, and he was associated, in the early days of electric smelting, with the Cowles brothers in developing their internally-heated electric furnace. In 1883 he became professor at the Case School of Applied Science, Cleveland, and since then his work related mainly to organic oils, lubrication and related subjects.

The late Mr. C. S. L. Petri, founder of the International Paint & Composition Co., Ltd., left £74,070.

Mr. W. C. Teagle, president of the Standard Oil Co. of New Jersey, is now in Germany, where he is negotiating with the Interessens Gemeinschaft in respect of its synthetic motor fuel.

The death is announced of Mr. R. Mason, J.P., deputy chairman of the Tynemouth Gas Co., and vice chairman of Langdale's Chemical Manure Co.

The following deaths are announced from Germany — Paul Fiedler, director of the Bleiindustrie A.G., W. Hill, director of the Gummiwarenfabrik S. Herz G.m.b.H., Prof. P. Oberhoffer, professor of ferrous metallurgy at Aachen.

Institution of Chemical Engineers—Recent Elections

Members

Stanley Robson, M.Sc., A.I.C., D.I.C., General Works Superintendent, National Smelting Co., Ltd., Avonmouth.
Alexander Sanders, A.I.C., Assistant Works Manager, National Smelting Co., Ltd., Avonmouth.
George Gerard Wilson, Engineer and General Manager, Whitwood Chemical Co., Ltd., Normanton.
Thomas Alexander Wilson, F.I.C., Chief Research Chemist, Glasgow Corporation Chemical Works.
Rowland Walker, Manager, Gaythorn Gas Works, Manchester.
Edward Escott Wood, General Works Manager, Brymbo Steel Co., Ltd., Brymbo; President, Coke Oven Managers' Association.

Associate-Members

Robert Edgeworth-Johnstone, B.Sc.Tech., A.I.C., Chief Chemist, "C.C." Processes, Ltd., London.
Richard Burt Robinson, B.A., Deputy General Works Manager of the Midland Tar Distillers, Ltd., Birmingham.
Charles Clitstone Smith, B.Sc., Superintendent, Gas Light & Coke Co.'s Tar Works, Southall.

Transfer from Graduateship to Associate-Membership

Dennis Morten, A.R.C.Sc., A.I.C., Chemical Engineer to H.M. Factory, Sutton Oak.
James Russell Ferguson, Works Chemist, Glasgow Corporation.

Graduates

Charles Danvers Power, Student at the Imperial College of Science and Technology, London.
John Myles, B.Sc., Student at the Imperial College of Science and Technology, London.
Robert Alfred Victor Tavar, A.I.C., Research Chemist, John E. Sturge, Ltd., Birmingham.

Students

Harold Morris, Chemist-in-Charge, J. L. Rose, Ltd., Barking.
Stuart Douglas Newall, Assistant with Ruston & Hornsby, Ltd., Lincoln.

Low Temperature Fuel

It is announced that Low Temperature Carbonisation has completed its first production of solid smokeless fuel, "Coalite," from its new works at Barnsley, and has sold its first parcel of 500 tons at a price 50% above that of best domestic house coal. It is further stated that the fuel oil produced by the company's process is of exceptional quality and is selling at double the price previously obtained for this commodity.

British Association Meeting at Leeds

Amongst the papers to be read in September at the Leeds meeting of the British Association are the following:—In the discussion on coal Prof. J. W. Cobb will discuss "Our available coal supplies and their utilisation," and Prof. R. V. Wheeler will deal with "The

chemistry of coal." Prof. R. A. Millikan will give an evening discourse on "Cosmic rays." There will be several big discussions, including a series on textiles.

International Congress of Photography

The seventh International Congress of Photography will be held in London in 1928, under the auspices of the Royal Photographic Society. The last meeting was held two years ago in Paris.

Sulphuric Acid in Canada

It is announced that the Consolidated Mining and Smelting Company of Canada will proceed immediately with the erection of a large contact-process sulphuric acid plant. This plant will make sulphuric acid from the smelter fumes, and the first unit will cost approximately \$250,000. In conjunction with this plant an experimental phosphate fertiliser plant will be erected, using phosphate from the fields in the Crows Nest district, where the Consolidated Co. has located large beds.

Platinum in Quebec

According to advices received in London, tests of ore in the Rouyn (Quebec) mining field have uncovered a rich deposit of platinum. The following assay was quoted:—Copper ranging from 3 to 21 per cent., gold from 80 cents. to \$199.5 per ton, platinum from \$290 to \$2,100 per ton. Unfortunately, when ore of such richness is discovered, it is generally in comparatively small lots.

Food Colours in the U.S.A.

The coal-tar dyes which are accepted for certification in the United States, subject to the Food Inspection Decisions (76, 77, 106, 129, 159), are as follows:—

Red shades: Ponceau 3R (80). Amaranth (184). Erythrosine (773).

Orange shade: Orange I (150).

Yellow shades: Naphthol yellow S (10). Tartrazine (640). Yellow AB (22). Yellow OB (61).

Green shades: Guinea green B (666). Light green SF yellowish (670). Fast Green FCF (*p*-hydroxy derivative of the sodium salt of alphaniline FG, 671).

The numbers following the names refer to the index numbers given in the Colour Index of the Society of Dyers and Colourists.

Nitric Acid from Ammonia

In a recent article (*Ind. & Eng. Chem.*, July, 1927), Dr. C. L. Parsons points out that nitric acid produced by the oxidation of ammonia can now be made in any concentration, and, including fixed charges on plant, for at least \$30 per ton less than it can be made from Chilean nitrate, even when this is charged on the basis of 2 c. per lb. Nitrogen in the form of ammonia, says Dr. Parsons, is now obtainable for less than half the price of nitrogen in Chilean nitrate. This, with the development of chrome-steel alloys for tower construction, increased efficiency of operation, operation at higher temperatures, the general improvement of plant and automatic controls, and other developments, suggests that the ammonia-oxidation process is likely to prevail in the near future.

Chilean Nitrate Law

A law aiming at the development and protection of the nitrate industry has come into operation in Chile. The law creates a control service similar to the U.S. Bureau of Mines and empowers the President of the Republic to exploit the best nitrate reserves if producers refuse to restart their plants. It also empowers the President to reduce or increase the export tariff without the previous authorisation of Parliament if modification is deemed advisable. The law provides for loans to producers desirous of developing their plants or establishing stocks abroad for the purpose of selling direct to consumers. The Government can also adopt measures for reducing transport costs of nitrate and securing the lowest prices for fuel and other materials required for operating nitrate plants. According to the *Financial Times*, the effect of the law is already being felt, as the number of plants operating has increased to 35, and production and exports have risen, whilst the price has fallen, although the export tax remains unaltered.

The German Dye Trust

It is believed that the I. G. is negotiating with Russia for the establishment in that country of an artificial silk factory, which would have the patents and technical assistance of the I. G. in return for a share of the profits.

An agreement has been made between the Vereinigte Glanzstoff Fabriken and the Kodak Co. for the manufacture of sensitised materials for the European market.

Speaking at the annual meeting of the A.G. für Industrie, u. Technik, the chairman of the board, Herr Bruckmann, said the value of the I. G. was not to be judged by its 10% dividend. Its programme for the introduction of new technical processes was far from being completed. Now that the coal-liquefaction process had been shown to be economically sound, the I. G. would be able, at the beginning of 1928, to supply half the German requirements in motor fuel, and later would probably be able to export. New projects were continually under study and pleasant surprises could be expected in the future.

Apparently, the I. G. is going to use aerial transport, as it has made an agreement with the German aviation company, the Luft Hansa A.G., for reduced charges for the transport of a certain quantity of goods.

The German Steel Trust

The total property of the Vereinigte Stahlwerke A. G. (the German Steel Trust), including coal reserves, is assessed at over \$500,000,000. The Trust controls 31 cokeries, with a total yearly output capacity of over 9,500,000 metric tons of pig iron, 27 steel works with a yearly production of over 8,000,000 metric tons, in addition to rolling mills, foundries, and other finishing plant with a yearly output of over 7,100,000 metric tons. The coal reserves of the Steel Trust are computed at approximately 5,000,000,000 metric tons production capacity, and the mines at present being worked have a yearly output of over 30,000,000 metric tons.

Nitrogen Fixation in France

The State nitrogen-fixation factory which has been erected at Toulouse is now producing 40 metric tons of ammonium sulphate daily from the first of the six producing units which are to be installed. The capacity

of the works will eventually be 500 m.t. a day. At present the factory, which is controlled by the "Office national industriel de l'Azote (O.N.I.A.)," employs 30 engineers and 1500 to 2000 workmen.

Nitrogen Fixation in Poland

In Poland, the fixed nitrogen industry dates from 1922, when the factory built by the German Empire at Chorzow was taken over. Good results have been obtained at this factory, which uses the Bayerische Stickstoffwerke patents, and more attention is being paid to the utilisation of the by-products, such as oxygen. A new cyanamide factory is now to be built at Radon, also in Upper Silesia, with the help of American capital, but the Bayerische Stickstoffwerke patents are apparently not to be used. The new factory will be ready in 1930.

Nitrogen Fixation in Russia

The Stockholms Superfosfatakt., a Swedish company, is to erect a cyanamide works in Russia, with an annual capacity of 30,000 tons.

The Leucite Industry in Italy

Last year, the Società Italiana Potassa, which treats leucite by the Blanc process at Roccamonfina, near Naples, produced an average of 1,500 metric tons monthly of concentrated leucite. A new factory with a monthly output of 6,000 t. is under consideration. Three-quarters of the present production of leucite is utilised for the extraction of aluminium and potash salts; part is exported to France and England; and the remainder is sold in Italy as a fertiliser. Last year the Società made an agreement with the Società Italiana d'Elettrotecnica for the erection at Russi of a factory to treat 400 t. of leucite a month, and produce 80 t. aluminium chloride and 140 t. potassium chloride (largely for conversion into chlorate). At present, work at this factory is suspended owing to a disagreement. Two other works treat the Blanc leucites, and a group, in which French capital is interested, proposes to erect a factory at Naples to treat 150,000 t. of leucite annually and make potassium chloride, and alumina, which would be utilised for the manufacture of aluminium in the north of Italy. In addition, Peter Spence & Co., in Manchester, England, and the Société d'Electrochimie et Electrometallurgie, Lyons, France, are reported to use the Blanc process. The residual silica from the process is used in Italy chiefly for the manufacture of sodium silicate.—(*Ind. Chim.*, July, 1927.)

Third Census of Production (Abrasives)

The following statement gives particulars of the output in Great Britain in the year 1924 of abrasives produced by factories and workshops making returns on schedules for this trade:

Product	Quantity Reams of 480 sheets	Selling Value £
Manufactured abrasives:		
Emery cloth	152,000	301,000
Glass and sand paper	228,000	202,000
Other abrasives, cloths and paper:		
Quantity stated	4,000	11,000
Quantity not stated		8,000
Grinding wheels of artificial corundum	Tons	
carborundum, emery, etc.	3,100	442,000
Other manufactured abrasives		39,000
Total value		1,093,000

REVIEWS

I.—PROCEEDINGS OF THE OPTICAL CONVENTION, 1926. Part I, pp. ix + 491; Part II, pp. vii + 493–1051. London: Optical Convention, 1926. Price £3 net.

II.—CATALOGUE OF OPTICAL AND GENERAL SCIENTIFIC INSTRUMENTS. Pp. x + 326. London: Optical Convention, 1926. Price 6s. net.

I.—Science is measurement, and the development of science keeps step with the development of measuring-instruments. That this is true of the development of chemistry is clear. Think of the advances in so-called pure chemistry attributable to the introduction of the spectrometer. What of the advances in applied chemistry associated with scientific instruments? Did not our Prime Minister tell us at the opening meeting of the Optical Convention that for our supplies of good ale we are entirely in the hands of the polarimeter and microscope? *Et hujus generis omnia*, so far as chemical products are concerned.

The optical industry of the world is based very largely upon the pioneering work of British scientists and inventors. "Nature and nature's laws were wrapped in night. God said, 'Let Newton be,' and all was light."

It is well, therefore, that the Proceedings of the third Optical Convention held in London in 1926, containing the full text of the Presidential Address and of the papers, numbering nearly 100, read at the Convention, show that British scientists have not lagged in their development of optical theory and the design of optical instruments since the previous Optical Convention held in 1912. These two handsome profusely-illustrated quarto volumes are something infinitely better than any record of scientific achievement with which we are familiar outside the realms of the publications of the learned societies. The primary purpose of the Convention was, we presume, to impress upon the world that the British optical trade is capable of supplying the whole of the optical requirements of the world. These two volumes definitely establish that fact. Here is a record of great achievements by British scientists and firms during the war and post-war period in the manufacture of optical glass and optical elements, the design of optical instruments, colour, photometry and illumination, astronomy, cinematography, etc. Every paper is authoritative, and in most cases very readable. The volumes are well indexed, and the price is reasonable.

II.—The Catalogue of optical and general scientific instruments is useful as an indication of the newer types of optical instruments of British origin placed upon the market since 1912. It should be in the hands of all who are potential purchasers of optical instruments. The value of the catalogue would have been increased if some indications were given of the approximate prices of the various instruments described. Optical instruments are generally regarded as being rather expensive luxuries. Possibly on account of the prevalence of this notion, the use of such instruments in British chemical technology is much less extensive than it should be. Thus, the interferometer might be usefully employed in a number of operations in which the composition of a gas or liquid is to be ascertained. We are

not familiar with any such application of the instrument in this country. It is used in Germany for, *inter alia*, the rapid determination of the composition of flue gases. The misconceptions referred to can be best removed by a familiarity with optical instruments, so to speak, in the flesh. Alternatively, let the volumes published by the Optical Convention be found upon the shelves of all the chemical manufacturing firms of the country.

J. S. G. THOMAS

INORGANIC CHEMICAL SYNONYMS AND OTHER USEFUL CHEMICAL DATA. By E. R. DARLING. Second, revised and enlarged edition. Pp. vii + 119. New York: D. van Nostrand Co., 1922. Price \$1.00.

No one will dispute the utility of a dictionary of chemical synonyms, even though it makes no pretension to completeness. In addition to lists of synonyms, this book contains various scraps of information, such as "*monine* is the French word for monk," "a peculiar feature of chromium is its valency, which is divalent, tetravalent, and hexavalent." Prof. Darling also declares that ferric iron has a valency of four, and elsewhere he has similar views regarding cobalt and nickel. "Argonite" and "calspar" are calcium carbonate. "verdigris" is basic copper acetate: "Candy's liquid," "kieserite" and other old friends have new faces. The reviewer, in fact, began to make a list of errata which might charitably be considered typographical, but he tired of the task. A. A. E.

ESSENTIALS OF VOLUMETRIC ANALYSIS. AN INTRODUCTION TO THE SUBJECT, ADAPTED TO THE NEEDS OF PHARMACEUTICAL CHEMISTRY. By HENRY W. SCHIMPF, Ph.G., M.D. Fourth edition, revised and enlarged by Alfred L. Cone, Ph.D., Ph.G. Pp. xiv + 370. New York: John Wiley & Sons, Inc.; London: Chapman and Hall, Ltd., 1926. Price 15s.

Both in this country and America the chemical education of the pharmacist is reaching a higher level to-day than ever before. This fact is marked here by the establishment of central schools of instruction, the requirement of a higher standard of attainment at the examinations of the Pharmaceutical Society, and the institution of degrees in pharmacy by several of our Universities. The appearance of a book such as that under review, which is ostensibly adapted to the needs of students of pharmaceutical chemistry, is a sign of the times.

The book is divided into three parts. Part I deals with general principles, apparatus, indicators, calculation of results, and analysis by neutralisation, precipitation, oxidation, indirect oxidation, and iodimetry. Part II describes processes of special interest to the pharmacist, such as the estimation of alkaloids, fats, formaldehyde, and alcohol; whilst in Part III there are various exercises with the nitrometer. Finally, there is a useful appendix containing the description of various indicators, and an exposition of the principles underlying the γ_H determination, and the use of buffer solutions.

There are slight misprints in equations on pp. 106 and 127. Burettes with rubber tube and pinch-cock

are described as the simplest and most common form (p. 29). It is to be hoped the latter statement is not now true. Phenolphthalein (p. 27) is said to be useless as an indicator in presence of ammonia and its salts, yet its use is recommended in the estimation of ammonium carbonate; the titration of borax (p. 79) with N-acid and methyl orange as indicator estimates only Na_2O . On p. 180, O_3 is made to stand for three atoms of nascent oxygen, and in other places the following formulæ appear: Hg_2 , C_2 , Cl_3 , I_4 , Cl_6 , Br_6 .

Notwithstanding these blemishes, the book is valuable, and may be recommended for use in schools of pharmacy.

R. M. C.

PROJEKTIERUNGEN UND APPARATUREN FÜR DIE CHEMISCHE INDUSTRIE. I. GRUPPE: NITROCELLULOSE, SYNTHETISCHER CAMPHER, PULVER. By J. L. CARL ECKELT und DR. OTTO GASSNER. Pp. 156. Leipzig: Otto Späner, 1926. Price: paper, 15 r.m.; bound, 18 r.m.

In the preface the authors state that the purely chemical and theoretical foundations of the processes under consideration are sufficiently dealt with in the literature. They therefore deal with the subject more from the constructional and engineering aspects. The book is not an exhaustive description of the various constructional and engineering methods, or even of the different types of plant in use. It apparently describes the type of plant employed in one German factory, but gives no indication of alternative processes used for similar purposes in other countries, or even in other German factories.

Apart from these reservations, however, the volume gives an excellent idea of the processes involved and the plant employed in the various manufactures described.

The first section deals with the plant for the manufacture of nitrocellulose, including the preparation of the cotton. A very good practical description is given of the design of the various parts of the plant, including the volumes and working pressures. The manufacture of campher is dealt with in a similar manner in the second section. A very complete description is given in the third section of the various machines used in the manufacture of nitrocellulose powder. Here, again, full information is given regarding weight, volume, and working pressure of each item of plant.

As an appendix to the chapter on nitrocellulose, a description is given of the Torkret cement-spraying process in connexion with the construction of hollowers of reinforced concrete. The authors write enthusiastically on this method of construction.

Particular interest attaches to the pages on solvent handling at the end of the third section of the book, and while there is nothing special in the apparatus described for other manufacture, the descriptive matter as regards the recovery of volatile solvent by cresol and reactive charcoal is very well presented.

A large number of excellent photographs and drawings is given throughout the book.

Apart from the reservations given above, the book appears to be an excellent one for students of chemical engineering.

J. W. McD.

PARLIAMENTARY NEWS

Duty-Free Spirit (Conveyance)

Replying to Mr. Clayton, Mr. McNeill said that the Finance Bill would make it possible to allow, under suitable Regulations, conveyance by tank wagon or pipe-line in the case of methylated spirits, but not in the case of spirits which, though denatured, were not methylated. -July 26.

Fuel Research Board (Expenditure)

In answer to Mr. C. Edwards, the Parliamentary Secretary to the Board of Education (Duchess of Atholl), said that the net amounts included in the estimates of the Department of Scientific and Industrial Research for fuel research and the net amounts annually expended were as follows, the amounts actually expended being given in brackets:—1922–23, £45,779 (£46,772); 1923–24, £32,540 (£42,751); 1924–25, £43,191 (£48,142); 1925–26, £61,536 (£76,147); 1926–27, £91,863 (£88,350). The figures showed that the increase in expenditure considerably exceeded the £30,000 authorised by the late Government. The cost of additional accommodation made necessary by the extension of the work had been borne on the Office of Works' Vote, and was not included in these figures. -July 27.

Safeguarding of Industries

The Parliamentary Secretary to the Board of Trade (Sir Burton Chadwick), in reply to Dr. Vernon Davies, said that up to the present 14 applications under the Safeguarding of Industries procedure had been received by the Board of Trade. Fifteen of these had been referred to Committees for enquiry, and seven duties had been imposed. Of the remaining 29 applications, three had been withdrawn or were in abeyance, 22 had been rejected without reference to a Committee, and four were pending. -July 27.

Sugar-Beet Pulp

In reply to Major Braithwaite, Mr. Guinness said that under their current contracts with the factory companies, the growers had the option of purchasing from the factory dried beet pulp of an amount equal in weight to 5% of the total net weight of beets delivered by them, at the price of £5 per ton ex factory, provided the option was exercised, in writing, before August 1, and the grower undertook to use upon his own farm the dried beet pulp so purchased. He was informed that growers had not taken full advantage of this facility in the past and that, in fact, less than one-quarter of the dried pulp to which growers were entitled last year was purchased by them. The two large groups of factories had this year undertaken an extensive propaganda, through the Press and otherwise, to bring to the attention of farmers the importance of sugar-beet pulp as a food for stock, and he understood that satisfactory results had followed this publicity.—July 27.

Insulin Treatment

In a written answer to Mr. Forrest, Mr. Chamberlain stated that insulin was not a curative agent in the ordinary sense of that term. It was administered with the object of neutralising for the time being the consequences of the disease, although in certain cases its prolonged administration might be followed by a diminution in,

or even the entire disappearance of, the active symptoms. Statistics as to the number of persons treated were not available, nor was it possible to ascertain the number of cases in which insulin treatment had contributed to the cure of the disease. — July 28.

Cocaine and Cocaine Hydrochloride

Sir P. Cunliffe-Lister informed Mr. Fenby that before he could make any recommendation to the Treasury under Section 10 (5) of the Finance Act, 1926, to exempt the above articles from duty, he must be satisfied that there was no reasonable probability that the article would be made in H.M. Dominions in substantial quantities within a reasonable period. Preparations for the manufacture of cocaine and cocaine hydrochloride in this country were well advanced, and he did not propose to make any recommendations to the Treasury on the subject at present. — July 29.

Potato Flour

Replying to Commander Bellairs, Sir P. Cunliffe-Lister said that the quantity of potato flour produced in the United Kingdom could not be stated separately from that of dextrine produced. For these two commodities the output in Great Britain in 1924 for sale amounted to 39,000 cwt., and in that year the imports into Great Britain and Northern Ireland from the Netherlands of these two products amounted together to 493,000 cwt. The output of potato flour in the Netherlands in 1922–23 was about 3,000,000 cwt., the amount being exceptionally high owing to the abundant crop of potatoes in 1922. Figures for later years were not available. — July 29.

Salt Output of India

In a written reply to Mr. Kelly, Earl Winterton stated that the Government output of salt in India in 1922–23 was 19,089,677 maunds (one maund equals 82½ lb.), in 1923–24, 20,349,338 maunds, and in 1924–25, 17,097,505 maunds. During the same years the total production of salt in British India was 39,972,698 m., 42,124,412 m., and 38,141,715 m., respectively, and for the same periods the total receipts from sales of Government salt amounted to 47,85,649 rupees, 68,92,249 rupees, and 40,56,358 rupees, respectively. Figures for the last two years were not yet available. — July 29.

Adjournment

The House adjourned on July 29 until Tuesday, November 8, 1927.

COMPANY NEWS

NATIONAL SMELTING CO., LTD.

The ninth annual ordinary general meeting was held on July 28, the Rt. Hon. Sir Robert Horne, G.B.E., K.C., M.P. (chairman) presiding. After reviewing the accounts (cf. *Chem. and Ind.*, July 29, 1927, p. 694), the chairman said that as the company dealt in commodities which fluctuated largely in price, they had to be conservative in the administration of their resources. Another reason was that they had nearly £2,000,000 invested in plant and property in this country which represented the capital employed in plants connected with the blende-roasting and the production of sulphuric acid and spelter. Whilst the great roasting and acid

sections of their equipment might be regarded as up-to-date, and in their character more or less permanent, it was fairly certain that metallurgical developments would soon necessitate substantial changes in the methods of producing spelter if it was to be a continuing industry in the United Kingdom. This would mean large expenditure on new plant. The company's main programme for new equipment, involving an expenditure during the past four years of upwards of £500,000, was completed during the year. The works at Avonmouth and Swansea Vale were equipped with mechanical blende-roasting furnaces and sintering machines, and in both cases mechanical handling and special storage arrangements had been installed. Also, at Swansea Vale, a new acid plant had been set up, and two extra units of the Avonmouth plant had been brought into operation. The supply of zinc ores and concentrates had shown a great expansion, and in place of the scarcity of a year or two ago, there was now an over-supply of no inconsiderable proportions. The consequence had been a substantial rise in the returning charges quoted by Continental smelters. On the other hand, the price of the metal had fallen substantially, to-day's price being £5 7s. 6d. below that ruling at this date a year ago, and £5 2s. 8d. less than the average for the whole of 1926. The company's chief supply of raw material in the past had been derived from the contract with the British Government for Australian concentrates. This contract expired in June, 1930, but through arrangements made and the stocks which the company were now in a position to accommodate they should be able to meet all their needs until 1933 at least. In conclusion, the chairman said the outlook was favourable. He did not expect that the current year's returns would reach the high level of last year, but so far the works had given good results and the investment revenue was satisfactory.

TANGANYIKA CONCESSIONS, LTD.

The ordinary general meeting, held on June 28, was presided over by the chairman, General Sir Francis R. Wingate, Bt., who said that the year under review had proved to be one of exceptional activity, especially as regards the rapid progress of the Benguela Railway, which should reach the Congo frontier by the end of the current year. Notwithstanding a smaller copper production and a lower level of market prices for the metal, the profits of the Union Minière were higher than in 1925. Apart from copper, about 662 tons of tin and 300 tons of cobalt were produced and marketed at satisfactory prices, together with about 20 grammes of radium extracted from the company's uranium ore. The direct leaching process now being installed would lessen the cost of production. It required much less labour, no fluxes, used the water power of the country instead of imported coke, and only needed a comparatively small amount of imported sulphur, whilst it obtained the maximum extraction of copper from the ore. The new large reverberatories at Panda were expected to be at work before the end of this year, and would be capable of yielding some 30,000 to 40,000 tons of bar copper annually. The first unit of the electrolytic leaching plant, of 30,000 tons capacity, was also progressing, and was expected to be ready for operation in 1929, together

with other additions to the treatment and power plant and mine equipment. When these new plants were running, the copper production would be about 140,000 tons per annum. The completion of the Benguela Railway connexion, in two or three years' time, would enable the Western mines to be worked and the yearly production of copper steadily increased. It was satisfactory to note from the Union Minière report that the proved reserves of copper, which amounted to over 5,000,000 tons, again showed an increase over the figures of the previous year, in spite of the large extraction during the year. The Tanganyika Concessions, in conjunction with the Zambesia Exploring Company, had taken a joint interest with the British Metal Corporation and the Zinc Corporation in the recently formed British (Non-Ferrous) Mining Corporation, whose objects were the investigation and development of promising base metals propositions.

[For the accounts, cf. *Chem. and Ind.*, July 29, 1927, p. 694.]

JURGENS, LTD.

A dividend has been announced for the half-year ended June 30, 1927, on (guaranteed) 7% cumulative participating preference shares at 7% per annum, payable on July 30, under deduction of tax at 4s. in the £.

INVERESK PAPER CO., LTD.

At an extraordinary general meeting of the Inveresk Paper Co., Ltd., held on July 29, resolutions were passed increasing the capital of the company to £2,200,000 by the creation of 1,000,000 additional shares, 600,000 of which will be 6½% "B" cumulative preference shares and 400,000 ordinary shares. The whole of the 600,000 cumulative "B" preference shares and 120,000 of the ordinary shares have been earmarked for issue to the holders of the 8% cumulative participating preference shares of the International Pulp and Chemical Company, Ltd., in accordance with the offer recently made to them for the purchase of their interests. The meeting directed that the balance of the ordinary shares be issued by the directors as and when and on such terms as they should think fit.

CELANESE CORPORATION OF AMERICA

According to the *Financial Times*, the directors of the American Celluloid Company, probably the largest producer of celluloid in America, have approved a re-organisation scheme for submission to the shareholders by which control of the company will be taken by the Celanese Corporation. According to the scheme, the Celluloid Company will erect a plant with an initial capacity of 5 tons of cellulose acetate daily and will increase its capital (\$10,000,000) by \$3,500,000, of which the Celanese Corporation will supply \$1,000,000. The new board of the company will comprise seven representatives of the Celanese Corporation (including Drs. C. and H. Dreyfus) and five representatives of the Celluloid Company.

BRITISH SUGAR MANUFACTURERS, LTD.

The loss for the year ended March 31, 1927, was £8,015, to which must be added loan and debenture interest for period, £14,227, and depreciation amounting to £22,559, making £44,831 to be added to debit balance brought forward of £39,040, making a total deficit of £83,872.

These unsatisfactory results were partly due to constructional work being in progress during the production period, to the heavy cost of coal, and two breakdowns in the boiler-house for about ten days, in addition to the unexpected short supply of beetroot. A sufficient acreage has been contracted for for the current season, to ensure a full supply, and alterations at the factory necessary for increased output will be completed in ample time for the coming season.

ENGLISH VELVET AND CORD DYERS ASSOCIATION

An interim dividend has been declared at the rate of 4% per annum on the ordinary shares.

FRANÇOIS CEMENTATION CO., LTD.

The seventh ordinary annual general meeting was held on July 22, Mr. H. Clayton (chairman) presiding. The net profit was £12,072, and after allowing for the payment of the preference dividend and adding the balance brought forward, there was an available sum of £29,915. After transferring £6,535 to reserve, and paying a dividend on the ordinary shares of 6d. per share, free of income tax, the balance of £10,880 was carried forward. During the year the company took up further patents, including a process for grouting with asphalt, and had taken an interest in Asbestos Cement Pipes, Ltd., a syndicate formed to deal with pipes made from asbestos and cement in accordance with the "Eternit" patents. The company had proceeded with the development work on the Betonac hardening material, which, considering the adverse circumstances of the coal stoppage, had done very well. The special qualities of this material were its resistance to wear and its impermeability to water, oils and other liquids, its freedom from dust and its durability and adaptability. The experimental areas of Betonac previously laid, whether for floors or roads, had successfully stood the test of trial and wear.

BENN BROTHERS

The report of this London firm of publishers for the year ended June 30, 1927, states that losses and difficulties resulting from the general strike and the coal stoppage have been more than balanced by the further expansion of the company's activities in new directions. The directors consider that the time has arrived for capitalisation of part of general reserve and an increase in authorised capital. The resolutions for carrying out these proposals will be considered at an extraordinary general meeting to be held immediately after the annual meeting. The effect of the resolutions is to increase the capital from £150,000 to £250,000 by the creation of 99,250 preference shares of £1 each and 15,000 deferred shares of 1s. each. The net profit for the year under review amounted to £37,552, plus £16,800 brought in. Directors have allocated to leasehold reserve £1,500, and to general reserve £10,000. The dividend recommended will absorb £24,097, leaving £18,756 to be carried forward.

DAVID THOM AND CO., LTD.

The accounts for 1926 of this company of soap and glycerine manufacturers show a profit of £3,991, plus £3,497 brought in. Dividends have been declared of 6½% on the preference shares and 10% on the ordinary shares, carrying forward £3,008.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. (Chloride of Ammonia.—£37—£45 per ton, carr. paid.)
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—3s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£9 5s. per ton. Grey, £15 10s. per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6 15s.—£10 per ton according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 9d.—4s. per gal., 60% O.P. Solvent, 3s. 11d.—4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4—£5 10s. per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s.—£41 10s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 4½d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 8d.—2s. 9d. per gal. 97/99.—2s. 1½d.—2s. 4½d. per gal. Pale, 95%, 2s.—2s. 3d. per gal. Dark, 1s. 9d.—2s. 1d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 11d.—1s. per gal., ex works in tank wagons; Standard motor, 1s. 9d.—2s. 2d. per gal., ex works in tank wagons; Pure, 1s. 7d.—2s. 3d. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 8d.—1s. 10½d. per gal. Pure, 2s.—2s. 3½d. per gal.
 Xylol.—2s.—2s. 4d. per gal. Pure, 2s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10½d. per gal. Standard specification, 6½d.—8½d. per gal. Middle Oil, 7½d.—7½d. per gal. Heavy, 8½d.—8½d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/160, 1s. 2d.—1s. 6d. per gal. Solvent 95/160, 1s. 5d.—1s. 6d. per gal. Solvent 90/190, 11d.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—80s.—87s. 6d. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—7s.—13s. per gal. Nominal. 90/180.—4s. 6d.—5s. per gal. Heavy.—5s.—8s. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.).—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Nevillo and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—8s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzdine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—2s. 7½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 9d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—5 cwt. lots Cryst. 41s. per cwt. Powder 45s. per cwt. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7½d.—1s. 10d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 3d.—1s. 6d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £30 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. per lb.
 Benzophenol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively: Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—5 cwt. lots, Crystal 25s. per cwt. Powder 27s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d. per lb. Potassium.—1s. 11d. per lb. Sodium.—2s. 2d. per lb. Granulated ½d. per lb. less. All spot.
 Calcium Lactate.—1s. 3½d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ½ lb., 9s. 6d. per doz.; ¼ lb., 6s. 6d. per doz.
 Hydroquinone.—2s. 11d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 22s. per cwt.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 11s.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—6s. 10d. per lb.; Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb.; Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—9s. 6d.—9s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—2s. 9d.—3s. per lb.
 Phenazone.—4s. 3d.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d. per oz. in 100 oz. tins (1000 oz. lots).
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923—2s. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—97s. 6d. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb.; Crystal, 1s. 10d.—1s. 11d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—6s. 6d.—6s. 9d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
 Thymol, Puriss.—10s. 6d.—10s. 9d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.
 Aubepine (ex Anethole).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 6d. per lb.
 Ethyl Cinnamate.—6s. 6d. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol.—9s. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. 6d. per lb.—(ex Shui Oil) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safral.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—17s.—18s. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.
 Camphor.—70s. per cwt. Cananga, Java, 26s. per lb.
 Cassia, 80/85%.—7s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%. 1s. 11d. per lb., Ceylon, Bure, 1s. 9d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%. 22s. 6d. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 18s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Sept. 21th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on August 11th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Boistel, Hugel, and Paul. Manufacture of catalysts etc. 18,997. July 18. (Ger., 28.2.27.)

British Rotary Filter Co., Ltd., and Talbot. Apparatus for subjecting materials to continuous washing etc. 19,457. July 22.

Brooks. Filters etc. 18,974. July 18.
 Campbell, and Electric Furnace Co. Manufacture of crucibles etc. 19,145. July 19.

Carpmael (I.-G. Farbenind.). Distillation etc. process. 19,316. July 20.

Chadwick. Treatment of smoke etc. from furnaces etc. 18,999. July 18.

Coplan. Capola furnaces. 19,068. July 18.

Excelsior Feuerlöschgerate A.-G., and Schnabel. Producing foam for fire extinguishing. 19,538. July 22.

International Combustion, Ltd., and Rosencranz. Pulverising systems. 19,026. July 18.

Knoch. Process for manufacture of stable dry substances from colloidal liquids. 19,114. July 21.

Laing. Filters. 19,176. July 19.

Meyerhofer. Continuous conversion of solids etc. 19,289. July 20. (Ger., 24.7.26.) Furnaces. 19,531. July 22. (Ger., 27.7.26.)

Simon. Shaft furnaces. 19,413. July 21.

Soc. L'Air Liquide. Carrying out exothermic catalytic chemical reactions. 19,049 and 19,187. July 18 and 19. (Fr., 30.4.27 and 9.8.26.)

I.—Complete Specifications

145 (1926). Vicars, Ltd., and Crosland. Ovens for baking, drying, etc. (273,861.)

1237 (1926). Disney and Kernot. Emulsifying agents. (274,142.)

20,203 (1926). Carborundum Co., Ltd. Furnaces. (257,261.)

11,607 (1927). Theisen and Theisen. Centrifugal apparatus for treating gases with liquids. (270,340.)

*22,234 (1926). Electrolytic Zinc Co. of Australasia. Centrifugal separators. (274,406.)

*18,645 (1927). Nivling. Viscosimeters. (274,479.)

II.—Applications

Chadwick. 18,999. See I.

Coley and Kekwick. Productions of hydrocarbons. 19,368. July 21.

I.-G. Farbenind. Dehydration of moist fuel. 18,996. July 18. (Ger., 21.7.26.) Production of liquid hydrocarbons etc. 19,279. July 20.

Johnson (I.-G. Farbenind.). Manufacture of viscous oils. 19,374. July 21. Oxidising paraffins etc. 19,501. July 22.

Koks- und Halbkoks-Brikettierungs-Ges. Manufacture of briquettes. 19,270. July 20. (Ger., 24.7.26.)

Laing and Nielsen. Distillation of carbonaceous materials. 19,619. July 23.

Lederer. Production of carbon. 19,294. (Austria, 21.7.26.)

Power-Gas Corporation, Ltd., and Rambush. Gas producing etc. plant. 19,253. July 20.

Smith. Gas-producers. 19,302. July 30.

II.—Complete Specifications

6435 (1926). I.-G. Farbenind. Manufacture of hydrocarbons and derivatives. (249,501.)

7054 (1926). I.-G. Farbenind. Manufacture of hydrocarbons. (249,156.)

7099 (1926). Toogood, and Dempster and Sons, Ltd. Gasworks retort settings. (274,154.)

13,342 (1926). Kling and Florentin. Obtaining light hydrocarbons. (253,507.)

18,128 (1926). Cachemulle (Bunting). Coal pulverisers. (274,278.)

19,155 (1926). Wollaston. Gas-producer and furnace combined. (274,286.)

23,543 (1926). Collin & Co. Coking retorts. (266,286.)

9216 (1927). Silica en Ovenbouw Mij. Coke ovens. (268,832.)

12,778 (1927). I.-G. Farbenind. Manufacture of hydrocarbons and derivatives. (274,410.)

15,262 (1927). I.-G. Farbenind. Manufacture of hydrocarbons. (274,404.)

*18,439 (1927). Producing oils from coal. (274,465.)

III.—Application

Soc. des Etabl. Barbet. Distillation of gas tar etc. 19,078. July 18. (Fr. 17.7.26.)

III.—Complete Specification.

*19,078 (1927) Soc. des Etabl. Barbet. Distillation of gas or coke-oven tars. (274,513.)

IV. Applications

Carmichael (I.-G. Farbenind.). Manufacture of dyestuffs. 19,066—7. July 18.

Gegy A.-G. Manufacture of azo dyestuffs. 19,493. July 22. (Ger., 29.7.26.)

I.-G. Farbenind. Manufacture of carboxylic acids of acenaphthene. 19,492. July 22. (Ger., 24.7.26.) Manufacture of derivatives of acenaphthene. 19,602. July 23. (Ger., 24.7.26.)

Johnson (I.-G. Farbenind.). Production of nitrogenous dyestuffs. 19,605. July 23.

Scottish Dyes, Ltd., Anderson, Thomas, and Thomson. Production of benzanthrone derivatives. 19,315. July 20. Production of dyestuffs. 19,514. July 20.

IV.—Complete Specifications

4842 (1926). I.-G. Farbenind. Production of azo-dyestuffs and lakes insoluble in water. (250,909.)

7195 (1926). Drescher, Harris, Wylam, Thomas, and Scottish Dyes, Ltd. Dyes and dyeing. (274,156.)

10,148 (1926). I.-G. Farbenind. Manufacture of anthraquinone derivatives. (250,968.)

10,281 (1926). Carmichael (I.-G. Farbenind.). Manufacture of anthraquinone derivatives. (274,211.)

10,998 (1926). British Dyestuffs Corp., Shepherdson, and Hailwood. Preparation of indanthrone disulphonic acids and indanthrone. (271,226.)

21,955 (1926). Wylam, Harris, Thomas, and Scottish Dyes, Ltd. Dyes and dyeing. (274,303.)

*18,936 (1927). Haller and Kappeler. See XX.

V.—Applications

British Celanese, Ltd., Ellis, Kirk, and Olpin. Treatment of materials containing cellulose derivatives. 19,118. July 19.

British Celanese, Ltd., Ellis, and Olpin. Treatment of materials containing cellulose derivatives. 19,155, 19,222, and 19,252. July 19 and 20.

Calvert. Treatment of viscose artificial silk yarn. 19,232. July 20.

Celli. Transforming vegetable fibres into product resembling wool. 19,390. July 21.

Dreyfus. Production of solutions etc. of cellulose esters etc. 19,364. July 21.

Hetherington & Sons, Ltd., and Wellfens. Manufacture of artificial silk etc. 19,105. July 19.

I.-G. Farbenind. Opening-up materials containing cellulose. 19,424. July 21. (Ger., 21.7.26.)

Lilienfeld. Treating cotton fabrics. 19,027. July 18. (U.S., 20.7.26.)

Mellor. Treatment of viscose artificial-silk yarn. 19,232. July 20.

V.—Complete Specifications

30,563 (1926). Krupp Grusonwerk. Cleaning plant fibres. (262,761.)

*12,104 (1927). I.-G. Farbenind. Protecting materials from moth. (274,425.)

VI.—Applications

Johnson (I.-G. Farbenind.). Desizing processes. 18,995. per cwt., Great Brit.

Kohorn & Co., and Perl. Apparatus for wet treatment of textile material. 19,305. July 20. (Ger., 20.7.26.)

VI.—Complete Specifications

7195 (1926). Drescher, Harris, Wylam, Thomas, and Scottish Dyes, Ltd. See IV.

9622 (1926). Wilson, Thomas, and Scottish Dyes, Ltd. Dyeing and printing of vat colours. (274,178.)

16,613 (1926). Silver Springs Bleaching & Dyeing Co., Ltd., Mason, and Hall. Mercerising etc. textile materials containing viscose artificial silk. (274,266.)

18,024 (1926). Sandoz Chemical Co., and Woodhead. Dyeing cotton materials. (274,276.)

21,955 (1926). Wylam, Harris, Thomas, and Scottish Dyes, Ltd. See IV.

6845 (1927). Eclipse Textile Devices, Inc. Dyeing. (267,548.)

VII. Applications

Coley. Production of zinc white. 19,503. July 22.

Johnson (I.-G. Farbenind.). Process for recovery of sodium nitrate. 19,373. July 21.

Rosenheim. 19,393. See XXXIII.

Suida. Recovering concentrated acetic acid from dilute acetic acid. 19,074 and 19,544. July 18 and 22. (Austria, 9.11.26.)

VII.—Complete Specifications

10,052 -3 (1926). Applby and Carter. Manufacture of solid sodium hypochlorite preparations. (274,197—8.)

15,951 (1926). Moore, Polack, and Castner-Kellner Alkali Co., Ltd. Manufacturing ammonium chloride. (274,263.)

20,785 (1926). Stevens, Norris, and Watson. Removal of silica from zinc, copper, and vanadium solutions. (274,297.)

10,827 (1927). Gaillard. See XVI

VIII.—Applications

Campbell, and Electric Furnace Co. 19,145. See I

Norway and Scholz. Stained glass etc. 19,437. July 22.

VIII.—Complete Specifications

11,117 (1926). Hancock. Manufacture of pottery. (274,230.)

32,126 (1926). Scheidhauer & Gessing A.G. Manufacturing refractory acid-proof and other ceramicity-bonded products. (263,194.)

5588 (1927). Hartford Empire Co. Glass furnaces. (273,245.)

IX.—Application

Lutovich. Asphalte colouring. 19,153. July 19.

IX.—Complete Specification

8746 (1926). Soc. Anon. des Chaux et Ciments de Lafarge et du Teil. Manufacture of cement. (250,246.)

X.—Applications

Ashcroft. Metallurgy of ores. 19,606. July 23.

Coplan. 19,068. See I.

General Electric Co., Ltd., and Smithells. Chemically resistant alloys. 19,358. July 21.

Goebel and Rademacher. Magnetic separation of minerals. 19,399. July 21. (Ger., 23.7.26.)

Marks (Kemet Laboratories Co.). Producing metals. 19,043. July 18.

Schrobsdorff. Production of alloys etc. 19,121. July 19. (Ger., 21.7.26.)

Siemens & Halske A.-G. Electrical depositing of chromium. 19,608. July 23. (U.S., 27.7.26.)

Steinheil. Alloys. 19,603. July 23.

X.—Complete Specifications

18,669 (1926). Davis, and Metropolitan-Vickers Electrical Co., Ltd. Sintering refractory metals. (274,283.)

28,741 (1926). Loos, Lehnig, Henning, and Dassdorf. Composition for coating metal etc. (274,333.)

849 (1927). Loos, Lehnig, Henning, and Dassdorf. Coating metal etc. (274.355.)

*7327 (1927). Piwowarsky and Oberhoffer. Production of high grade iron or steel. (274.419.)

*16,155 (1927). Wüst. Purifying pig iron. (274.438.)

*17,831 (1927). Buess. Rotary melting furnaces. (274.451.)

*18,217 (1927). Verein. Stahlwerke. Manufacture of high-grade cast iron. (274.457.)

*18,635 (1927). Sundberg. Electrodeposition of copper or its alloys. (274.477.)

*18,706 (1927). Rachleff and Gofmann. Chemical welding of metals. (274.481.)

XI.—Applications

Electric Furnace Co., Ltd., and Taylor. Crucibles for electric furnaces. 19,144. July 19.

Marks (Batterien- und Elemente-Fabr. System Zeiler). Production of insulating material etc. 19,518. July 22.

Siemens & Halske A.-G. High-frequency inductance furnace. 19,377. July 21. (Ger., 24.7.26.) 19,608. See X.

Western Electric Co., Inc. (Bell Telephone Laboratories, Inc.). Insulating-materials. 19,058. July 18.

XI.—Complete Specifications

11,463 (1926). Wade (Philips' (Gloeilampenfabr.). Manufacture of oxide cathodes. (274.233.)

32,942 (1926). British Thomson-Houston Co., Ltd. Inductance furnaces. (263,856.)

16,493 (1927). Harrison. Electrolytic process and apparatus. (274.405.)

*18,635 (1927). Sundberg. See X.

XII.—Application

Soc. des. Etabl. Barbet. Extraction of glycerin. 19,203. July 19. (Fr., 19.7.26.)

XII.—Complete Specification

*19,203 (1927). Soc. des Etabl. Barbet. Extraction of glycerin from distillery vinasses. (274.519.)

XIII. Applications

Baron Nixon and Lamson Paragon Supply Co. Production of colour compositions for printing. 19,072. July 18. Manufacture of carbon papers etc. 19,073. July 18.

British Thomson-Houston Co., Ltd. Resinous compositions etc. 19,366. July 21. (U.S., 2.8.26.)

Glaserit Werke Winkelmann. Production of coating materials. 19,130. July 21. (Ger., 9.4.27.)

Kunstharzfabrik Pollak. Production of artificial compositions. 19,306. July 20. (Austria, 31.5.27.)

XIII.—Complete Specifications

3737 (1926). Meigs. Forming synthetic resinous materials. (274.146.)

4842 (1926). I.-G. Farbenind. See IV.

7131 (1926). Mond (I.-G. Farbenind.). Production of resinous condensation products from aromatic amines. (274.155.)

21,354 (1926). Craven, Bedford, and Yorkshire Dyeware & Chemical Co., Ltd. Manufacture of a cement for linoleum etc. (274.300.)

32,896 (1926). Grasselli Chemical Co. Producing aldehyde amine condensation products. (263,853.)

XIV.—Application

Noar. Manufacture of sponge rubber. 19,123. July 19.

XIV.—Complete Specification

7248 (1927). Carlsson. Regeneration of vulcanised rubber. (274.387.)

XV.—Complete Specification

*18,758 (1927). Hönsch. Preparing a cold glue powder. (274.490.)

XVI.—Complete Specifications

24,577 (1926). Hochstetter and Schneidel. See XIX.

10,827 (1927). Gaillard. Treating superphosphates. (269,921.)

XVIII.—Complete Specifications

10,937 (1926). Hansena A.-G. and Nathan. Fermenting and maturing beer (274.225.)

27,300 (1926). Croad (Noldin.) Manufacturing vinegar. (274.328.)

*19,203 (1927). Soc. des Etabl. Barbet. See XII.

XIX.—Applications

Baker Perkins, Ltd., and Socy. Jeanjean et Cie. Manufacture of chocolate etc. 19,515. July 22.

Dawkins. Preparation of tea. 19,108. July 19.

George and Hall. Treatment of wheat etc. 19,164. July 19.

Stabback. Preservation of edible products. 19,000. July 18.

XIX.—Complete Specifications

9083 (1926). Vautin and Whiffen. Preservation of food-stuffs etc. (274.164.)

10,076 (1926). Fowler and Edser. Preservation of natural products. (274.200.)

24,577 (1926). Hochstetter and Schneidel. Preserving animals and plants. (274.314.)

XX.—Applications

Binz and Rath. Production of nitropyridinearsinic acids. 19,071. July 18. (Ger., 5.8.26.)

British Celanese, Ltd., Bader, and Dreyfus. Manufacture of aliphatic compounds 19,597--8. July 23.

XX.—Complete Specifications

16,503—4 (1925). Dreyfus. Production of aliphatic compounds. (273,622 and 273,810.)

9470 (1926). Potts (Chem. Fabr. Grunau, Landshoff & Meyer). Manufacture of *N*-monoalkyl-*p*-aminophenol. (274.175.)

15,428 (1926). Heyn. Production of alkylene diguanidines. (274.259.)

3327 (1927). Imray (I.-G. Farbenind.). Manufacture of 1-phenyl-3-methyl-5-pyrazolone. (274.366.)

*16,198 (1927). Chem. Fabr. vorm. Schering. Manufacture of alkylated phenols and their hydrogenated products. (274.439.)

*18,743 (1927). Soc. Anon. Distilleries des Deux-Sevres. Manufacture of crotonic aldehyde and its homologues. (274.488.)

*18,797 (1927). Comp. de Bethune. Catalysts for the synthesis of alcohols. (274.492.)

*18,936 (1927). Haller and Kappeler. Manufacture of condensation products of arylamines. (274.501.)

XXI.—Application

Gschopf. Colour cinematography. 19,298. July 20. (Austria, 15.1.27.)

XXI.—Complete Specification

17,550 (1926). I.-G. Farbenind. Manufacturing photographic silver halide emulsions. (259,538.)

XXIII.—Applications

Baron (Neumann). Water-softening apparatus. 19,179. July 19.

Burt, Hoperoff, and Paton. Treatment of sewage etc. 19,611. July 23.

Rosenheim. Production of base-exchanging substances. 19,393. July 21. (Ger., 1.9.26.)

XXIII.—Complete Specification

9863 (1926). British Dyestuffs Corp., Fairbrother, and Renshaw. Disinfectant tablets etc. (274.187.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:— *Australia*: Glassware, chinaware, hardware (69); chemicals and machinery (Official Secretary, Commercial Bureau, Australia House, W.C.2, ref. 471). *British India*: Iron piping, asbestos goods, leather cloth and olecloth (70); foundry sand conveyors (91, Petty France, Westminster, S.W.1). *France*: Technical and industrial rubber goods (76). *Greece*: Oil in barrels, bar tin (79). *Hagti*: Laundry soap (86). *Holland*: Rubber (81). *South Africa*: White lead oil paste (B.X. 3662); filtration plant (A.X. 4972). *Turkey*: Pharmaceutical preparations (83).

Sulphate of Ammonia

Nitram, Ltd., Victoria Station House, London, S.W.1, has issued a leaflet (2/28N) giving the prices at which orders will be booked for sulphate of ammonia for home agricultural use during the present season. The new price for August, £9 18s., represents a reduction of 48s. per ton, or nearly 20%, compared with the price for last spring. At the average of the prices given, the unit of nitrogen in sulphate of ammonia costs about 9s. 11d. The quotations refer to 6-ton lots.

News from Advertisements

There is a vacant lectureship in fuel technology at the Imperial College of Science and Technology (p. vi).

A Coal Research Fellowship at the Imperial College of Science and Technology is offered in connexion with Sensible Heat Distillation, Ltd. (p. vi).

Students will be interested in the facilities offered at the Imperial College of Science and Technology for study and research in fuel technology, chemical engineering and electro-chemistry (p. vi).

The University of St. Andrews (Scotland) gives particulars of various courses and examinations for the Session 1927–28 (p. vi).

The British School of Malting and Brewing at the University of Birmingham is advertising a Diploma Course, Certificate Courses, and a Faculty of Science Degree Course (p. vi).

A firm of manufacturing pharmaceutical chemists is advertising for analysts (p. vi).

A chemist (B.Sc.) desires a chemical or commercial position (p. vi).

Surplus chemical manufacturing plant is for sale (p. vi).

There are 105 firms represented under the various headings in our Buyers' Guide.

PUBLICATIONS RECEIVED

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF STANDARDS. Washington: Government Printing Office, 1926: U.S. Government Master Specification No. 443 for Cement, Masonry Circular No. 321. Price 5 c.—U.S. Government Master Specification No. 444 for Integral Waterproofing Material, Water-Repellent Type (for Use with Portland Cement

Mortar or Concrete). Circular No. 322. Price 5c.—Tinware, Galvanised and Japanned Ware. Elimination of Waste, Simplified Practice Recommendation No. 55. Pp. 11. Price 5 c.—Puncture-Sealing Compounds for Pneumatic Tyres. Circular No. 320. Pp. 5. Price 5 c.—Wrought-Iron and Wrought-Steel Pipe Valves and Fittings. Elimination of Waste Simplified Practice Recommendation No. 57. Report of National Committee on Metals Utilisation. Pp. 15. Price 5 c.—Alphabetical Index and Numerical List of United States Government Master Specifications. Circular No. 319. 1927. Price 10 c.—Carbon Brushes and Brush Shunts. Elimination of Waste, Simplified Practice Recommendation No. 56. Pp. 11. 1927. Price 5 c.—Loaded Paper Shot Shells (Second Revision, October 19, 1926). Elimination of Waste, Simplified Practice Recommendation No. 31. Pp. 12. 1927. Price 5 c.—Rotary-Cut Lumber Stock for Wire-Bound Boxes. Elimination of Waste, Simplified Practice Recommendation No. 59. Pp. 10. 1927. Price 5 c.—Staple Vitreous China Plumbing Fixtures. Elimination of Waste, Simplified Practice Recommendation No. 52. Pp. 25. 1927. Price 5 c.—Thermal Expansion of Graphite. By P. Hidvert and W. T. Sweeney. Technologic Paper No. 335. 1927. Price 5 c.—Determination of the Magnetic Induction in Sheet Steel. By R. L. Sanford and J. M. Barry. Scientific Paper No. 545. 1927. Price 10 c.—Miscellaneous Publication of the Bureau of Standards, No. 76. Moller Chart (Metric Engineering Units). Properties of Ammonia. Price 10 c.—Magnetic Reluctivity Relationship. By R. L. Sanford. Scientific Paper No. 546. Pp. 743–755. 1927. Price 5 c.—The Lovibond Color System. 1. A Spectrophotometric Analysis of the Lovibond Glasses. By K. S. Gibson and F. K. Harris, with a prefatory statement by I. G. Priest. Scientific Paper No. 547. Pp. 46. 1927. Price 15 c.—Comparative Tests of Six-inch Cast-iron Pipes of American and French Manufacture. By S. N. Petrenko. Technologic Paper No. 336. Pp. 231–254. 1927. Price 15 c.—Use of Sulphite Cellulose Extract as a Tanning Material. By E. L. Wallace and R. C. Bowker. Technologic Paper No. 339. Pp. 309–321. 1927. Price 30 c.—U.S. Government Master Specification No. 445 for Cement, Plastic Magnesia. Circular No. 323, 1927.—U.S. Government Master Specification No. 1a for Cement, Portland. Circular No. 33, 1927. Price 10 c.—U.S. Government Master Specification No. 476 for Chrome Yellow (Lemon, Medium, and Orange; Dry, Paste in Oil, and Paste in Japan). Circular No. 331, 1927. Price 5 c.—U.S. Government Master Specification No. 475a for Oil, Linseed, Boiled. Circular No. 330, 1927. Price 5 c.—U.S. Government Master Specification No. 4a for Oil, Linseed, Raw. Circular No. 82, 1927. Price 5 c.—U.S. Government Master Specification No. 137a for Paint, Olive Drab (Semipaste and Ready-Mixed). Circular No. 165, 1927. Price 5 c.—U.S. Government Master Specification No. 10b for Paint, White, and Tinted Paints made on a White Base, Semipaste and Ready Mixed. Circular No. 89, 1927. Price 5 c.—U.S. Government Master Specification No. 447 for Rope, Cotton. Circular No. 326, 1927. Price 5 c.—Colour in the Sugar Industry. 1. Colour Nomenclature in the Sugar Industry. 2. Colorimetric Clarification of Turbid Sugar Solutions. By H. H. Peters and F. P. Phelps. Technologic Paper No. 338. Pp. 261–308, 1927. Price 20 c.—United States Government Master Specification No. 14b for Paint, Black, Semipaste and Ready Mixed. Circular No. 94, 1927. Price 5 c.—Electrodeposition of Chromium from Chromic Acid Baths. By H. E. Haring and W. P. Barrows. Technologic Paper No. 340, 1927. Price 15 c.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, AUGUST 12, 1927

No. 32

EDITORIAL

Liquor Effluents from Gas Works

THE Chief Alkali Inspector, Dr. T. L. Bailey, has published in his Annual Reports, during the past few years, the results of his investigations upon the methods of removing from the effluents from sulphate of ammonia plant those constituents which are harmful when added to sewage beds or rivers. This valuable work was summarised by him in a paper before the Institution of Chemical Engineers in 1925.

Now it appears that his pioneer work has been taken up by the gas industry, with the result that a special Research Committee of the Institution of Gas Engineers entitled "The Liquor Effluents Research Committee" has been appointed to look into this subject. We are glad to see that the Institution has obtained the co-operation of Dr. Bailey as a member of the committee.

The First Report of this new committee is now to hand. It sets down the object of the work as being to investigate the methods, which might be adopted, for minimising the production of gas liquor effluents, or for rendering such effluents suitable for running into town sewers or into rivers and streams. The Report is divided into two sections - the first is a memorandum prepared by Dr. A. Parker on the subject of the disposal of liquor effluents from gas works, which gives a careful summary of the existing knowledge of the subject. The second part gives a summary of conclusions drawn from experiments at Hinckley, which have been carried out by Dr. Monkhouse.

Expressed in a few lines, if we understand it correctly, the effluent problem may be stated as follows. The waste liquor from sulphate of ammonia plants contains obnoxious constituents, which may be termed oxygen absorbing bodies. These are, in the main, phenols and oxidation products of ammoniacal liquor. Ammoniacal liquor becomes contaminated by phenolic bodies when there is excessive contact between tar and liquor; and ammoniacal liquor becomes oxidised by contact between liquor and air. To reduce to a minimum the difficulties associated with effluent disposal, the aim is therefore to produce a minimum volume of liquor and to keep the ammoniacal liquor as clean as possible, by collecting and

keeping it as far as is practicable out of contact with tar and air.

As regards methods of purification or disposal of spent gas liquor, several proposals have been put forward. It has been suggested to purify the liquor in bacterial beds, by flue gases, by chemical means, by solvents and so on. In the Report of the Investigation Committee, however, it is considered that the only satisfactory method of disposing of the liquor at the present time is to admit it under careful control into the sewage stream.

One occasionally hears of troubles between local authorities and gas works as regards effluent disposal, but we venture to think that in many cases these troubles would disappear if there was co-operation between the sewage disposal authorities and the gas works. It is the responsibility of the gas works to reduce the obnoxious constituents to a minimum and to supply the waste liquor in a carefully adjusted stream. Under these circumstances, the sewage beds should be able to deal with the spent liquor with little difficulty.

It would be premature at this stage to discuss the experimental work which the Research Committee is undertaking, but the Second Report should have some interesting data. The Institution of Gas Engineers is to be congratulated on its foresight in the formation of this committee and in the prosecution of the research work. In this way it is doing its best to solve a difficulty before it has grown to dimensions of any serious magnitude.

The Origin of "Sour Gas"

Anyone who has passed by the excavations made by a gas authority in the street must have noticed the curious odour which often rises from it. Such an odour is usually ascribed to "sour gas," an explanation which seems to assume that even coal gas may possess at some time linked sweetness, long drawn out. An interesting observation which throws new light on the question is recorded by Mr. Arthur Marsden, in a paper read recently before the Western Junior Gas Association and published in the *Gas Journal*. In the course of

extensions to plant at a gas works, it became necessary to open up a gas holder main, and an 18-in. foul main, which was exposed at the same time, was found to be partially covered with a beautiful deposit of greyish-white fibrous crystals, which much resembled a mass of asbestos. As it was thought that the occurrence might have some bearing on the corrosion of mains, the deposit was analysed and found to consist to the extent of nearly 94% of calcium acetate. The "sour gas" odour, however, led Mr. Marsden to surmise that some higher fatty acid was present, and the results given by dry distillation of a sample showed that a butyrate was also present. The origin of the deposit still remains uncertain, though it is thought that, as the main carries hot crude gas, the warmth has encouraged bacteria to utilise food borne by soil water from higher ground. Endeavour is now being made to trace the organisms responsible for this interesting synthesis, for it seems probable that the process is an example of symbiosis, an association which we find fairly commonly in the plant world, the products of one organism being utilised for further change by another organism closely associated with it. The pipe was laid some forty years ago, so that the process must be a fairly slow one, and is hardly ready for large-scale exploitation. It is another example of the prowess of the lower organisms as manufacturers, working at low potentials, utilising waste materials, but carrying out organic syntheses with an ease which we cannot yet emulate. Mr. Marsden's paper has whetted our curiosity, and we hope that, not only shall we soon learn the names of the organisms which produce the deposit, but that the attention of others will be drawn to the rather neglected possibilities of microbiology. Excavations are usual features of our modern streets, and now "sour gas" will, thanks to Mr. Marsden, serve as a general reminder of the unexplored realms that await the attention of the chemist and the bacteriologist.

Research

The appreciation of the necessity for research and, still more, of the benefits which accrue from it, is growing, we think, in a satisfactory manner. From an article in *British Industries*, which is the official organ of the Federation of British Industries, we learn that during the 12 months ended in June last, the electrical industry had a "record" year, for, although the home trade decreased, not unnaturally, by 6%, the exports increased by 134%. The electrical industry believes in research, and one wonders if this satisfactory situation is a result of that belief. Another aspect of research, the subservience of its application to economic considerations, is well illustrated in the article, on the present position of low-temperature carbonisation, which Major Henrici has contributed to this issue. The conclusion which he reaches is that the success of the various processes of low-temperature carbonisation will largely depend on the degree to which they can combine with other industries, and so ensure the proper utilisation of all the products, whether solid, liquid or gaseous. So far, it appears, no process has yet proved that it can make a profit. We shall await with interest the results of the exploitation by Fuel Production, Ltd., of the process developed at the Fuel Research Station, for in the not

too distant future, data should be forthcoming to clarify the financial aspects of the problem, and the present uncertainty regarding the value of the by-products of the process should be largely removed. Research of another, but no less important kind, is illustrated by the Report of the Food Investigation Board for the years 1925 and 1926, of which a short account appears on another page. It is gratifying to note that the increasing interest taken by the food industries in research has not been allowed to hinder attention to those investigations which keep the basal knowledge not merely abreast but well ahead of the practical problems. The Report should be widely read, for it is of concern to all.

The Chemical Engineer

Last week it was our privilege to record the publication of the fourth volume of the Transactions of the Institution of Chemical Engineers. One does not readily remember that the Institution is, in point of age, a mere stripling amongst the scientific bodies of our land. It is pleasant, however, to look back over the few years since its inception and admire the progress it has made and its contributions to the advancement of knowledge, and recall the many pleasant meetings which it has arranged. One of the chief duties of the Institution, one which it has ever held steadfastly before it, is, as Sir Arthur Duckham said in the course of his presidential address in 1925, to organise courses of technical education and to institute examinations which will develop and stamp students as chemical engineers. In pursuance of this duty, the Institution examined the facilities available for instruction and, after consulting representative industrial leaders, drew up the well-known Memorandum in which the Institution lays down the lines on which it considers the training of the chemical engineer should proceed. The Memorandum has been circulated among education authorities, and we believe it has had the result of securing a considerable amount of co-operation in framing a suitable training for would-be members of the profession. To the Institution also falls the duty of deciding the standard to which its members must attain, and last year we recorded the publication of the papers which had been set at the first examination for Associate-Membership. This week-end we have been able to counteract the charm of this lovely summer by a consideration of the questions which were set for the second examination, held in the middle of July. We were greatly interested by the various papers and thought that they were exceedingly well designed to show how far the candidates were able to appreciate the fundamental principles which they would be called upon to apply in industry. It seems to us that students who can satisfactorily answer such papers should make worthy members of the chemical engineering profession. Those who still are uncertain about the definition of the title "chemical engineer" could not do better than read these papers carefully; they will realise not only the type of knowledge required, but also its breadth and its close relation to the practical affairs of chemical industry. We are glad to be able to print the papers set at the recent examination for Associate-Membership of the Institution in this issue, as we think that they will be of particular interest to chemical engineers and chemists alike.

THE PRESENT POSITION OF LOW-TEMPERATURE CARBONISATION

BY MAJOR E. O. HENRICI

The carbonisation, or distillation, of coal at low temperatures is rousing considerable interest in many quarters, technical, financial, and political, but not all well informed, and there is some evidence of confusion in the minds of many speakers and writers as to what such processes can achieve and how near they are to achievement. There is more than one process of low-temperature carbonisation, just as there are several high-temperature processes, and they have different objects. For example, the first, and essential, requirement of the gas industry is a sufficient supply of gas of suitable and uniform quality. Any coke, tar, or other by-products are useful as sources of income, but they are necessarily of secondary importance. Similarly, the first requirement of the coke-oven industry is the supply of coke suitable for metallurgical and other purposes; gas, tar, etc., are useful if they can be disposed of. The type of plant to be adopted depends in the first place on the primary product required and the nature of the coal to be used, and in the second place on the relative importance of the various by-products, which again depends on the markets locally available.

The primary object of low-temperature carbonisation is not so clearly defined. One object, perhaps the most important from the national health point of view, is the production of a solid smokeless fuel suitable for use in the ordinary domestic grate, or cooking range, and in the smaller industrial furnaces. The general adoption of such a fuel would go a long way towards providing our cities with a purer atmosphere and abolishing what is generally referred to as the "smoke nuisance." If this object is to be achieved the coke produced must be in a suitable lump form, strong enough to stand transport, easily ignitable, and reasonably free from ash.

Such a fuel can be produced from suitable coal in retorts in which it lies quiescent during carbonisation, such as the Parker retorts, or where it is only moved intermittently, as in the Fuel Research Station retorts. Any turning over, or considerable movement during carbonisation, tends to form an undesirable amount of small coke. Experience at the Fuel Research Station indicates that any medium- or strongly-caking coal can be used, or a blend of weakly- and strongly-caking coals. It is found most satisfactory to charge the coal to the retorts in the form of nuts, with sizes below $\frac{3}{8}$ inch screened out. Sizing the coal in this way increases both the throughput of the retort and the yield of tar. With a strongly-caking coal the resulting coke is in large lumps; with a weakly-caking coal the coke remains, generally speaking, in the same sized lumps as the coal charged. If large quantities of coal are to be treated with a view to supplying domestic fuel, it will be necessary to utilise the fine coal as well as the larger sizes. This can be done by briquetting before carbonising, or in other ways.

A process such as that outlined above produces a considerable amount of rich gas, with a calorific value in the neighbourhood of 1000 B.Th.U. per cub. ft., and full value for this can only be obtained if it be used for

town's gas, in other words, if disposed of through a gas undertaking. In such a case it should be possible to credit the process with 3d. to 4d. a therm for the gas produced, whereas if the gas were used directly for heating the retorts, or under boilers, or for any other purpose where the high calorific value was of no particular advantage, the cash value of the gas would only be 1d. or 2d. a therm. For this reason it would appear that, generally speaking, the proper place for carbonising coal when the coke is to be used for domestic purposes is at a gas works. This has the further advantage that a market for the coke is also available on the spot, with a selling agency in existence.

For these reasons the Government asked Sir David Milne Watson, the Governor of the Gas Light and Coke Company, to go into the whole matter, and to say:—

(a) Whether, in his opinion, any of these processes had reached such a point of development that it was worth while for his Company to continue the experimental development on a large scale;

(b) If so, whether he considered the selected process or processes sufficiently promising to justify his Company in taking the entire risk of this development;

(c) If not, whether he would submit a scheme, after discussion, whereby the Government would be asked to bear a part of the risk involved.

The result of his report was that a subsidiary company (Fuel Production, Ltd.) has been formed, the capital of which has been guaranteed under the Trades Facilities Act, to erect a plant at the Richmond Gas Works with a capacity of 100 tons a day, and of the general design developed at the Fuel Research Station. This plant will be worked by the Gas Light and Coke Company, and the experience gained should show in the course of two or three years whether such a scheme will pay or not. Arrangements have been made by which all the experience gained will be freely at the disposal of any company desirous of taking up the process. Further particulars of the system, and of the arrangements made, will be found in the Annual Report of the Fuel Research Board for 1926, and in the report of a debate on Coal (Scientific Research) in the House of Commons on May 11, 1927.

Low Temperature Carbonisation, Ltd., are also erecting a plant on the "Parker" system, and the results obtained will afford parallel experience.

It does not follow that processes producing domestic fuel should necessarily work in connexion with a gas works. For example, the Maclaurin and the Midland Coal Products processes produce a lump coke, but as the retorts are internally heated by the combustion of a portion of the charge, the gas produced is large in volume and low in calorific value. It is not suited for general town supply, but only for heating retorts, boilers, furnaces, etc., or for use in internal-combustion engines, and then only when it can be used near the retorts where it is produced. Commercial plants on both these systems are in use, but both are finding a difficulty in obtaining a remunerative outlet for the gas. Neither process is suitable for carbonising a strongly caking coal.

In some cases the primary object of low temperature carbonisation may be the recovery of the oil-producing

tars from the coal, the solid residue being used as an industrial fuel. In these cases the technical problem is in some respects simpler, as the coke need not be in lump form, nor is low ash content of such importance. It is thus possible to use a system in which the coal is turned over during carbonisation, thus increasing the output by more rapid heating of the coal, and a lower grade coal can be used. On the other hand the coke will have a lower value than has domestic fuel. A process in which the coal is turned over during carbonisation will also give as a rule a higher tar yield, and the tar may be less "cracked." Strongly-caking coals are not suitable for this type of retort. Many types of retorts, mostly on the rotary principle, have been proposed for such purposes, and these may be either internally or externally heated. Several large-scale plants are being erected in this country and abroad to test the commercial feasibility of this type of process.

A plant which stands rather in a category by itself is that on the McEwen-Runge system, which is being tested at the Milwaukee power station. In this system the coal is pulverised and then carbonised in a current of hot gas, the tar is recovered, and the coke burned in the pulverised form in which it emerges from the retort.

In other cases, again, the primary object may be to produce a comparatively high-grade solid fuel from a low-grade raw material, with the recovery of such gas and tar as may be feasible. Such processes have the greatest promise of success where large quantities of low-grade fuel exist naturally, where they can be cheaply mined, as is the case with the brown coals in Germany, Canada, and Australia. They have also a definite but somewhat limited application in this country.

The most suitable site for the plant depends on the circumstances of each case. Where the coke is to be charged direct to furnaces there are advantages in having the plant close to the furnaces. Where a low-grade fuel is to be stepped up into a higher-grade solid fuel, a site near the colliery is indicated, but in all cases a suitable outlet for the gas is of importance, and in many cases the price obtained for the gas will decide whether or no the project is a financial success. It will be realised from what has been said that low-temperature carbonisation processes are largely dependent for success on the degree to which they can combine with other industries so that all the products, solid, liquid and gaseous, can be used with advantage.

One great source of uncertainty in the financial outlook—and a financial profit is essential if any process is to be developed commercially—is the still unknown value of the tar. The tar is different both from high-temperature tar and from natural oils. Its properties have not yet been fully investigated, and their study forms the subject of most interesting research which is being actively pursued in several quarters, private and official, from various aspects. There is no doubt that these tars will yield fuel oil and motor spirit, but the best methods of treatment are not yet fully worked out. They will probably yield lubricating oils, and certainly various chemical products of use in the manufacture of disinfectants, preservative paints, and probably dyes and fine chemicals.

It is impossible in the space available to attempt to describe, or even to mention, the large number of different processes that have been tried or are being developed, but it can be said that over half a dozen different types of plant of a commercial size are, or are being, erected in various parts of the world, and the results obtained in the next few years should give information on various factors which are still unknown, such as the cost of working, the life of the retorts, and the prices to be obtained for the various products when these are available in considerable quantities. It is, unfortunately, still a fact that no process has yet proved that it can make a profit. It is to be hoped that this statement will no longer be true in the not too distant future.

REPORT OF THE FOOD INVESTIGATION BOARD*

The years 1925 and 1926, reviewed in the present Report, were noteworthy for the increased attention paid to industrial problems. When the Board started, work was mainly devoted to basal problems, but gradually the interest of the industry was aroused to such an extent that the demands on the staff for the solution of special problems increased to a point that it threatened to prevent them from fulfilling their primary duty, that of keeping the basal knowledge not merely abreast but well ahead of the practical problems. Relief was afforded, however, as the Imperial Economic Conference was so impressed with the work of the Low Temperature Research Station, that when the Empire Marketing Board was established it provided funds to increase the size of the station. Specific investigations for outside bodies have related to the freezing of fish, the leakage of vapours from storage chambers, the conditioning of meat, the carriage of hams without the use of preservatives, the carriage of liquid eggs and so on. A new laboratory has been established at Covent Garden Market, and will make it possible to carry out a scientific survey of the conditions of produce after transport and storage.

In the report of the Director of Food Investigation for 1925 and 1926, the various sections have been written by the officers who have actually conducted the researches described.

Much interest attaches to the work on the water content of muscle, as no satisfactory explanation is available of the remarkable water-holding power of some colloids in the state of gels, or of the tissues of animals and plants. Work has been done on the determination of the variation of free water in animal tissues; on the hydration of proteins (haemoglobin, 20%; serum albumin, 30%; serum globulin, 50%; gelatin, 60%); on the determination of the osmotic pressure of gelatin dissolved in solutions of magnesium chloride (the molecular weight of gelatin was found to be about 55,000); and on heat diffusion in gelatin gels, the results closely resembling those calculated for pure water.

The chief conclusion arrived at in the study of the transport of ham and bacon without the use of preser-

* Department of Scientific and Industrial Research, H.M. Stationery Office, 1927. Price 2s. 6d.

vatives was that fluctuations of temperature, hence of relative humidity, were the main cause of deterioration during transit. Interesting differences in the behaviour of mild and hard-cured hams on freezing were noted. The effects of freezing and thawing on gelatin gels of varying concentrations are still being examined from various angles and considerable advance has been made, particularly in relation to the freezing of beef and mutton.

Systematic work on the formation of fat by yeast has continued and the interesting observation has been made that after incubation of yeast in oxygenated glucose-phosphate solution, the amount of ergosterol (identified by Rosenheim as the precursor of vitamin D) is increased. The experiments gave an opportunity of testing whether a fatty aldehyde occurred as an intermediate substance on the path from sugar to fatty acid and the results lend support to the view that no intermediate substance containing a less number of chains is formed, such as acetaldehyde or pyruvic acid, but that a chain of six carbon atoms forms the unit for further condensation. Progress has been made with the studies of the hydration of stearolic acid, and it is already clear that, whilst the reaction leads to the production of both possible keto-stearic acids, the formation of 10-ketostearic acid is favoured. The hydration of palmitolic and behenolic acids is also being studied, and a result has been obtained with the latter which is in accord with the theory of electron-displacement.

Further work has been done on the chemistry of glycogen, though progress has been retarded owing to the difficulty of obtaining reliable glycogen in sufficient quantity. A special variety of starch is being examined and it is hoped the work may decide the question whether starch and glycogen are chemically identical or not.

The investigations on apples have led to the conclusion that apples which keep the best, contain, as a rule, the least protoplasm and the most sugar, and exhibit the lowest respiratory activity, whereas fruit which does not store well has a high content of protoplasm, relatively little sugar, and a high respiration rate. Other work related to the internal breakdown in cold-stored apples, to pectic changes in apples and pears, to the systematic analysis of apple samples, and to various other important questions in connexion with the storage and transport of fruit and vegetables.

Amongst the physico-engineering investigations, the development of a temperature-measuring outfit for marine use is recorded, and work has been done on the constancy of nickel wire resistance thermometers, on flowmeters, on the behaviour of the Venturi meter with fluids other than water, on insulating materials, and on the rate of cooling of large masses. A result of the work on humidity measurements has been the development of a new form of hygrometer, based on the principle of "fog formation" in the atmosphere when it is adiabatically expanded; the instrument is still under investigation. Experiments have been made on a compound spiral type of wet and dry-bulb hygrometer and an apparatus has been devised for making comparative tests of the resistance of insulating materials to indentation.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, will be available about the middle of August. The reprints will be in Journal format, with paper cover, and the price will be 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent at once to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

MANCHESTER SECTION

The following provisional programme for the forthcoming 1927-28 session has been issued by the Manchester Section:—On October 7, 1927—Chairman's Address—C. J. T. Cronshaw. November 4, 1927—Joint meeting of the Manchester Sections of the Society of Chemical Industry, the Institute of Chemistry, Society of Dyers' and Colourists and the Manchester Literary and Philosophical Society. December 2, 1927—Joint meeting with the Fuel Section. "Coal and co-partnership," by J. A. Bowie, M.A., D.Litt., Head of the Department of Industrial Administration, College of Technology, Manchester.

On January 6, 1928 Joint meeting with the Textile Institute. "The action of caustic alkali on partially-methylated cellulose—The heat of reaction and adsorption," by F. C. Wood, M.Sc., A.T.I., and Agnes C. Alexander, B.Sc., A.T.I. February 3, 1928—Joint meeting with the Institution of the Rubber Industry. "The influence of zinc oxide on the coefficient of vulcanisation," by S. A. Brazier, M.Sc., A.I.C., and L. R. Ridgway, Ph.D., M.Sc., A.I.C. February 17, 1928—Joint meeting with the Liverpool Section at Liverpool. Visit to the works of Bryant & May, match manufacturers. March 2, 1928—"Some industrial applications of the potentiometric and conductometric methods of analysis," by T. Callan, M.Sc., Ph.D., and S. Horobin, B.Sc., and on April 13, 1928—the Annual General Meeting of the Section, when Dr. R. H. Pickard, F.R.S., will deliver an address on "Fundamental researches in the leather industry."

CALENDAR OF FORTHCOMING EVENTS

Aug. 20. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS. Newcastle-upon-Tyne. Annual Meeting at 2.30 p.m.

Aug. 31 BRITISH ASSOCIATION FOR THE ADVANCEMENT OF to Sept. 7. SCIENCE. Annual Meeting (97th year) at Leeds.

Sept. 6 INSTITUTE OF METALS. Autumn Meeting to be held at Derby. On September 6, at 8 p.m., the Sixth Autumn Lecture on "Non-ferrous metals in modern transport," will be delivered by Dr. L. Aitchison, in the Municipal Technical College. On September 7, a general meeting of members will be held at 10 a.m., and in the afternoon, at 2.30 p.m., visits will be paid to the Carriage and

Wagon or Locomotive Works of the London, Midland and Scottish Railway Company, or Derby Crown China Works. On September 8, at 2.30 p.m., visits will be paid to the works of Messrs. Rolls-Royce, Ltd., or Messrs. Leys Malleable Castings, Ltd., or to Messrs. W. Bemrose & Sons, Ltd. (printing works). During the meeting the following papers will be read at the different sessions: "Copper-magnesium alloys. Part II," by W. T. Cook and W. R. D. Jones; "Researches on intermetallic compounds. VI. The reaction between solid magnesium and liquid tin," by W. Hume-Rothery. "Age-hardening tests with elektron alloys," by K. L. Meissner. "Equilibrium diagram of copper-tin alloys containing from 10 to 25% of tin," by A. R. Raper. "Note on cathodic disintegration as a method of etching specimens for metallography," by C. S. Smith. "Protection of aluminium and its alloys against corrosion," by H. Sutton and A. J. Sidery. "Nature of the film produced by anodic oxidation of aluminium," by H. Sutton and J. W. W. Willstrop. "Grain growth in compressed metal powder," by C. J. Smithells, W. R. Pitkin and J. W. Avery. "The undercooling of some aluminium alloys," by Marie L. V. Gayler. "Constitution of alloys of aluminium with silicon and iron," by A. G. C. Gwyer and H. W. L. Phillips. "Effect of work and annealing on the lead tin eutectic," by F. Hargreaves. "The system magnesium-cadmium," by W. Hume-Rothery and S. W. Rowell. "Constitution and physical properties of some of the alloys of copper, zinc and cadmium," by C. H. M. Jenkins.

Sept. 9. INSTITUTE OF BREWING, Research Fund Committee and Corporate Members. Visit to hop-growing districts in Kent. Luncheon will be held at Canterbury.

Sept. 12 to 14. INTERNATIONAL SOCIETY OF LEATHER TRADES' CHEMISTS. Bi-Annual Conference in London. On Sept. 12, at 10 a.m., at the Leathersellers' Hall, St. Helen's Place, E.C.3, reception of members by Prof. D. McCundlish (president), supported by the Master of the Leathersellers' Company (H. C. Dove), and the presidents of the Society of Chemical Industry, Chemical Society, Institute of Chemistry, Society of Dyers and Colourists, British Association of Chemists, and the Royal Microscopical Society. At 1 p.m., Luncheon will take place at the Connaught Rooms, Great Queen Street, W.C., by invitation of The United Tanners' Federation and The Federation of Curriers, Light Leather Tanners and Dressers. At 3 p.m. a discussion will be held of Technical Agenda. On Sept. 13, at 10 a.m., the discussion will continue, also at 2.30 p.m., and at 7 p.m., Dinner will be held at the Hotel Cecil, Strand, W.C., by invitation of the members of the British Section of the International Society of Leather Trades' Chemists. Sept. 14, at 10 a.m., the discussion of Technical Agenda will continue, and also at 2.30 p.m. The Chemical Industry Club, 2, Whitehall Court, S.W.1, has kindly granted facilities for members attending the Conference to have the use of the Club during the period of the Conference.

Sept. 14. INSTITUTION OF SANITARY ENGINEERS. Visit to the Shipping, Engineering and Machinery Exhibition at Olympia.

INSTITUTION OF CHEMICAL ENGINEERS

We are glad to print below the questions set by the Institution of Chemical Engineers at the recent examination for Associate-Membership. One question, each, from Sections A and B, had to be attempted at home. The other sections consist of the questions set in London; three hours were allowed to answer four questions in each section; and reference books were provided for use by candidates.

HOME PAPER, JUNE, 1927

SECTION A

1. Design a plant for the manufacture of 500 galls. per day of 12 vol. hydrogen peroxide. Estimate the cost of the plant and the cost of production. How does this price compare with the current price of hydrogen peroxide, taking the selling costs as 10% on the sale price?

2. Three hundred tons of gypsum, containing 75% calcium sulphate, at 5s. per ton, and 200 tons of lignite, containing 37.25% of carbon, 35% of volatile matter, 23% of moisture, 3.5% of ash and 1.25% of nitrogen, at 4s. per ton, are available per week. Iron pyrites, free from arsenic, containing 50% of sulphur, can be purchased at 7d. per unit of sulphur, delivered on the site. Limestone containing 94.5% of calcium carbonate is also available in large quantities at 6s. per ton. Prepare a report on the commercial possibilities of the materials available, and indicate what raw material, and what process, you would recommend, in the circumstances, for the production of (a) sulphuric acid and (b) commercially pure sulphur, for both of which there is an excellent demand. Give a sketch drawing, showing the general arrangement and a specification of the plant for either (a) or (b), indicating the cost of manufacture and probable profit, assuming (a) 80% sulphuric acid commands a price of £3 per ton and (b) that the price obtaining for commercially pure sulphur is £5 15s. per ton.

3. Design a plant for the production of 20,000 lbs. of sulphur trioxide per day (24 hours). The sulphur trioxide is to be used for the manufacture of oleum. Crude sulphur (sulphur content = 99%) is available.

Prepare the necessary heat balance and material flow sheets. Estimate the heat interchanging surfaces and sizes of the plant units. Prepare a specification of the plant and estimate its cost. Draw to scale a diagrammatic plan and elevation of the plant.

4. Design a plant for the manufacture of 1 ton of acetone per 24 hours from grey acetate of lime.

Make drawings of the layout and show by sketches the details of the plant.

Estimate the cost of production, taking the price of grey acetate of lime 80% at £15 per ton and current prices for the other chemicals. Assuming the selling cost to be 10% of the market price, find the market price at which the manufacture will cease to be profitable.

SECTION B

1. (a) A magma containing water, ammonium sulphate and sulphuric acid, has to be treated in a centrifuge. The sulphuric acid content of this magma is 4%; what

metal would you recommend for the construction of the centrifugal basket?

(b) Assuming the sulphate of ammonia collected in the centrifugal basket had to be treated with a weak solution of ammonium carbonate as a neutralising medium, would you still continue to use the metal recommended for (a)? If not, what metal would you suggest?

(c) Describe in detail the experiments which you would conduct in each case on the metals in order to support your recommendation.

2. The temperature of a cold storage room has to be maintained at 30° F. The area of the wall surface is 3,000 sq. ft. and the estimated average live load is 60,000 lbs. of goods entering per day (24 hours).

Assuming ammonia as the refrigerant, calculate the heat interchanging surfaces and estimate the sizes of the various plant units which will be required. Prepare a dimensioned sketch of the plant.

The following data may be assumed:—

Mean specific heat of the goods = 0.9 relative to water
 Leakage loss coefficient = 0.07 B.T.U. per sq. ft. wall surface per hour per °F.
 difference between inside temperature and outside air temperature
 Heat equivalent of the workmen, lights, conveyors, etc. = 1,000 B.T.U. per hour operating for 7 hours
 Leakage loss during loading = 8,000 B.T.U. per hour.
 Temperature of air outside = 70° F.
 Water is available at 55° F.

N.B.—Candidates are expected to calculate the duty of the compressor but not to design it.

3. The walls of a cylindrical producer, 5 ft. internal diameter by 6 ft. long, consist of a layer of firebrick 9 in. thick surrounded by a layer of sand 2 in. in thickness which is held in position by a steel casing $\frac{1}{2}$ in. in thickness. If the inner surface of the brickwork is maintained at a temperature of 650° C. and the temperature of the surroundings of the producer is 15° C., calculate the heat lost by the producer. How will this loss be altered and by how much by increasing the brickwork to 14 in.

Neglect surface resistances.

Conductivity of brickwork

0.7 cal. cu. m. °C. hr.

“ iron

58.6 “ “

“ sand

0.336 “ “

Peclet constant for iron

3.36

Heat lost by radiation etc., given by

$a(\tau_1^4 - \tau_2^4)$

$10^{-8} + b(\tau_1 - \tau_2)^{1.25}$

in kilogram cal. per sq.

per hour

where a = Peclet constant.

b = constant value 3.

τ_1 and τ_2 = absolute temperature of outer surface of producer and air respectively.

4. Blue water gas is being used by a submerged flame process for the elimination of water from activated sludge, the original water content of which is 40%. Five hundred tons of dried product, with a 5% water content, are being produced per day. For every 1,000 lb. of activated sludge evaporated, 2,000 cu. ft. of gas are used, and 350 lb. of steam, at 90 lb. absolute pressure, are available. What quantity of such steam would you set apart (1) for the generation of blue water gas, for the “run,” and (2) how would you propose to utilise the balance of the steam, assuming a large factory existed and electrical energy and light were required? Give an indication of the cost of electricity per Board of Trade Unit, assuming the surplus steam was charged to the electrical plant at 6d. per ton.

LONDON PAPERS, JULY 14 AND 15

SECTION C

1. (a) Discuss the sources of power loss in industrial plants and indicate the factors which determine the losses and the means by which these may be kept within reasonable limits.

(b) Ten thousand galls. per day (24 hours) of a liquor have to be taken from a tank 4 ft. above ground level and then to a double tube preheater discharging to an evaporator. The liquor passes through the inner tubes which are of steel and of diameter 1 in. and arranged in series in ten lengths of 6 ft. each.

The friction factor for the liquor flow in the tube may be taken as 0.006 and the specific gravity of the liquor 1.1.

The liquor is being evaporated under a pressure of 15 lbs. per sq. in. absolute.

What power would be required to deliver the liquor to the evaporator? If the supply of liquor were reduced to 50 galls. per hour, what effect would the reduction have upon the operation of the preheater?

2. A cylindrical steel vessel $\frac{1}{2}$ in. thick is homogeneously lined with lead to a thickness of $\frac{3}{8}$ in.

The inner surface of the lead is maintained at a temperature of 200° C. and the outer surface of the steel at 70° C. Calculate how much heat will be transmitted through the wall per sq. ft. per hour.

Conductivity of lead = 27.5 cal. / cu. m. / °C. / hour.

Conductivity of iron = 58.6 cal. / cu. m. / °C. / hour.

3. Ammoniacal liquor, as produced at many gasworks, can only be disposed of at a pecuniary loss. From your knowledge of the methods by which ammonia is recovered at the present time at gasworks, can you suggest any alteration or modification of existing practice which is calculated to assist gas undertakings to dispose of their ammoniacal liquor at a profit?

4. How would you propose to produce dehydrated copperas (the ferric sulphate content of which must not exceed 5%) from ordinary copperas (crude ferrous sulphate)? Discuss the merits of a vacuum heated oven, and an open cast iron pan, for the purpose in question.

5. Indicate the relative advantages and disadvantages of heating a vessel by direct exposure to a fire, by the use of a liquid such as oil and by employing superheated steam.

6. State what methods you would adopt for measuring the quantity of fluid passing in the following cases:—

(a) 2,000 cu. ft. of air per minute at 15° C. and 760 mm. passing through a 6 in. diameter pipe.

(b) 20,000 cu. ft. of air per minute at 50° C. and 760 mm. passing through a 6 in. diameter pipe.

(c) 25,000 galls. of water per hour passing through a 6 in. diameter pipe. The pipe is already assembled and cannot be dismantled.

(d) 5,000 galls. of water per hour passing through a 3 in. diameter pipe which is not yet assembled.

(e) 4,000 galls. per hour of an oil (specific gravity—0.9 and viscosity—100 relative to water) passing through a 4 in. diameter pipe.

(f) 15,000 galls. per hour of a liquid (specific gravity—1 and viscosity—1.2 relative to water) passing through a 5 in. diameter pipe. The power loss due to the flow-meter is not to exceed $\frac{1}{4}$ h.-p.

(g) 1,200 galls. per hour of cooling water required for a condenser.

7. A billet preheating furnace uses coal containing 74% of carbon, 4.8% of hydrogen and 9.4% of ash (sulphur and nitrogen can be disregarded). Assuming that 50% of excess air is employed in the combustion calculate the flue gas analysis (a) on the assumption that complete combustion is obtained, and (b) on the assumption that 10% of carbon is converted to CO only.

8. The output of caustic magnesia (MgO) from a kiln fired with powdered coal is to be 2 tons per hour. From the following data estimate the fuel requirements of the kiln.

Composition of available coal (moisture and ash free basis):

C 80%, by weight
H₂ 5.5%
O₂ 13.5%
N₂ 1%

	ash content 5% moisture content 2.5%
Net calorific value (moisture- and ash-free basis) :	13,000 B.T.U. per lb. of coal.
Temperature required for the complete dissociation of the magnesite	800° C.
.. of primary air/coal mixture fed to burner	20° C.
.. .. secondary air entering kiln at burner	300° C.
.. .. gases leaving kiln	400° C.
.. .. clinker leaving kiln	400° C.
Heat of formation of MgCO ₃ from MgO and CO ₂	390 B.T.U. per lb.
.. loss (by radiation and convection) from kiln shell	300,000 B.T.U. per hour
Specific heat of CO ₂ leaving the kiln	0.23
Mean specific heat of the gaseous products of combustion of the fuel	0.25
Specific heat of magnesite	0.22
.. .. clinker	0.28

Excess air to be used for the combustion of the fuel

30%.

Ratio primary air/total air 1/4.

The available magnesite may be assumed to be 100% MgCO₃.

9. Calculate the heat loss from the curved surface of a rectifying column of a still; air temperature 15° C.; temperature of the column 62° C. at top and 96° C. at bottom. Diameter of column 50 cm.; height 5 metres; material—copper.

10. Design a cooler for mixed gases containing 50% of steam at normal pressure and 50% non-condensable gas. The temperature of the mixed gases is 100° C. and it is necessary to cool to 20° C. 50,000 cu. ft. of the mixed gases are to be dealt with per hour. Ample cooling water is available at 15° C.

SECTION D

1. A plant is required to concentrate 2,000 galls. per hour of a 15% sugar solution to 60% concentration.

Steam is available at 5 lbs. per sq. in. gauge.

What plant would you suggest?

Calculate the heating surfaces and the lbs. of water evaporated per lb. of steam. Give a dimensioned sketch of the plant and indicate the position of any necessary auxiliary plant.

The following data may be assumed:—

Sugar Concentration. Grams per 100 grams of solution.	Elevation of Boiling Points : ° C. at 760 mm.
10	0.4
15	0.5
20	0.6
30	1.0
40	1.5
50	2.0
60	3.0

What influence would (a) the presence of permanent gases in the feed liquor, and (b) the increasing concentration of the juice have upon the design and operation of the plant?

For the purpose of this question, the elevation of the boiling point for any given concentration may be taken as independent of pressure.

2. Discuss any laws relating to the power required for the size reduction of material and state on what assumptions they are based.

Describe either a jaw crusher, gyratory crusher or disc crusher, indicating the materials used for the jaws and their method of fixing. Compare the advantages and disadvantages of each type of machine.

3. What plant would you recommend for the production of 20 tons of ammonium sulphate per day from a 30% solution of (NH₄)₂SO₄. (a) containing 2% of H₂SO₄, and (b) a neutral solution? Calculate the heat requirements and give a sketch indicating any essential accessory plant.

4. Describe, with sketches, giving the principles of operation, the type of plant which you would recommend for one of the following operations on a commercial scale:

(a) The production of "caustic" magnesite from magnesite.

(b) The combined production of a "smokeless" solid fuel and a gas of high calorific value.

(c) The production of dilute nitric acid from a mixture of oxides of nitrogen, oxygen and water vapour.

(d) The concentration of a dilute solution of NaOH.

5. What are the different methods of feed to a triple effect evaporator and what are the factors governing the selection of feed for an evaporator of this type?

How do the different methods of feed affect the steam consumption and the load upon the condenser? Are these dependent upon the inlet temperature of the feed, and, if so, in what manner?

6. What are the physico-chemical principles involved in the manufacture of sulphuric acid by the chamber process? What steps would you propose to take in order to minimise reaction space?

7. Describe machines for the continuous separation of:—

(a) An ore from its gangue.

(b) A mixture of brass and iron turnings.

(c) Two immiscible liquids having different densities.

State the fundamental principle or principles involved in each case.

8. The vapour from the last effect of an evaporator operating under vacuum amounts to 5,000 lbs. per hour.

What type of condenser would you recommend, the condensate to be used as feed water for a boiler?

If the temperature of the vapour at the inlet to the condenser were 52°C ., estimate the size of the condenser required.

The following data may be assumed :—

Latent heat at 52°C . = 567 C.H.U. per lb.

The pressure of the vapour (saturated) at 52°C . = 101.5 mm. of mercury.

Water is available at 16°C .

What would a rise in pressure in the condenser indicate and what effect would this have on the operation?

9. Describe, with sketches, the plant that you would adopt for the following grinding operations :—

(a) Sulphate to pass 90% through a 50 mesh screen ;

(b) Anhydrite, to pass 95% through a 120 mesh screen and

(c) Sulphur, to a powder for a sheep dip.

10. In a nitric acid plant, the following vapours leave the retort per hour :—

HNO_3 vap.	149 lbs.
$\text{NO}_2 + \text{O}_2$	27 lbs.
H_2O	7 lbs.

State the type of plant which you would recommend for condensing the vapours, assuming the whole of the $\text{NO}_2 + \text{O}_2$ passes to the absorbers and estimate the surface required for the plant which you propose.

For the purpose of this question, the following data may be assumed :—

The latent heat of vaporisation of HNO_3 = 7250 gram calories per gram molecule.

The heat of solution in kilogram cal. of 1 gram molecule of HNO_3 in M gram molecules of H_2O is as follows :—

M gram molecules of water	0.5	1	1.5	2	2.5
Heat of solution	2.0	3.29	4.16	4.86	5.27

Assume overall heat transmission coefficient in the condenser = 73 kilogram cal./sq. m./ $^{\circ}\text{C}$ /hour.

SECTION E

1. *Compulsory*.—Indicate in EIGHT only of the following cases :—

I. The materials you would employ in the construction of plants for the following purposes under industrial conditions.

II. The type of construction.

III. Any special precautions necessary.

(a) The transport of liquid chlorine by rail.

(b) The storage of acetylene.

(c) The manufacture of "iron free" salt cake.

(d) The production of a nitro-amino compound (which must be free from metallic impurities) from the corresponding nitrochlor hydrocarbon.

(e) The purification of the mixed vapours and gases from a pyrites burner.

(f) The distillation of coal at low temperatures.

(g) The condensation and cooling of pure acetic acid.

(h) The nitration of toluene.

(i) The storage of hydrochloric acid.

(j) The production from salt cake of crude sodium carbonate.

(k) The transport of anhydrous ammonia.

(l) The filtration of aluminium hydrate.

2. Write an essay on one of the following as constructional materials and the chief uses, mentioning the chemical, physical and mechanical questions which are involved :—

(a) Concrete.

(b) Alloys containing nickel.

(c) Alloys containing silicon.

3. Write a short essay on the use of paint as a protection for iron or steel. State briefly the composition of paints used for this purpose.

4. Discuss the factors governing the choice of refractory bricks for the construction of a reverberatory furnace to roast sodium sulphate with anthracite duff, for the manufacture of sodium sulphide.

5. What are the relative advantages and disadvantages of copper and aluminium as constructional materials for chemical plants?

6. Discuss the effect of heat upon the properties of metals and mention how the effect may influence the design of plant.

7. What are the difficulties likely to be encountered in the evaporation of a solution of ammonium chloride, from the point of view of materials of construction : what type of plant would you recommend, and of what materials should it be constructed?

8. Describe how you would attach a soft rubber lining to a steel tank. If the tank consisted of a railway wagon for the transport of hydrochloric acid, could you use an ebonite lining? Give a reason for your answer.

9. Would you employ the same quality of lead for a sulphuric acid concentration pan as you would for the construction of a sulphuric acid chamber? Give reasons for your answer and state whether you prefer Pattisonian refined lead or lead refined by the Parkes process.

10. Describe the operations which are employed in the following cases :—

(a) Production of metal castings.

(b) Joining of sheets of the metals - steel, copper, lead and aluminium.

(c) Jointing pipe lines for carrying—

(i) Ammonia gas under pressure, and

(ii) Nitric acid vapours.

SECTION F

1. What are the chief factors which influence the choice of prime movers for electric generators? The following results were obtained during a test on a gas engine driving a dynamo :—

No. of strokes per min.,	98
Mean effective pressure,	59.4 lb. per sq. in.
Area of cross section of cylinder,	44 sq. ins
Length of stroke,	15 ins.
Average gas consumed,	2.3 cub. ft. per min.
Mean temperature of gas at meter,	13°C
" pressure	3.8 in. of water gauge.
Barometer reading,	29.2 ins. of mercury
Average water to cooling jackets,	8 lb. per min.
" temperature of cooling water at inlet,	19°C
" " " outlet,	48°C .
Calorific value of gas,	400 B.T.U. per cub. ft. at 0°C . and 760 mm.
Average output of dynamo	{ Volts 220
	{ Amperes 20.5
Loss of power in engine friction,	20%.
" " " belt drive,	1 h.p.

Prepare a report on the performance of the gas engine

and the dynamo. What is the overall efficiency of the plant?

2. How would you propose to light a factory in which naphtha is distilled? What precautionary measures would you take against fire?

3. Assuming Bernoulli's theorem, deduce an equation giving the volume in cubic feet per second flowing through a Venturi meter and apply the formula to the following problem.

In a 12 in. Venturi meter the throat is 4 ins. diam. Taking the constant of the instrument as 0.982, determine the difference of head at the entrance and throat when discharging (a) 100, (b) 500, and (c) 1,000 gallons of water per minute.

4. Outline the type of cost sheet which you would adopt in connection with the process for the production of electrolytic caustic soda, where (a) the weak solution is evaporated and sold as solid caustic soda; (b) where the chlorine is used in the manufacture of bleaching powder; and (c) where the hydrogen is collected and filled into cylinders under pressure.

5. 1,000 cub. ft. per hour (measured at 15° C. and 760 mm.) of dry hydrogen have to be supplied to a reaction vessel operating under a pressure of 200 atmospheres.

Describe the type of apparatus which you would use, and estimate the power required. What would be the heat produced? What would be the effect of cooling the compressor with (a) running water, and (b) still air?

6. 6,000,000 cub. ft. per day of coke oven gas are available 10 miles from a city. (a) How would you suggest disposing of this gas? (b) What arrangement would you make? (c) How would you propose to ensure continuity of supplies? In whatever form you recommend the gas should be used, indicate the kind of distribution system you would provide.

7. Calculate the thickness of the cylinder for a hydraulic accumulator with a ram 12 ins. in diameter to supply water at a pressure of 2,000 lbs. per sq. in. Take the internal diameter of the cylinder as 15 ins. Find the total weight which must be applied to the ram to maintain this pressure. Give dimensioned sketches and show the type of packing you would employ. Take the safe tensile stress for the material as 10,000 lbs. per sq. in.

8. Discuss the effect on the composition of the gas from a producer supplied originally with air of:-

- (a) Admitting steam with the air blast.
- (b) Reducing the depth of the fuel bed.

9. If in a boiler plant the steam output fell below that guaranteed by the makers of the boilers, what equipment would you purchase and how would you install and use it to determine and, if possible, increase the efficiency of the boiler house?

10. Indicate the design and general arrangement of a plant for the manufacture of calcium superphosphate, bearing in mind that the product has to meet severe competition. Discuss the essential factors which lead you to recommend such a design and general arrangement.

CORRESPONDENCE

THE COLLEGE MAN AND CHEMICAL INDUSTRY

SIR,—Some time ago there was a discussion in your columns on the question as to whether college men were wanted in the chemical industry. I considered it rather futile at the time because there can only be one answer, viz., that chemical industry simply cannot get on without college men. It is true that the discussion rightly took the line that there was something wrong with the "type" at present being turned out, but it was noteworthy in this particular discussion as also in many others on the same topic, that the Industrialist has had very little to say; broadly speaking, the academic man hitherto has done most of the talking and writing. Now this is not as it should be. It is time that the few industrialists who can speak with authority came out into the open and gave a lead to the universities and technical colleges and I hope that they will do so. I cannot speak for them (the industrialists), but I do happen to know that my views are shared by at least some of them, and after all I have had some little experience both of the academic and the industrial side of chemistry.

The raw material for all the profession—the young man of matriculation age—is much the same, whether he sets out to be an engineer or a chemist. Yet when he has taken his degree and goes out into the world to earn his livelihood—for professions are, after all, decided upon as a means of earning one's livelihood—there is a subtle, but very definite difference between the engineer and the chemist. What that is is hard to define, but most people are perfectly aware of its existence. Broadly speaking, the chemist is rather academic and impractical, and it is not easy, therefore, to fit him into a works organisation. Moreover, he has quite a good idea of his own importance, which does not help matters at all. Even to-day he finds it very difficult to combine with his fellow chemists, so that there is now no one organisation which by general consent speaks for chemists as a whole.

I do not suppose for one moment that the foregoing diagnosis will be generally accepted, but whether it is or not, it is a fact that until quite recently very few of the important administrative positions in the world of industrial chemistry were held by chemists. Among chemical merchants, chemists are practically unknown and there was and is not to-day the equivalent of the commercial engineer.

Assuming for the moment that this diagnosis of a very complicated state of affairs is fairly accurate, and it cannot be far out because there are many nostrums for improving the chemist and his lot, ranging from the study of engineering and economics to a more intensive study of chemistry by means of post graduate specialisation and research. All of these are good, but life is so short and for most students the position after four years' study is largely governed by economics.

Now, I am free to admit that there is no exact comparison between the chemist on one side and the engineer on the other. Moreover, the chemical horizon is becoming wider every day and we may have to visualise the possibility of early specialisation, but, broadly speaking, something happens to most chemists during their four years of training which makes them different, certainly from engineers. What then causes this difference?

To my mind it is caused very largely by the teachers and more particularly their method of teaching chemistry. A certain proportion of research men must always find their avocation in industry, but I have a clear impression that the teachers as a body concentrate too much on this particular aspect of study and less on the economics of everyday chemical industry. After all, the chemist, if he is to be of any use at all in a works, must realise the importance of losses, yields, purity, maintenance and overhead charges—even though he is only running his laboratory. It is easy to instil these ideas even when teaching, but it is difficult if their importance is not realised by the teacher.

I suggest, therefore, that far too few of our professors have been through the mill and that as a consequence the teaching of chemistry has become much too academic. Even though a large body of opinion is with me in voicing this heresy it will be very difficult to put things right, but it is impossible even to make a start unless the leading industrialists speak out in no uncertain tones. In the meantime it would do every chemist an infinity of good if, as a part of his course, he had to fire a retort or a boiler for two months, or work the ordinary chemical labourer's shift in a works for the same period. He would learn something, probably not a lot, but the psychological effect would certainly be wonderful.

I am, Sir, etc.

WILLIAM CULLEN

A LONDON INSTRUMENT MAKER

SIR.—It is generally admitted that there are few finer craftsmen than the London instrument maker. As employers, therefore, we regret to find a Continental origin ascribed to any of his products.

Since 1849, when the late Mr. L. Oertling settled in London and commenced business as a builder of precision balances, instruments have born the mark "L. Oertling—London," which has, in fact, become known throughout the world as denoting the highest grade of workmanship in this very specialised field.

It is easily understood that the name might suggest to some a foreign origin; but the truth is that this has never been a foreign firm with a London address, or a firm importing foreign balances, or parts for erection here.

Every "Oertling" balance has been built throughout in London; and, since we find misapprehensions on this point, we wish to stress that our output is entirely British—the product of British brains, British craftsmen, and British capital.

Yours faithfully

(for L. Oertling, Ltd.),

MALCOLM DUNBAR,

Director

PERSONAL AND OTHER ITEMS

Sir Hugh K. Anderson (Master of Gonville and Caius College, Cambridge) and Professor T. R. Elliott (director of the medical unit, University College Hospital, London), have been appointed members of the Medical Research Council, to fill the vacancies caused by the retirement of Sir Frederick Andrewes and Sir Cuthbert Wallace.

In order to give two more delegates an opportunity of attending the forthcoming Empire Mining and Metallurgical Congress in Canada, Sir Robert Hadfield placed two travelling scholarships at the disposal of the Iron and Steel Institute and the Institution of Mining and Metallurgy. The former has nominated Miss C. F. Elam, D.Sc., and the latter Prof. B. W. Holman, O.B.E., both at the Royal School of Mines, South Kensington, and on July 25 they paid a visit to East Hecla Works. This public-spirited action of Sir Robert Hadfield will be much appreciated.

Dr. E. R. Weidlein, director of the Mellon Institute of Industrial Research of the University of Pittsburgh and president of the American Institute of Chemical Engineers, will be in Europe during September and October. Dr. Weidlein, who will visit educational institutions, research laboratories and chemical works and will discuss problems in industrial research organisation with various authorities, expects to be in England during September 11 to 24, and may be addressed—c/o The Old Colony Club, 79, Fore Street, London.

Dr. G. Korte has succeeded the late Dr. Kempner as chairman of the German Potash Syndicate. Dr. Zirkler has become chairman of the Potash Council.

Helmuth F. Manske, Ph.D. (Manchester), B.Sc. (Queen's, Ont.), has been awarded the Lilly research fellowship, valued at \$3000, at Yale University.

Blythe A. Eagles, B.A. (B.C.), has been awarded a Sterling fellowship, valued at \$600, at Yale University.

The death is announced of Mr. J. J. Wooler, a director of the Bleachers' Association, Ltd.

The death is announced, at Haybridge Hall, Hadley, near Wellington, of Col. James Patchett, J.P., D.L., Chairman and Managing Director of the Shropshire Iron Co., Ltd., Director of the Union Steel Corporation (of South Africa), and of other companies. He had been a member of the Society of Chemical Industry since 1897.

We regret to learn of the death, through a motor accident, of Mr. C. R. Timmings, process manager of the Thornton works of the United Alkali Company.

Medal for Agricultural Research

A silver medal is being offered by the Royal Agricultural Society for a monograph or essay giving evidence of original research on any agricultural subject, on any of the cognate agricultural sciences, or on agricultural economics. Candidates for the medal must reside in Great Britain or Ireland and must not be more than 30 years of age on September 29, 1927, and the monograph or essay must be forwarded to the Secretary of the Royal Agricultural Society on or before October 31.

Scientific Management of Industry

The third International Congress of Scientific Management will meet in Rome at the International Institute of Agriculture from September 5 to 8, when the following problems connected with scientific management will be discussed:—Industries and trade in industrial products; agriculture and trade in soil products; public services and public utilities; and domestic economies. These

subjects will be dealt with by four separate sections, and the conclusions arrived at will be submitted to a final meeting of the congress as a whole. The congress will also deal with such questions as maximum production; factory layouts; labour-saving devices; time-studies and administration systems, for public authorities as well as manufacturing units. The subscription fee to the congress is nominal, and persons attending may send in papers on the subjects under discussion, preferably dealing with practical cases and results obtained from the application of the principles of scientific management. Papers, subscription forms, etc., should reach the organisers, E.N.I.O.S. (Ente Nazionale Italiano per l'Organizzazione Scientifica del Lavoro), Piazza Venezia, 11, Rome, as soon as possible.

The French and Italian railways are making 50% reduction on tickets for members of the congress, and hotels have considerably reduced their normal charges. Further information can be obtained direct from the address given above, or through the Production Department of the Federation of British Industries, 39, St. James's Street, London.

Canadian Chemical Industry

The annual report for 1926 of the chemical group of industries, issued by the Dominion Bureau of Statistics, shows an increase of \$7,500,000 in value over the preceding year. Capital increased by \$6,000,000, whilst the number employed increased from 13,951 to 14,313; salaries and wages from \$17,169,157 to \$18,158,614; and materials used cost \$59,756,675, or about \$3,500,000 more than 1925. There was a slight increase of \$319,622 in value of the output of coal-tar and products; the acids, alkalis, salts, and compressed gases division showed an increase of \$1,231,000; explosives, ammunition, fireworks and matches, as a division, remained stationary, although explosives showed an increase in output and value; there was a slight improved value of output of complete fertilisers; medicinal and pharmaceutical preparations increased by \$1,160,000; paints, pigments, and varnishes advanced by \$2,468,317; soaps and washing compounds increased by \$1,152,000; inks, dyes, and colours increased by \$51,064; wood distillates and extracts declined by \$245,003, and miscellaneous chemical products increased by \$893,194 in value of output - all as compared with the preceding year. The total value of the products of these divisions was \$120,369,518, as against \$112,906,746 in 1925.

Activated Carbon Agreement

An agreement is reported to have been made between the Société des Charbons Actifs Urbain, of Paris, and the German Carbo-Union (controlled by the I. G. Farbenindustrie A.-G. and the Metallbank), providing for exchange of patents relating to activated carbons.

The I. G. and The Standard Oil Co.

It is reported that an agreement has been made between the Interessen-Gemeinschaft Farbenindustrie, represented by the Director-General, Herr Bosch, and other officials, and the Standard Oil Company, represented by the president of the company, Mr. W. Teagle, providing for the joint exchange of technical information and for co-operation in various respects between the two concerns. The object of the agreement is the joint

exploitation of a high-pressure process for refining crude oils which are ordinarily difficult to deal with. This process of the I. G. is at present only in the laboratory stage. No formal agreement was, it is believed, arrived at on the question of markets for products from the liquefaction of coal, as the I. G. synthetic motor fuel is not yet on the market. Subsequent co-operation from England and from France is, for this reason, considered likely in some quarters. When the synthetic fuel is ready it will be marketed by the German Petrol Company, of which half the shares is controlled by the I. G., and one-quarter each by the Standard Oil and Shell companies.

Artificial Silk in Germany

The Vereinigte Glanzstoff-Fabriken A.-G., Elberfeld, proposes to increase its ordinary share capital from 42 to 60 million marks and to issue 300,000 marks of new preference shares. The I.P. Bemberg A.-G., Barmen, is also increasing its capital from 16 to 28 million marks, of which 8 million marks are to be used with a view to extending and strengthening the existing community of interest associations. It is probable that the Vereinigte Glanzstoff-Fabriken A.-G. will require further funds in connexion with the construction or extension of new factories. It is already participating with Courtaulds, Ltd., in the erection of a big factory near Cologne, which is expected to start production, estimated at 3,000,000 kg. per annum, in the coming autumn. Another existing factory has also recently been acquired by the company, together with the Dutch Enka, while the factory of the Aceta, in which the Elberfeld concern has a part interest, will reach full capacity towards the end of the year.

The German Nitrogen Industry

Hitherto the German Potash Syndicate, according to the *Financial Times*, has been selling fixed nitrogen produced chiefly by the I. G., but reports from Berlin state it will probably market fixed nitrogen from plants at the Mont Cenis and Hibernia collieries, which are to begin producing at the rate of 9000 tons each a month. In 1925-26, the Potash Syndicate sold the equivalent of some 325,000 tons of nitrogen, and sales for the current year are estimated at 390,000 tons. As the additional output from the Mont Cenis and Hibernia collieries will total 216,000 tons per annum, the sales of I. G. fixed nitrogen by the syndicate would be considerably reduced. It is pointed out that the I. G. could easily reduce prices, as the cost of production is about 7½d. per kg. compared with a sale price of about 1s. per kg.

New Remedy for Leprosy

A new metallo-organic preparation for use in treating leprosy consists of a solution of 2-myristo-oxymethyl-3-oxybenzaldehyde in hydrocarpus oil. The new preparation, sold under the name of "Avenyl," is, it is stated, not poisonous, is free from the disadvantages of arsenic compounds, and is applied subcutaneously.

Titanium White

A controlling interest in the Titan Company of Frederikstad, Norway, has been acquired by the National Lead Company (U.S.A.), which controls the Titanium Pigments Company, of Niagara Falls.

REVIEWS

THE PRODUCTION OF COTTON. By Dr. H. G. COLLINGS. Pp. xi+256. The Wiley Agricultural Series, edited by J. G. Lipman, B.Sc., A.M., Ph.D., D.Sc. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1926. Price 17s. 6d.

This is an excellent book, well illustrated, and concisely yet interestingly written. The selection of material and its well-balanced presentation are obviously the product of a well-informed and orderly mind.

Written primarily for agricultural students and workers in America, the book deals with the growth of cotton from the time of preparation of the soil for planting till the harvesting, ginning and baling of the ripened cotton for transport to manufacturing areas. Climatic and soil conditions which affect the growth of cotton are fully dealt with. Much valuable information is given relating to the botanical characteristics, morphology and breeding of cotton, and the uses of such by-products as cottonseed meal and cottonseed oil receive adequate attention. A particularly interesting part of the book deals with the successful struggle of cotton planters against the various diseases and insect pests to which cotton is liable, the help which science is able to give in this direction being clearly indicated. It is important to remember that practically the whole of the book is devoted to cotton growing as carried out in America.

Perhaps the least satisfactory portion of the book is that relating to the growth and fine structure of cotton hairs within the bolls. This portion is much too compressed, and indeed certain valuable information is omitted. Cotton is grown only because it is one of the most important textile fibres, and for this reason both producer and user alike are vitally concerned with the physical and chemical characteristics of cotton hairs. It is desirable that future editions should give the reader the clearest possible presentation of all the growth factors which affect cotton hairs and their value in subsequent textile manufacture.

This book will be found extremely valuable by all concerned with the growth of cotton, while it is not less interesting to all those associated with the conversion of cotton into yarns and fabrics. A. J. HALL

LUBRICATION AND LUBRICANTS. By LEONARD ARCHBUTT, F.I.C., F.C.S., and R. MOUNTFORD DEELEY, M.Inst.C.E., M.I.Mech.E. Fifth edition, revised, enlarged, and reset. Pp. xxxii+650. London: Charles Griffin & Co., Ltd., 1927. Price 36s.

The last revision of this book took place in 1912 when the third edition was published, and consequently a large amount of new material has been available for the present (the fifth) edition. The authors have received the assistance of numerous other authorities on lubrication in the preparation of several of the sections.

Since the last edition a great deal of work has been published on the subject of oiliness and a considerable portion of the book is now given over to the theory of friction, all the recent work on this subject having been carefully reviewed and abstracted, making this one of the strongest sections of the book. The sources, pre-

paration and properties of lubricants are treated briefly, but some of the newest and most important developments in the preparation of lubricants appear to have been overlooked. Such processes as the Sharples "Bright Stock" and the Sharples "Long Residuum" processes, which account for a very large proportion of the world's lubricating oils at the present time, and also the contact clay filtration process, which has almost entirely superseded other methods of refining for the production of lubricants, have been either overlooked or received very scanty attention.

An excellent and very detailed section treats the subject of viscometry, all known methods of obtaining absolute viscosity in addition to the commercial viscometers being described. Numerous viscosity-temperature graphs are given in each case, the viscosity being plotted directly in absolute units, not as the logarithm of the absolute viscosity, a system which has much to be said in its favour. A full description is given of the methods of analysis recommended by the Institution of Petroleum Technologists as well as American and other methods.

Both physical and chemical testing of mineral and saponifiable oils is dealt with in great detail. There is also a large amount of space given to the subject of friction testing machines and to the appliances used for lubrication. One cannot help thinking that some of the space given to details of lubricating appliances might have been more profitably employed in other ways.

A section one would consider to be of prime importance, that is the portion of the book describing the nature of the oils to be used for various types of engines and machinery, receives remarkably little space; for example, the lubrication of all types of engines and mechanical appliances only receives some 20 pages in a book containing over 600 pages, and some of the material in this section is far removed from the modern practice. For example, for the lubrication of clocks, watches and other delicate mechanism, several oils are recommended, but the type of oil which is mainly used for this purpose at the present time, that is to say a white mineral oil of the transformer oil type, is not mentioned. A large proportion of the oils nowadays used for turbine lubrication are below the viscosity range mentioned under this heading. One would have expected some guidance as to the nature of the base oils to be employed for various purposes with recommendations as to the relative values of asphalt base, naphthene base and paraffin base mineral lubricants for the various services, but very little information is forthcoming on this subject.

The lubrication of motor cars only receives one-third of a page, a surprisingly small amount of attention, considering that the motor car consumes a greater quantity of lubricating oil than any other form of machinery. Aircraft engines are dispatched in one line. There is no doubt that this section is weak, considering the detail with which other and less important matters are treated.

The book contains much very valuable information, and will prove of great value to every student of lubrication.

H. MOORE

COMPANY NEWS

BRADFORD DYERS' ASSOCIATION

An interim dividend of 1s. per share, subject to tax, is to be paid on the ordinary capital of £2,170,363.

CHEMICAL AND INSULATING CO.

This company was registered on August 3 with a nominal capital of £100,000, in £1 shares, to carry on the business of manufacturing, wholesale and retail chemists and manufacturers of and dealers in articles and materials capable of being used for insulation or protection, packing, jointing or lining, and articles and materials composed of magnesite or asbestos. The subscribers are J. Campbell and P. W. Campbell, and the registered office is at Cockerton, Darlington.

FORSTER'S GLASS COMPANY

The eighth annual general meeting was held on July 28, Sir Sydney H. H. Henn, M.P., the vice-chairman, presiding. After speaking with regret of Mr. John Forster's declining health he said the company's loss through the coal strike amounted to £40,000, resulting from the use of foreign coal, increased cost of chemicals, electricity, gas, etc. The results, such as they were, had only been obtained by great improvements and developments in the works, and by the consequent reduction in the cost of production. The demand for the company's goods during the first three months of the present financial year had kept rather quiet, possibly owing to the decreased purchasing power of the general public, and as a result there had been a great deal of price-cutting by manufacturers to contend with, as well as the usual foreign competition. All the plant and machinery had been maintained and improved on the most modern lines. It was not yet possible to pay a dividend on the cumulative participating preference shares, or to put forward any proposals at present to deal with the accumulated arrears of dividend on those shares. This decision agreed with the best financial advice that they had been able to obtain. The report was approved and adopted. The retiring director, Sir Sydney Henn, K.B.E., M.P., was re-elected.

INDESTRUCTIBLE PAINT AND STANDARD VARNISH CO., LTD.

It is announced that no interim dividend will be paid this year. The company, which has an issued capital of £75,000, paid an interim in August, 1926, of 5th p.

BENN BROTHERS, LTD.

The annual general meeting was held on August 4, Sir Ernest J. P. Benn, Bt., C.B.E. (chairman) presiding. In moving the adoption of the report and accounts (cf. *Chem. and Ind.*, August 5, 1927, p. 712), Sir Ernest Benn said that although the annual improvement had been reduced to a relatively small amount, the accounts showed a better figure than ever. Goodwill and copyrights stood at a figure which was very little more than the annual trading profit of the company. The £57,286 which had been invested in subsidiary and other companies was, except for one or two very small sums, employed in the most successful book publishing enterprise of recent times. The board had decided to take what he hoped would be only the first step towards

making the nominal capital of the company approximate more nearly to the actual value of their property. After 31 years of saving, the reserve account had reached a total of £87,000. The carry-forward—£18,756—was by far the largest the company had ever had. As to trade during the year, they had had more than their share of difficulties. Notwithstanding this, their advertising revenues again constituted a record. Speaking of the burden of taxation, Sir Ernest Benn said that the State took out of their enterprise three or four times as much as the shareholders. They were frequently criticised because of the price of books, but in his view the present price of books, which was far too high, was composed half of books and half of taxation. The reports and accounts were adopted and the dividend as recommended was declared. At an extraordinary general meeting which followed, resolutions were passed for the capitalisation of £70,715, of the reserve account, and for the increase of the capital of the company to £250,000. At the annual meeting, the shareholders congratulated Sir Ernest Benn, the chairman of the company, on the approaching celebration of his silver wedding, and asked his acceptance of his portrait.

STANDARD AMMONIA COMPANY

The Standard Ammonia Company was registered on July 22 with a nominal capital of £50,000, in £1 shares, for the purpose of adopting an agreement with the Standard Ammonia Company and its liquidator, and to carry on the business of wholesale and retail dealers in chemical substances of all kinds, chemical refiners and manufacturers, manufacturing chemists, artificial fertiliser manufacturers and dealers, etc. The directors of the company are F. Lennard (chairman), C. Page, F. L. F. Lennard, W. L. A. Lennard, and E. S. Lennard.

STANDARD CHEMICAL CO.

The trading profits for the year to March 31, 1927, were \$194,979, compared with \$34,835 for 1926, the net profits being \$4,676, after deducting \$30,303 for interest and \$160,000 for depreciation. Total sales amounted to \$1,634,657, an increase of \$117,262.

RECKITT AND SONS, LTD.

A dividend has been declared of 9d. per share, less tax, on the ordinary shares.

RAYSHEEN, LTD.

The second ordinary general meeting, held on April 22, was presided over by the chairman, Sir Charles H. Wilson, LL.D., J.P., M.P., who said that the company had not yet had a trading period, and therefore no attempt had been made to write off such items as preliminary expenses, etc. The plant was now running and almost completed, and would be taken over from the makers as soon as the terms of the contract with them as to quality and quantity had been satisfied. The union of the company's yarn with linen, shown at the recent exhibition where the company's products attracted a good deal of attention, gave equal satisfaction to the weaver, and the directors were convinced that this product would find a ready market. An extraordinary general meeting followed, at which a resolution was passed to change the name of the company from Raysheen, Ltd., to Sunsheen, Ltd.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, curr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9—£9 5s. per ton. Grey, £15 per ton. Liquor, 9d. per gal. 32° Tw.
 Charcoal.—£6—£9 per ton, according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s.—4s. 1d. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4 10s.—£5 per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 6d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 9d.—2s. 10d. per gal. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 10d.—10½d. per gal., ex works in tank wagons; Standard motor, 1s. 3d.—1s. 3½d. per gal., ex works in tank wagons; Pure, 1s. 6d.—1s. 7d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 4d.—1s. 9d. per gal. Pure, 1s. 7d.—2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 2s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Standard specification, 7½d.—7½d. per gal. Middle Oil, 9d.—10d. per gal. Heavy, 8½d.—8½d. per gal. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/100, 1s. 2d.—1s. 4d. per gal. Solvent 95/100, 1s. 4d.—1s. 5d. per gal. Solvent 90/100, 1s.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—88s. 9d.—92s. 6d. per ton, f.o.b. according to district. Nominal.
 Pyridine.—90/140.—5s. 9d.—7s. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. 3d. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzdine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—2s. 7½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene. 60/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 8d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£30 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 5d.—2s. 6d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—5 cwt. lots. Cryst. 41s. per cwt. Powder 45s. per cwt. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7½d.—1s. 8d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 3½d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. per lb.
 Benzophenone.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—5 cwt. lots. Crystal 25s. per cwt. Powder 27s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 4d. per lb. Potassium.—1s. 11d. per lb. Sodium.—2s. 2d. per lb. Granulated ½d. per lb. less. All spot.
 Calcium Lactate.—1s. 2½d.—1s. 3½d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate. 6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730.—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—1 lb., 16s. per doz.; ½ lb., 9s. 6d. per doz.; ¼ lb., 6s. 6d. per doz.
 Hydroquinone.—2s. 11d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 20s.—22s. per cwt.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 10s. 6d.—14s. 6d. per lb., according to quantity; Liquid (95%), 12s. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonat.—9s. 6d.—9s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—2s. 9d.—3s. per lb.
 Phenazone.—4s. 3d.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb.
 Potass. Metabisulphite.—8d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins (1000 oz. lots).
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911.—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. *consignee's station in 1-cwt. kegs.*
Sod. Nitroprusside.—16s. per lb.
Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
Sod. Salicylate.—Powder, 1s. 9d.—1s. 10d. per lb. Crystal, 1s. 10d.—1s. 11d. per lb.
Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
Sulphonal.—6s. 6d.—6s. 9d. per lb.
Tartar Emetic B.P. cryst. or powder.—2s.—2s. 2d. per lb.
Thymol, Puriss.—10s. 6d.—11s. 6d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.
Aubepine (*ex Anethole*).—10s. 6d. per lb.
Amyl Acetate.—2s. per lb. **Amyl Butyrate.**—5s. 3d. per lb.
Amyl Salicylate.—3s. per lb.
Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. **Benzyl Alcohol free from Chlorine.**—2s. per lb.
Benzaldehyde free from Chlorine.—2s. 6d. per lb. **Benzyl Benzoate.**—2s. 6d. per lb.
Cinnamic Aldehyde.—Natural, 17s. per lb.
Coumarin.—10s. per lb.
Citronellol.—13s. 9d. per lb.
Citral.—8s. 6d. per lb.
Ethyl Cinnamate.—6s. 6d. per lb.
Ethyl Phthalate.—2s. 9d. per lb.
Eugenol.—8s. 6d. per lb. **Geraniol** (Palmarosa).—18s. 6d. per lb. **Geraniol.**—6s. 6d.—10s. per lb. **Heliotropine.**—4s. 9d. per lb. **Iso Eugenol.**—13s. 6d. per lb. **Linalol.**—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. **Linalyl Acetate.**—(*ex Bois de Rose*) 18s. 6d. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.
Methyl Anthranilate.—8s. 6d. per lb.
Methyl Benzoate.—4s. per lb.
Musk Ketone.—35s. per lb.
Musk Xylol.—8s. 6d. per lb.
Nerolin.—4s. 6d. per lb.
Phenyl Ethyl Acetate.—12s. per lb.
Phenyl Ethyl Alcohol.—10s. 6d. per lb.
Rhodinol.—32s. 6d. per lb. **Safrol.**—1s. 6d. per lb. **Terpineol.**—1s. 8d. per lb. **Vanilin.**—18s. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. **Anise.**—3s. per lb. **Bergamot**—28s. per lb. **Bourbon Geranium.**—14s. 6d. per lb.
Camphor.—70s. per cwt. **Cananga, Java,** 26s. per lb.
Cassia, 80/85%.—7s. 6d. per lb. **Cinnamon, Leaf.**—6d. per oz. **Citronella.**—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. **Clove, pure.**—6s. per lb.
Eucalyptus, 75/80%.—2s. 3d. per lb. **Lavender.**—Mont Blanc 38/40%, 22s. 6d. per lb. **Lemon.**—8s. per lb. **Lemon-grass.**—4s. 6d. per lb. **Orange, Sweet.**—10s. 6d. per lb.
Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. **Palma Rosa.**—10s. 6d. per lb. **Peppermint.**—Wayne County, 17s. per lb. **Japanese,** 8s. per lb. **Petitgrain.**—7s. 9d. per lb. **Sandalwood.**—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Oct. 4th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on August 14th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Akt. Ljungströms Angturbin. Heat exchangers. July 25. (Swed., 31.7.26.)

Bisch. Continuous kilns. July 29. (Fr., 6.8.26.)
Blair, and Sunderland Forge & Eng. Co. Centrifugal separators. July 26.
Blamey. Separation of materials of different specific gravity. July 29.
British Thomson-Houston Co., Ltd. Depositing emulsified solids. July 26. (U.S., 16.8.26.)
Dunlop Rubber Co., Ltd., Chapman, and McKay. Deposition of organic materials from aqueous dispersions. July 25.
Godel. Separation of gases and vapours. July 25.
I. G. Farbenind. Catalytic gas reactions. July 25. (Ger., 24.7.26.)
I. G. Farbenind. Supplying heat in high-pressure reactions. July 28. (Ger., 28.7.26.)
Maschinenfabr. Grevenbroich. Drying apparatus. July 27. (Ger., 27.7.26.)
Morgan. Heaters or retorts. July 28.
Morgan. Forming agglomerates etc. from pulverised materials. July 29.
Mulot. Filtering apparatus for gases. July 26. (Fr., 18.6.27.)
Russell and Thynne. Furnaces. July 30.
Seavia. Distillation process. July 26.

II.—Complete Specifications

11,462 (1926) and 5479 (1927). **Raw.** Separation of solid materials of different specific gravities. (274,587.)
 14,072 (1926). **British Dyestuffs Corp., Baddiley, and Chapman.** See I.
 1899 (1927). **Smallwood and Fallon.** Furnaces. (274,730.)
 8303 (1927). **I. G. Farbenind.** Drying agent for gases. (272,173.)
 13,363 (1927). **Dörsting.** Roller mills. (274,784.)
 14,212 (1927). **Kordt.** Grinding bodies for ball-, drum-, and tube-mills. (274,786.)
 *14,873 (1927). **Soc. Anon. des Charbons Actifs.** Analysis of a mixture of gases or of vapours. (274,826.)
 *17,389 (1927). **Electrolux Ltd.** Condensation of gases or vapours. (274,840.)
 *18,490 (1927). **Soc. Internat. des Proc. Prod'homme-Houdry.** Treatment of compounds or gases by gaseous agents. (274,846.)
 *19,289 (1927). **Meyerhofer.** Continuous conversion of solids, solutions and gases. (274,881.)
 *19,679 (1927). **I. G. Farbenind.** Catalytic gas reactions. (274,904.)

II.—Applications

Anderson. Distilling carbonaceous material. July 25.
Broué and Strevena. Hydrogenation of shales. July 26.
Calcott, Lorrman, and Parmelee. 19,868. See XX.
Kelly. Treating coal, peat, etc. July 29.
McLuckie, and Oldham & Sons. Apparatus for detecting etc. presence of explosive gas. July 25.
Oswald. 19,907. See XI.
Wildish. Treatment of oil fuel refuse. July 28.
Wisner. Coal ball manufacture. July 25. (U.S., 7.8.26.)

II.—Complete Specifications

7676 (1926). **Bone, and Wilson Bros. Bobbin Co., Ltd.** Production of active carbon. (274,538.)
 7804 and 13,259 (1926). **Testrup, Boberg, and Techno-Chemical Laboratories, Ltd.** Treating bituminous and like materials. (274,540.)
 10,809 (1926). **Potts (Canada Carbide Co., Ltd.).** Dissociation of carbonaceous gases or vapours. (274,573.)
 13,935 (1926). **Casale.** Preparation of mixtures of carbon monoxide and hydrogen from hydrocarbons. (274,610.)
 19,431 (1926). **Simon-Carves, Ltd., and Brown.** Regenerative coke ovens. (274,653.)
 22,048 (1926). **Plassmann.** Low-temperature distillation or coking of fuels. (258,261.)

3887 (1927). *Silica en Ovenbouw Mij.* Recovery of benzenes from coal gas. (265,984.)

7115 (1927). *Arnold (Standard Development Co.).* Cracking hydrocarbons. (274,763.)

*7660 (1927). *Holzverkohlungs-Ind. A.-G.* Fuel for internal-combustion engines. (274,811.)

*15,205 (1927). *I. G. Farbenind.* Bleaching of mineral oils and fats. (274,828.)

*18,996 (1927). *I. G. Farbenind.* Dehydration of moist fuel. (274,858.)

*19,270 (1927). *Koks- u. Halbkoks-Brikettierungs-Ges.* Manufacturing briquettes from fuels, ores, etc. (274,876.)

*19,294 (1927). *Lederer.* Production of carbon. (274,883.)

III.—Application

Leonard. Treatment of higher phenols. July 29.

III.—Complete Specification

3887 (1927). *Silica en Ovenbouw Mij.* See II.

IV.—Applications

British Dyestuffs Corp., Ltd., and Mendoza. Dyes etc. July 27.

Carpmael (I. G. Farbenind.). Manufacture of sulphur dyestuffs. July 28.

Holliday & Co., Ltd., and Shaw. Production of black vat dyestuffs. July 28.

I. G. Farbenind. Manufacture of triarylmethane-dyestuffs. July 27. (Ger., 9.8.26.)

I. G. Farbenind. Manufacture of stable diazo-salt preparations. July 27. (Ger., 2.8.26.)

I. G. Farbenind. Manufacture of azo-dyestuffs. July 28. (Ger., 5.8.26.)

I. G. Farbenind. Production of coloured compounds. July 29.

I. G. Farbenind. Manufacture of azo-dyestuffs. July 29. (Ger., 29.7.26.)

IV.—Complete Specifications

4599 (1926). *Carpmael (I. G. Farbenind.).* Manufacture of vat dyestuffs of the 2-thionaphthene-2-indolindigo series. (274,527.)

10,265 (1926). *I. G. Farbenind.* Manufacture of cyclic hydrocarbons and derivatives thereof. (251,270.)

10,560 (1926). *Carpmael (I. G. Farbenind.).* Manufacture of derivatives of the anthraquinone series. (274,558.)

10,570 (1926). *Carpmael (I. G. Farbenind.).* Reduction of aromatic nitro compounds. (274,562.)

16,223 (1926). *Johnson (I. G. Farbenind.).* Manufacture of colour lakes. (274,627.)

17,039 (1926). *I. G. Farbenind.* Manufacture of azo-dyestuffs. (255,072.)

29,899 (1926). *Holliday & Co., Ltd., and Shaw.* Manufacture of chloranil and bromanil. (274,700.)

127 (1927). *I. G. Farbenind.* Manufacture of dyestuffs of the triarylmethane series. (263,879.)

8285 (1927). *I. G. Farbenind.* Manufacture of alkylated or cyclo-alkylated aryl-sulphonic acids. (268,375.)

10,319 (1927). *I. G. Farbenind.* Manufacture of compounds of aromatic paradiamines with sulphur dioxide. (269,583.)

*19,492 (1927). *I. G. Farbenind.* Manufacture of carboxylic acids of acenaphthene. (274,894.)

*19,602 (1927). *I. G. Farbenind.* Manufacture of derivatives of acenaphthene. (274,902.)

V.—Applications

British Celanese, Ltd., and Bower. Apparatus for manufacture of artificial threads. July 26.

Carpmael (I. G. Farbenind.). Treatment of cellulose. July 28.

Ellis. (Soc. Fabr. Soie Rhodiaseta). Treatment of filaments, threads, etc. July 26.

Holkenseide Ges. Treatment of artificial silk. July 29. (Ger., 26.10.26.)

Waelc. 20,274. See XIII.

V.—Complete Specifications

802 (1926). *Lilienfeld.* Manufacture of artificial materials from viscose. (274,521.)

11,247 (1926). *Parker, Kershaw, Barrett, and Bleachers Assoc., Ltd.* Treatment of yarns or fabrics of artificial silk. (274,584.)

28,291 (1926). *Lilienfeld.* Manufacture of artificial threads from viscose. (274,690.)

32,332 (1926). *Krupp Grusonwerk.* Cleaning plant fibres. (274,716.)

*9500 (1927). *Soc. Chim. Usines du Rhône.* Continuous manufacture of cellulose acetate. (274,814.)

*17,525 (1927). *British Celanese, Ltd.* Application of cellulose esters and ethers. (274,841.)

*19,424 (1927). *I. G. Farbenind.* Opening-up materials containing cellulose. (274,892.)

VI.—Applications

British Celanese, Ltd., Ellis, Miller, and Olpin. Dyeing etc. materials containing cellulose acetate. July 30.

Carpmael (I. G. Farbenind.). Vat dyeing of leuco ester compounds of indigo dyestuffs etc. July 26.

I. G. Farbenind. 19,986. See IV.

I. G. Farbenind. Production of yellow dyeings on cellulose esters. July 25. (Ger., 29.7.26.)

VI.—Complete Specifications

10,241 (1926). *Leitch & Co., Ltd., Everest, and Wallwork.* Vat dyeing. (274,550.)

14,072 (1926). *British Dyestuffs Corp., and Chapman.* Wetting-out agents or emulsifiers. (274,611.)

18,138 (1926). *Durand & Huguenin A.-G.* Dyeing animal fibres. (255,501.)

19,100 (1926). *Mitchell.* Dyeing or like machines. (274,651.)

31,844 (1926). *Karrer.* Treatment of cotton and viscose silk fibres, preparatory to dyeing. (263,169.)

18,995 (1927). *Johnson (I. G. Farbenind.).* Desizing. (274,795.)

*13,966. (1927). *I. G. Farbenind.* Dyeing acetate silk. (274,823.)

*19,027 (1927). *Lilienfeld.* Treating cotton fibre. (274,860.)

*19,305 (1927). *Kohorn & Co., and Perl.* Apparatus for wet-treatment of textiles. (274,885.)

VII.—Applications

Carpmael (I. G. Farbenind.). Manufacture of chlorides etc. of silicon and titanium. July 26.

Fagelston and Smith. Oxidation of ammonia. July 30.

Johnson (I. G. Farbenind.). Manufacture of phosphates. July 27.

Johnson. Manufacture of cobalt carbonyl. July 28.

Meyerhofer. Decomposing salts of complex hydrofluoric acids. July 28.

Sacchi. Production of hydrogen etc. July 25.

Zaidan Hojin Kikagaku Kenkyujo. Preparing pure alumina. July 29. (Japan, 3.2.27.)

VII.—Complete Specifications

14,800 (1926). *Blumenfeld.* Manufacture of titanium oxide. (253,550.)

16,448 (1926). *Ring Ges.* Producing active silicic acid. (254,726.)

7661 (1927). *Daloze.* Manufacture of pure lead carbonate from crude lead sulphate. (273,660.)

VIII.—Application

Goldschmidt, Thiel, and Vacha. Manufacture of unbreakable glass. July 25. (Ger., 12.10.26.)

IX.—Applications

Leuchte and Tauber. 10,989. *See* XIII.

Spencer and Walkden. Brick etc. kilns. July 25.

IX.—Complete Specifications

15,235 (1926). Scheidemandel and Scheidemandel. Production of heat-insulating material. (253,919.)

12,949 (1927). Harnisch. Manufacture of artificial stone. (271,108.)

X.—Applications

Debuch. Treatment of ores. July 27.

Garnett, Holden, and Smith. Iron alloys. July 27.

General Electric Co., and Weintraub. Metallic coatings. July 26. (Fr., 27.7.26.)

General Electric Co., and Goldsmith. Manufacture of metal powders. July 28.

King, Morris, Schiff, and Wilder. Treatment of complex minerals. July 30.

Koehler. Production of magnesium. July 29.

Krupp A.-G. Blast furnaces. July 25. (Ger., 6.8.26.)

Krupp A.-G. Steel alloys. July 25. (Ger., 23.8.26.)

Lundberg. Electrolytical precipitation of metals. July 25. (Swed., 24.6.26.)

Mauler. Ascertaining resistance to rusting of iron etc. July 28.

Metallbank und Metallurgische Ges. Converting tin ores. July 29. (Ger., 9.8.26.)

Pocock. Manufacture of white alloys. July 25.

Smith. Separation of cobalt. July 25.

Southern, and Wincott, Ltd. Manufacture of metals and alloys. July 29.

X.—Complete Specifications

22,663 (1926). Gothe. Electroplating. (274,671.)

28,447 (1926). Ezeberg. Concentrating ores etc. by flotation. (261,395.)

28,815 (1926). Blackford. Fluxes for soldering. (274,693.)

*29,345 (1926). Wittek. Reducing ores. (274,803.)

*19,121 (1927). Schrobdsdorff. Alloys. (274,866.)

*19,270. (1927). Koks- u. Halbkoks-Brikettierungs-Ges. *See* II.

*19,293 (1927). Appel. Electrolytic separation of chromium. (274,882.)

*19,762 (1927). Sundberg. Electrolytic precipitation of metals. (274,913.)

XI.—Applications

Almeida Accumulators, Ltd., and Levy. Galvanic batteries. July 27.

Dufour. Electric furnaces. July 28. (Belg., 4.8.26.)

Furness. Electric cells. July 25. (U.S., 23.7.26.)

Hilbrenner. Electric insulating substances. July 26.

Kohne and Suhreke. Electric cells. July 28.

Lahousse. Composition for electric insulation etc. July 25. (Fr., 12.8.26.)

Lundberg. 19,762. *See* X.

Oswald. Carbons for electrotechnical uses. July 27.

Siemens & Halske A.-G. High-frequency induction furnaces. July 28. (Ger., 29.7.26.)

XI.—Complete Specifications

22,663 (1926). Gothe. *See* X.

*19,293 (1927). Appel. *See* X.

*19,377 (1927). Siemens & Halske A.-G. High-frequency induction furnace. (274,888.)

*19,762 (1927). Sundberg. *See* X.

XII.—Complete Specifications

2895 (1927). Petroff. Decomposing the emulsions in the splitting of fats and oils. (274,741.)

*15,205 (1927). I. G. Farbenind. *See* II.

XIII.—Applications

Bakelite Corp. Artificial resin compositions. July 26. (U.S., 3.8.26.)

British Thomson-Houston Co., Ltd. Coating-materials. July 25. (U.S., 16.8.26.)

Eberhard. Coating-materials. July 26.

Leuchte and Tauber. Coating and binding compositions. July 27. (Ger., 3.8.26.)

Rostschutz-Farb. Liebreich. Rust-preventing oil paints. July 26. (Ger., 27.7.26.)

Waele. Cellulose paints, varnishes, etc. July 30.

Zuccarino. Composition for indelible reproduction etc. July 25.

Zuccarino. Producing indelible documents. July 26.

XIII.—Complete Specifications

10,914 (1926). Drummond. Synthetic resins of the phenol-aldehyde type. (274,581.)

13,024 (1926). Soc. Chem. Ind. in Basle. Condensation products from urea or a derivative thereof and formaldehyde. (253,094.)

16,223 (1926). Johnson (I. G. Farbenind.). *See* IV.

143 (1927). Craven, Bedford, and Yorkshire Dyeware and Chemical Co., Ltd. Cement for linoleum etc. (274,722.)

XIV.—Applications

Cook. Extracting oils from waste rubber. July 26.

Dunlop Rubber Co., Ltd., Chapman, and McKay. 19,461. *See* I.

Dunlop Rubber Co., Ltd., and Twiss. Manufacture of articles from aqueous dispersions containing rubber etc. July 25.

Du Pont de Nemours & Co. Rubber compositions. July 26. (U.S., 31.8.26.)

XIV.—Complete Specifications

27,156 (1926). Soc. Ital. Pirelli. Regenerating vulcanised rubber. (260,620.)

3039 (1927). Butler. Liquidised crude rubber. (274,742.)

*23,712 (1926). Hercules Powder Co. Reclaiming rubber and fabric from scrap. (274,797.)

XV.—Application

Hirsch. Manufacture of threads, cords, etc. from gelatin. July 25.

XVI.—Application

Gordou, and Imperial Chem. Industries, Ltd. Fertilisers. July 29.

XVII.—Complete Specifications

*27,450 (1926). Raffinerie Tirlémontoise. Curing masse-cuite etc. (274,799.)

*27,451 (1926). Raffinerie Tirlémontoise. Removal of false grain from sugar syrups or molasses. (274,800.)

XVIII.—Application

Kelly. Treating fermented materials. July 29.

XVIII.—Complete Specification

31,468 (1926). Jordt (Freise). Production of sparkling wines. (274,707.)

XIX.—Applications

Diethelm and Stiner. Preparation of foodstuffs, etc. July 26. (Switz., 26.7.26.)

Gyllenhammer. Producing corn products. July 26.

Krause. Sterilisation. July 25. (Ger., 26.7.26.)

North. Manufacture of beverages. July 27.

XIX.—Complete Specifications

*19,723 (1927). Krause. Sterilisation. (274,909.)

*19,837 (1927). Stiner and Diethelm. Preparation of foodstuffs and fodder. (274,915.)

XX.—Applications

Calcott, Loriman, and Parmelee. Production of tetra-ethyl lead. July 26. (U.S., 3.11.26.)

Comp. de Bethune. Catalysts for synthesis of alcohols. July 25.

Dreyfus Manufacture of aliphatic compounds. July 30.

Imray (Monsanto Chem. Works). Production of benzoic acid from phthalic anhydride. July 29.

Marks (Internat. Nahrungs u. Genussmittel A.-G.). Producing mercaptans of the furfuryl series. July 25.

XX.—Complete Specifications

10,265 (1926). I. G. Farbenind. See IV.

13,024 (1926). Soc. Chem. Ind. in Basle. See XIII.

23,798 (1926). Austerweil. Manufacturing borneol and isoborneol. (258,901.)

20,899 (1926). Holliday & Co., Ltd., and Shaw. See IV.

82,85 (1927). I. G. Farbenind. See IV.

XXI.—Applications

Kodak, Ltd. (Eastman Kodak Co.). Photographic sensitizers. July 28.

Martinez. Colour photography. July 26.

XXI.—Complete Specifications

11,853 (1926). Thornton. Kinematograph and other colour films. (274,591.)

*30,061 (1926). Chromo Filmes. Colour kinematography. 274,804.)

*17,198 (1927). Berthon. Films for colour kinematography. (274,837.)

XXII.—Application

Guthke. Manufacture of explosives. July 25. (Ger., 28,726.)

XXIII.—Application

Krause. 19,723. See XIX.

XXIII.—Complete Specification

*19,723 (1927). Krause. See XIX.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Argentina*: Paint, varnish (105); brass sheets, tar oil, palm oil, sodium silicate (107); electric generating plant and pumping machinery (A.X.4996). *Belgium and Belgian Congo*: Pharmaceutical products (91). *British India*: Industrial rubber goods, cement (87); steel rails, copper plates, mild steel sheets, potassic iodide (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Canada*: Sheep dip (89). *Cuba*: Earthenware (108). *Czechoslovakia*: Brass tubes, aluminium and raw copper (92). *South Africa*: Disinfectant fluid (B.X.3678); creosote (B.X.3677). *Turkey*: Carbide (103).

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during July, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 641, of which 480 were from merchants or importers. To these should be added 26 cases outstanding on June 30, making a total for the month of 667. These were dealt with as follows:—Granted—578 (of which 532 were dealt with within 7 days of receipt); referred to British makers of similar products—70 (of which 51 were dealt with within 7 days of receipt); referred to reparation supplies available—3 (all dealt

with within 2 days of receipt); outstanding on July 30, 1927—16.

Of the total of 667 applications received, 586, or 88 per cent., were dealt with within 7 days of receipt.

Condensed Milk Regulations

The Minister of Health is about to make regulations amending the Public Health (Condensed Milk) Regulations, 1923, so far as they relate to the labelling of condensed milk. The regulations will apply to all condensed milk intended for sale for human consumption in England and Wales. Copies of the draft regulations can be purchased from H.M. Stationery Office, or through any bookseller (price 1d.). Any representations on the subject should be addressed to the Secretary to the Ministry at an early date.

Caledon Dyes on Cotton Yarn

Scottish Dyes, Ltd., have issued a pattern card entitled "Caledon colours on cotton yarn," showing the principal vat colours which they manufacture. As is well known, the Caledon colours belong to the anthraquinone vat series and are of unsurpassed fastness, so that their use is essential for the highest classes of fast coloured goods. Notes on the method of dyeing are given, and the patterns show the colours in self and mixed shades on a mercerised bleached cotton yarn.

News from Advertisements

There is a vacant Lectureship in fuel technology at the Imperial College of Science and Technology (p. vi).

A Coal Research Fellowship at the Imperial College of Science and Technology is offered in connexion with Sensible Heat Distillation, Ltd. (p. vi).

Students will be interested in the facilities offered at the Imperial College of Science and Technology for study and research in fuel technology, chemical engineering and electro-chemistry (p. vi).

A lady with scientific training, and good knowledge of French and German, is required for extracting technical literature and to take charge of a library (p. vi).

Surplus chemical manufacturing plant is for sale (p. vi).

PUBLICATIONS RECEIVED

ELEMENTARY PRACTICAL PHYSICAL CHEMISTRY. By J. F. Spencer, B.Sc., D.Sc., Ph.D. Pp. viii+263. London: G. Bell & Sons, Ltd., 1927. Price 5s.

PHOTOGRAPHY: ITS PRINCIPLES AND PRACTICE. By C. B. Neblette, A.R.P.S. Pp. xviii+644. London: Chapman & Hall, Ltd., 1927. Price 30s.

A LIST OF OFFICIAL CHEMICAL APPOINTMENTS. Compiled by direction of the Council of the Institute of Chemistry under the supervision of the Publications Committee by The Registrar of the Institute. Pp. 335. Sixth edition, revised and enlarged. London: The Institute of Chemistry, 1927.

THE LANCASHIRE COALFIELD: THE RAVINE SEAM. Part II. —Carbonisation in Continuous Vertical Retorts. Department of Scientific and Industrial Research. Fuel Research. Physical and Chemical Survey of the National Coal Resources No. 9. Pp. vi+37. H.M. Stationery Office, 1927. Price 1s. 6d.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES AND WORKSHOPS FOR THE YEAR 1926. Factories and Workshops. Cmd. 2903. Pp. 130. H.M. Stationery Office, 1927. Price 2s. 6d.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY 'CHEMISTRY & INDUSTRY'

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

VOL. 46 NEW SERIES

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1927 33

EDITORIAL

Crystalline Insulin

THE discovery of insulin, its production in adequate quantities at a rapidly diminishing cost, and the almost miraculous results in the treatment of diabetes which have been made with its aid, are matters which have been so graphically told by the President of the Society in a series of addresses that there can be few chemists or chemical engineers, however engrossed in their own specialised activities, who will remain quite unimpressed as the story of further progress is unfolded. Although the manufacture of insulin has progressed so that preparations with greater and greater potency have been made, a single active principle has not yet been isolated. The preparation of crystalline insulin by a group of American investigators whose results are reported in the *Journal of Pharmacology and Experimental Therapeutics*, published in Baltimore, presents an interesting landmark in this field. Not only has the wealth of scientific knowledge been increased by this work, but it may be that it marks an important stage in the identification of the active principle of insulin, a stage which must precede any attempts at the preparation of synthetic insulin. It may be long before this is achieved, but, with the recollection of the isolation of thyroxine from the thyroid gland, its identification, characterisation, and final synthesis, we may escape the charge of undue optimism if we venture to hope that synthetic insulin will eventually appear amongst the successes of British fine chemical manufacture.

It has been known for some time that insulin separates from solution most satisfactorily at its isoelectric point, and it now appears that when pyridine is added to an acid solution of commercial insulin containing brucine acetate, marked precipitation occurs at a hydrogen-ion concentration less than 5.5, but the precipitate consists mainly of impurities associated with a little active material. At the isoelectric point, however, that is, between pH 5.55 and 5.65, the further addition of pyridine or ammonia causes the separation of insulin in a crystalline condition. From commercial insulin showing, we presume, a content of around eight or ten International Standard Units per milligram, some 25% of crystalline insulin with an activity of over 40 units per milligram; can fairly readily be prepared, and the relative availability of crystalline insulin may be expected to stimulate investigations into more fundamental matters. Already a formula for insulin has been advanced, namely, $C_{45}H_{69}O_{14}N_{11}S_3H_2O$, or a multiple of this. As in the case of commercial insulin, crystalline insulin shows the biuret, Pauly, Millon and other characteristic reactions, whilst it contains no tryptophan.

The exact mechanism of the action of brucine acetate is not clear, but it appears probable that a complex between the acetate of the alkaloid and insulin is formed just as in the case of phosphotungstic acid with vitamins or digitonin with sterols, and this remains in solution until the isoelectric point of insulin is reached, whereupon insulin separates on account of its low solubility at this point. Much remains to be done before it can be surely asserted that a single active principle has been obtained, for it is not without the bounds of possibility that the crystalline material obtained is nothing more than some other substance containing an extremely small amount of an amazingly potent principle associated with it, and that the formula noted above may be very wide of the mark. It will be remembered that claims for the isolation of pure vitamins have not seldom been made, only to be falsified by later investigations. The most recent work on crystalline insulin cannot be disregarded, however, if only from the point of view of the commercial production of a more concentrated and more stable preparation.

"Chemical Reviews"

If there is one thing that grows faster than another, it is the literature of chemistry; the other, of course, is the opportunity of reading it. Time was when professors acquainted themselves, as a matter of routine, with the manifold details of almost all contemporary chemical research, and secured at first hand a working knowledge of developments in many of the other branches of science. To-day the systematic perusal, from cover to cover, of an abstract journal is a habit to be proud of. Time also was when it was possible for the average man to appreciate all that was said at an average meeting of a chemical society; now he accounts himself fortunate if he is able to grasp with lightning rapidity the general significance of work remote from his own, to which end, moreover, it is usually necessary to learn the other fellow's jargon. Chemical science, in fact, is becoming so highly disperse a phase that soon the school investigating the nucleus will cease to associate with the school studying the electron shells, except at conversaciones. Thus does the wood tend to become obscured by the trees. The chemical tourist nowadays finds it increasingly necessary, therefore, to fall back on regular reports of the "state of the roads" (if one may so refer to the Annual Reports) and to handy pocket guides (if such a description may be applied to "Chemical Reviews," of which Volume IV, No. 1, is the most recently issued part).

Obviously reviews, if they are to be reviews and not mere compilations, must be written by men who know, and know that they know. Too often those who know

don't talk, and those who talk don't know. Hence it is as well to remember that most of the articles in "Chemical Reviews," which is published quarterly under the auspices of the American Chemical Society, are received by invitation. Moreover, a survey which is really authoritative and survives the attention of an obviously competent editorial board leaves little loophole for the perpetuation of errors of comprehension or transcription, a matter of importance when the work is likely to be used as a source of inspiration in preparing lectures and in writing text books. The perpetuated error is a public nuisance. Was it not Pe-hung who remarked that it is easy to kill a dragon, but quite impossible to keep him dead? Let us therefore learn from the Masters; let us read Richards on atomic weights, Donnan on membrane equilibria, Urban on the yttrium earths, von Weimarn on precipitation, Davey on atomic and ionic radii, Irvine on polysaccharides, Mouren and Dufraisse on catalysis and auto-oxidation, Munsfield Clark on reversible oxidation-reduction in organic systems, Hevesey on the discovery of new elements with X-rays, and as many as in us lies of the thirty-five other articles which are already available.

The Art and Science of Perfumery

Whether we like it or no, perfumes and perfumed preparations are being increasingly used by both men and women to-day. Perfumes and aromatic substances have appealed to man to a smaller or greater extent throughout the ages, and it is probable that the sense of smell was more highly developed for utilitarian purposes in the creatures of an uncivilised world than it is to-day, or even, for that matter, in the days of the earliest civilisations. The blending of Nature's gifts of odoriferous materials into a true perfume which should appeal to the aesthetic appetite of man has ever been an art, and, although science has recently shown how best to extract natural odoriferous principles in perfection and to prepare artificial perfumes, resembling those of nature or even striking entirely new notes, the final preparation of the blended perfumes still remains an art. The study of the chemistry, physiology, and psychology of odour perception will open out the science of perfumery, and the researches of the organic chemist will further extend the range of odoriferous materials, but the blending of the raw products into sweet, invigorating, languorous, or wild perfumes will remain a task for the artist perfumer.

But science must also play an important part in the cultivation of a general artistic sense of odour, and the chemist, by providing materials and developing theories upon the basis of which odour perception may be more clearly defined, the physiologist and psychologist, by tracing the specific appeals of various odoriferous substances and co-relating odour perception and association, physiological effect or mental reaction, will furnish the artist's studio more usefully and elaborately than has ever before been possible.

Perfumes, spices, and aromatic gums were in use in the most ancient civilisations, and there is evidence of their employment five thousand years ago. In Babylon, Egypt and Palestine scented ointments and embalming materials were used, whilst gums were employed in the temples. In India, Persia, and Arabia the preparation

of perfumes was a highly developed art in the early years* of the Christian era, and there is indirect evidence that distillation processes were known in India earlier than three thousand years before Christ, for otherwise the potency of the beverage "Soma" can scarcely be understood. It is probable, then, that the art of distillation was also brought to bear upon the preparation of perfumes from flowers, spices, and aromatic substances. A considerable trade in spices and aromatics was carried on in the days of the early civilisations, and precious scents, spices, and oils were royal gifts. There are many references to the matter in sacred writings, both in the Old and New Testaments. Thus, we find that the caravan which carried off Joseph into Egypt was laden with spices, which in the olden days were reserved by the priests for religious ceremonial.

About three hundred years before Christ, Appollonius wrote a treatise on perfumes, and, *inter alia*, essences of roses and iris were described, and the places of origin of the flowers were noted. In tracing the use of perfumes amongst the greater civilisations, it is noteworthy that excessive use has almost invariably been associated with a decadent nation. The extravagances of the Athenians in the perfume shops and in their homes, where trained doves with perfumed wings fluttered in an atmosphere already semi-saturated with expensive perfumes, the excesses of Nero, Louis XV and Madame Pompadour, may serve as reminders of this fatal association. It must not be inferred, however, that perfumes tend to moral degeneration in general, for the Athenian, the Roman, and the French societies would have fallen to the dust had not a single drop of perfume volatilised into their rotten atmospheres.

After the fall of the Roman Empire the use of perfumes in Europe disappeared until it was revived by the Moorish invaders, amongst whom the appreciation and use of perfumes had never waned. The fashion spread to France and Italy, whence in the reign of Elizabeth the Count of Oxford introduced it into this country. Although perfumes were more and more applied in England, the excesses and extravagances of the French court were never copied, but it is interesting to note that an Act of 1770 provided that any woman who should "deceive, entice or influence to marry any of His Majesty's subjects by the aid of perfumes . . . shall be subject to the same penalty as that now in force against sorcery, and that marriage shall be declared void and of no effect."

The use of perfumes and perfumed preparations is now widespread throughout the civilised world, and by modern methods of production from natural and synthetic bases, exquisite perfumes can be obtained at low prices, even in spite of the high duty which legislators place upon the alcohol used as solvent and vehicle for the base.

Although, then, the artist, the physiologist and the psychologist have an intimate connexion with the use of perfumes, the chemist has no mean task. He controls the extraction and purification of natural perfumes, and makes artificial odoriferous materials in large amounts. The synthetic perfume industry was born in this country, and when we return to the subject we shall hope to show that this section of the British chemical industry is by no means insignificant.

WEIGHING IN THE CHEMICAL INDUSTRIES*

By W. A. BENTON†

I do not propose to deal in any detail with the chemical balance in this address, as that instrument alone would require a much longer time than is available for treating the entire subject.

Let it suffice to say that the recent introduction of very light and rigid alloys for the construction of the beam, and the much greater attention now given to the smooth working of relieving devices by all makers of repute have resulted in rendering the modern chemical balance an extremely accurate and sensitive appliance.

The short beam-length now used in order to reduce the period of vibration and enable rapid weighments to be achieved has been accompanied by a loss of intrinsic sensitivity, which many makers—especially on the Continent—have endeavoured to compensate for by using extremely keen knives, and making all the balanced parts excessively light.

For ordinary laboratory use such balances are not to be recommended. It is very much better to sacrifice a little sensitivity than to obtain that quality at the cost of reliability and general accuracy.

May I suggest that when purchasing a balance for ordinary laboratory use attention should first be given to the mounting and relieving devices, the contour of the relieving cam, and the length and correct alignment of the knife-edges. If these features are satisfactory, next have regard to the equality of arm length by exchanging weights and loads from one pan to the other. Gauss's method may be used to find the divergence of the indicated weight of the load in the load-pan from the true weight. Extract the square root of the product of the apparent weights of a load weighed successively in each pan. This gives the true weight irrespective of any difference in the lengths of the arms of the beam.

It is rather astonishing to find how many of the cheaper sort of beautifully-finished chemical balances break down badly under this test. The head of a large laboratory told me a little time ago that fifteen short beam German instruments in his laboratories had proved on his examination to be very defective, in spite of the fact that the junior chemists who were using them were very pleased with their great sensitivity and rapidity of operation. The majority of these balances turned at a fraction of a milligramme—a near approach to the original guaranteed sensitivity of one-tenth of a milligramme on a maximum load of two hundred grammes.

Just think of that ratio for a moment. It is one in two-millions. Now an indicator fraction of one two-millionth is a very high degree of sensitivity in any type of weighing device. But an accuracy fraction of one two-millionth is only obtainable if extremely great care is taken. As a matter of fact, I am unable myself to accept anything like that figure in the case of any weighment made carefully under usual conditions on an ordinary high-class chemical balance. An accuracy fraction of one five-hundredth-thousandth is a very good figure, and anything better than this can only be

certified after very careful double weighing of the weights used, and after taking special precautions in respect of constancy of temperature, humidity of atmosphere, freedom from convection currents and other disturbing conditions—not to mention, in the case of light or bulky bodies, correction for barometric pressure.

Our own practice in the testing of ordinary standard weights is always to use the Borda or counterpoise method of weighing which eliminates arm-length errors. It may be mentioned here that by means of the theory of probabilities, it has been calculated on the basis of reasonable suppositions that the error on two weighments checked by the Borda method will probably be twice as great as the error on two weighments checked by the method of Gauss; but such errors are extremely minute.

Figure 1 shows diagrammatically the Borda or counterpoise method. Such an illustration may have already suggested to some chemists present that the best way

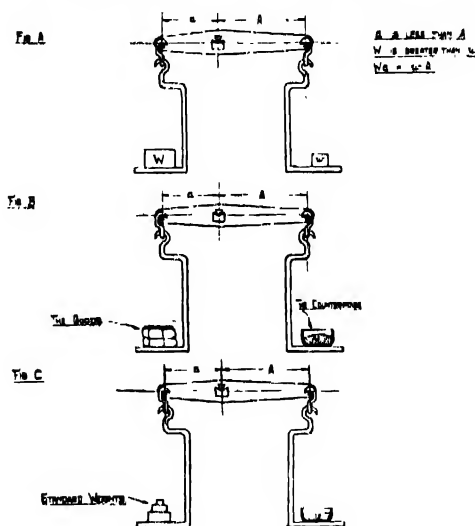


FIG. 1

Borda weighing

The load is counterbalanced by shot or other suitable material until perfect equilibrium is obtained. The load is then removed, and the counterpoise balanced by standard weights replacing the load. Such weights must be exactly equal to the load.

to get rid of arm inequality would be to have only one weight-pan—a so-called one-armed balance. Dr. Branner, in his book on the "Construction of the Balance," thinks that Bockholtz was the first inventor, and L. Reiman the re-discoverer of this type of balance. The illustration (Fig. 2) shows in diagrammatic form the chief features of such an instrument. No relieving gear is shown, but would, of course, be necessary.

The period of oscillation may be reduced to about half that of an equal-armed balance, and I do not think that the difficulties presented by changes due to temperature are insuperable, as it should be possible mathematically to calculate the shape and location of the counterpoising mass so as to give the best conditions. Such a balance always carries the same load, for the rigid counterpoise is sufficiently great to balance a load equal to the total capacity of the instrument, and when the load-pan is empty weights are always on the lower pan—that is, the weight-pan—equal to this amount.

* Read before the Chemical Engineering Group and the Midland Section of the Society of Chemical Industry, at Birmingham, April 20, 1926.

† Head of Research Department, Messrs. W. & T. Avery, Ltd., Soho Foundry, Birmingham

The substance to be weighed is placed on the top pan and weights are then removed from the weight-pan until a balance is obtained. The weights removed are equal to the weight of the substance.

An objection made to this type of balance is that the knife-edges are always subjected to the maximum load the beam is designed to carry. As against this there is the great practical advantage that the beam is always flexed to an equal extent, whereas with all equal-armed beams employed in the usual manner the stability of the system increases with the load, owing to the inevitable bending of the beam.

Whether this admirably simple and reliable type of balance will ever become popular with chemists remains to be seen. I am of opinion that it presents great practical advantages, and this opinion is shared by several mathematicians, physicists and balance-makers of my acquaintance, both in England and abroad. It is probably only the extreme conservatism of chemists in regard to their all-important instrument,

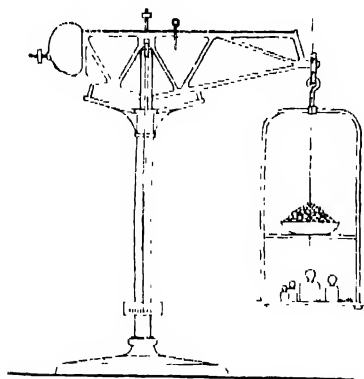


FIG. 2

Diagram of one-arm chemical and physical balance working under constant total stress. A balance eliminating arm-length error

the chemical balance, which prevents the adoption of a design along the lines here suggested.

For determinations of specific gravity an instrument of the above type is specially adapted.

Very large capacity balances are used for weighing bullion and other costly substances (Fig. 3), and these are precisely similar in almost every respect to chemical balances, but their construction, in view of the great stresses involved, presents special problems, the solution of which has only been found as a result of innumerable experiments.

We noticed a moment ago that the so-called "one-armed" balance was specially adapted for determinations of specific gravity, and I may here call attention to the demand which is now arising for very large sensitive physical balances to enable the exact specific gravity or relative density of heavy ingots to be quickly ascertained. For many technical purposes it is extremely important to know whether an ingot is absolutely sound, free from blow-holes and the like. The physical balance presents a ready way of ascertaining the facts, but the experiment requires to be performed with some

care. The temperature and density of the water should be known accurately, and these data related to the density of a specimen weighed under standard conditions and known to be sound.

While a sensitive balance is necessary for this determination, it is, perhaps, proper to point out that generally

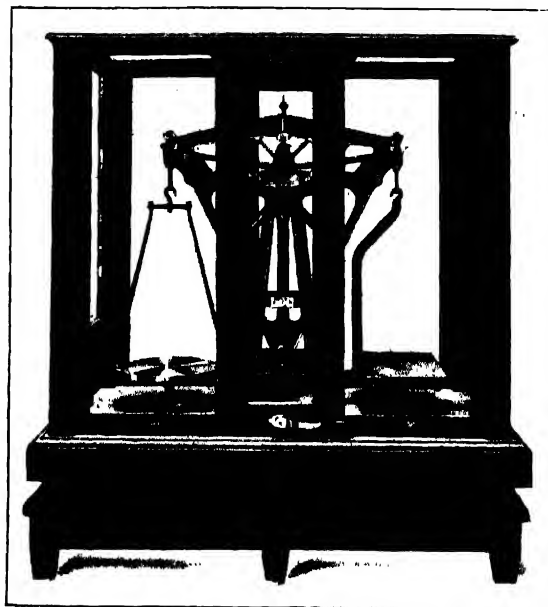


FIG. 3
"Avery" bullion balance

the errors due to faults of experimentation are much greater than those due to the balance. Not only is it necessary to take note of the temperature and density of the water; it is even more important to see that every part of the specimen is perfectly wetted, and that there are no minute bubbles clinging to its surface.

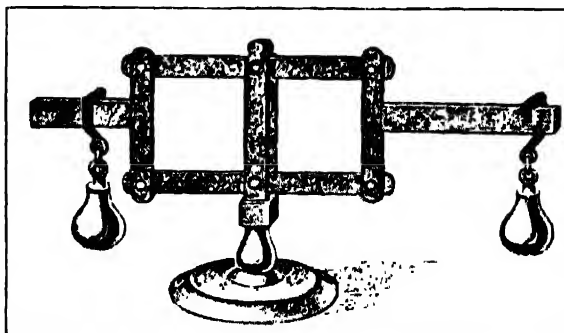


FIG. 4
The original Roberval balance

The use of a camel-hair brush is advisable, or, better still, the specimen may be wetted under a water jet escaping at a reasonably high pressure. If such precautions are taken, I know no better way of testing the soundness of an ingot or other piece of material than by finding its relative density.

I will now briefly indicate the chief features of some of the weighing instruments used in industry, which are likely to be especially interesting to chemical engineers. Leaving single-beam instruments we will turn to linked mechanisms.

Fig. 4 represents a model of the famous static enigma invented by Roberval in 1670. It is the basis of the well-known counter scale in which the weight-pans are located above the beam, and vertical legs are extended

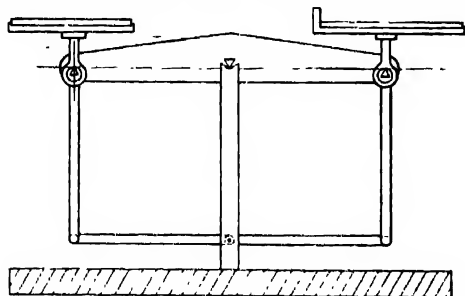


Fig. 5

Diagrammatic view of Roberval pattern counter scale

from the pans either upwards above them, or downwards below them, and connected by means of pivoted stays to anchor centres on the framework so disposed as to form linkage parallelograms. Over a hundred years elapsed before a satisfactory explanation was given of the static enigma, and probably a rather longer time before the first weighing instruments embodying the principle were available for use.

If the legs are made long the Roberval parallelogram gives a well-designed, robust and very reliable instru-

the lecture table is an example of the "French" stay mechanism used to obtain frictionless contact on one line in tension or compression—a very beautiful form of kinematic pivot.

Beranger's mechanism is the type usually favoured by chemists for "large sample" weightings. In this

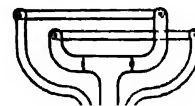


Fig. 6

Diagrammatic view of the inverted or "Imperial" type of Roberval balance

design we have a rather elaborate compound lever device, which will not weigh reliably or accurately unless made by highly-trained mechanics. Given good design and workmanship, however, no type of pan-above-beam

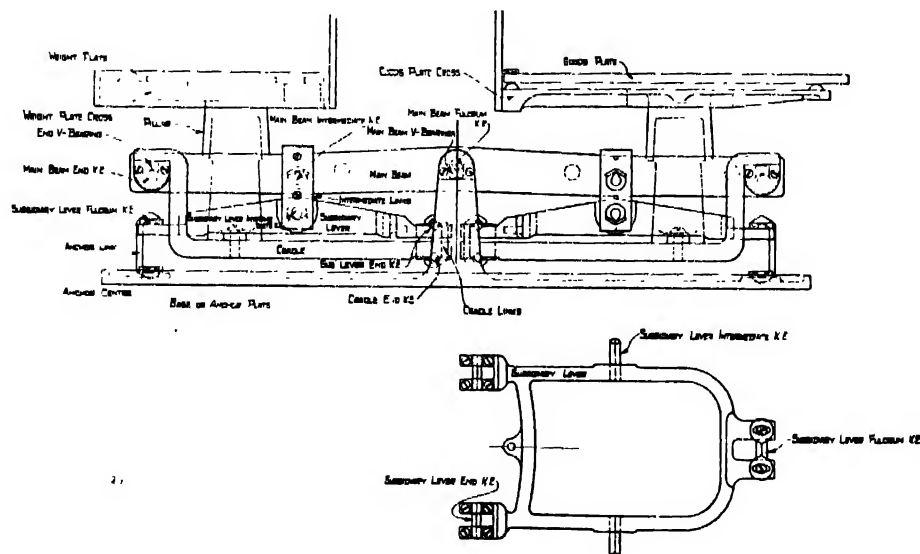


Fig. 7

Diagrammatic outline of Beranger balance. New pattern

ment. It has the great advantage over other types of weighing with a high degree of accuracy even if the beam is inclined considerably to the horizontal. The illustrations (Figs. 5 and 6) show various forms, and on

mechanism is more suitable for general use for the purposes indicated above. It is very sensitive and very dependable. The mechanism is shown in the line illustration (Fig. 7). It will be noted that the subsidiary

levers hang from the main beam at intermediate knife-edges, and that their outside knife-edge pivots are anchored by vertical links to the base-plate. The leverage of the main beam and the two subsidiary levers must be precisely the same.

Passing now to machines of higher capacity we come to compound lever mechanisms such as are used in platform machines from 3 to 50 cwt. and in weighbridges up to 100 tons or more. All these mechanisms are based on the combination of levers first invented by the famous Birmingham mechanic, John Wyatt. His first bridge was erected about the year 1745. In its main principles it is similar to the bridges we make to-day.

Other illustrations will make clear the construction of modern compound lever machines and their connexion to the wonderfully accurate steelyards that modern dividing engines enable us to construct. In Fig. 8 the transfer lever connecting the great load-bearing levers to the steelyard can be clearly seen. It may interest chemists to know that a weighbridge, properly constructed and adjusted, is a marvellously sensitive and accurate instrument. I have recently tested a 50-ton bridge fitted with a new type of dial. Under a load of 30 tons the pointer moved forwards or backwards when a load of 1 lb. was added to or removed from the platform. Fitted with a steelyard, a load of 100 tons has responded to the addition or removal of 1 lb.—an *indicator fraction* of one two-hundred and twenty-four thousandth. It may thus be fairly claimed that a well-made weighbridge possesses sensitivity and accuracy of the same order as an ordinary chemical balance.

Before leaving these mechanisms I would remind you of the *printing devices* now fitted to steelyards, and of the



FIG. 8

A large modern weighbridge under test

ingenious means provided for making it impossible to print a ticket unless the weigh-beam is completely balanced.

The question is sometimes asked whether at the present

time a loose-weight steelyard is not always better than one devised to balance the entire load by the movement of a poise. I should answer "Yes," providing that equal care be taken to make the best type of each

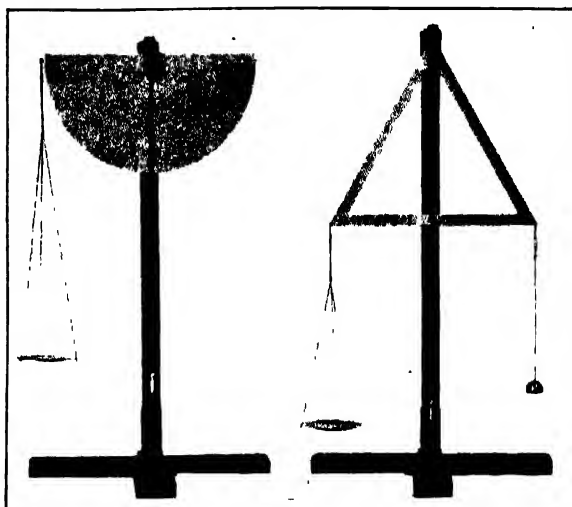


FIG. 9

The earliest known form of self-indicating weighing instruments

These models have been constructed by the Research Department of Messrs W. & T. Avery, Ltd., from sketches made by their inventor, Leonardo da Vinci, the great Italian artist, mathematician, and scientist (born 1452, died 1519). The sketches are to be found in the notebooks of Leonardo now preserved in Paris. From his description it is clear he was very much alive to the advantages of viable automatic weighing, for he enlarges on its exactness and rapidity. The models are rather smaller than "half-an-arm's length" in diameter of dial—the dimension which Leonardo had in mind. He says that to prevent injury by damp they should be made of a gold-like material ("Debbe essere di richelcho"). Possibly he means good brass. — SOHO FOUNDRY, BIRMINGHAM, Feb., 1926.

instrument. Undoubtedly the most accurate method of weighing a load is to balance it as far as can conveniently be done by the deposition of weights on one and the same knife-edge. On the other hand, extreme accuracy is not always necessary even in the chemical industry, and wonderfully accurate weightings are now possible with steelyards of the "no-loose-weight" type, while the advantages in point of rapidity and convenience of weighing are all in favour of the latter form.

We must now attempt a brief mention of some of the various types of self-indicating scales which during recent years have become of such immense importance in industry and commerce. It must not for a moment be supposed that the use of these automatic devices is confined to retail shops—the number and variety of types sold for industrial purposes is enormous, and their use grows from year to year.

I have had two models built up from sketches and descriptions preserved in the notebooks of Leonardo da Vinci, their inventor (Fig. 9). These are the first authentic records of the invention of self-indicating weighing machines, unless we include the automatic or semi-automatic balance invented by Al Khazini in the eleventh century for determining specific gravities.

(To be continued)

SPECTRUM ANALYSIS IN METALLURGY; SOME FURTHER NOTES

By J. R. GREEN

As a confirmed user for several years of spectra methods of analysis I was very glad to see the paper by Mr. Twyman (CHEM. & IND., April 1 and 8, 1927). It was high time that such a clear and authoritative statement on the whole subject of "spectrum analysis"

of purity would be more easily done by spectral means than by chemical. In many cases the requirement is that some impurity shall not exceed a specified percentage, and in such cases spectroscopic or spectrographic control is particularly suitable.

The accuracy which can be obtained with only a moderate amount of experience (and without any special apparatus for measuring the density of the lines) is remarkable. The Bureau of Standards Paper



FIG. 1

Spectra of lead-tin alloys. Note little difference in spectra for widely differing major composition



FIG. 2

Spectra of lead-tin alloys. Note great difference in spectra for less difference in composition than in Fig. 1

as it stands to-day should be available in this country, although by a coincidence there appears in the Chemical Society's "Annual Reports" this year a good survey on similar lines—the first in 23 years.

Most readers must be familiar with the broad outlines of qualitative spectrum analysis, although it is to be feared that very few will have got even as far as, for example, observing the "D" line as a doublet. It is the last part of Mr. Twyman's paper, dealing with quantitative work, that will be new to nearly all, and

No. 441, by Meggers, Kiess, and Stimson (quoted by Mr. Twyman), gives spectrographic results within 0.02% of the chemical, which is the average discrepancy, but this can be reduced to 0.01% in many cases if the range of comparison samples is well chosen.

For the benefit of those who may be sceptical or uncertain, I should like to emphasise four points with regard to quantitative spectrum analysis which Mr. Twyman has not, perhaps, fully brought out.

First, it is useless to try to make a complete analysis

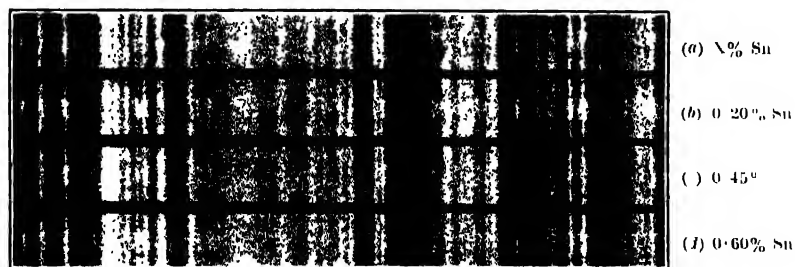


FIG. 3

Estimation of tin in lead. Tin spectrum superposed as central band in each case

from experience I can confirm all that is claimed as to speed and accuracy.

Metallurgical control work of nearly every kind offers the widest scope for spectral methods, and it is no overstatement to assert that anyone in charge of such work who neglects to investigate the use of spectrum analysis is behind the times. It is probable that the control of many inorganic products, besides metals and alloys, which have to be turned out to a certain standard

by spectral methods. Fig. 1 indicates this clearly enough; the spectra of the three alloys of widely differing composition are nearly identical.

Secondly, it is the special province of quantitative spectrum analysis to estimate the small percentages (i.e., 1% or less). A comparison of Fig. 2 with Fig. 1 will make this plain. The differences between the spectra of the three alloys are very marked.

Thirdly (and some are very sceptical about this), the

chemical results *do* agree with the spectrographic. In Fig. 3 are shown the spectra of lead containing tin in unknown percentage (x), and, below, of lead containing 0.20%, 0.45% and 0.6% of tin respectively. The "steps" between the comparison samples being irregular and large, no great accuracy was expected, but in this case the spectrographic estimation (0.5% Sn) agreed with the chemical (0.5%) very well. One took 45 min. to carry out, the other a day.

Fourthly, the major composition of comparison samples and of the unknown must be approximately the same. Fig. 4 is an enlargement of part of a spectrogram of metals of the composition shown, with copper for comparison. The lines 2824 and 2618 of copper

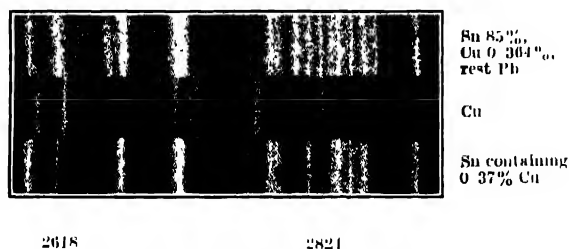


Fig. 4

are respectively absent and much fainter in the 85/15 alloy than in the tin, although the percentage of copper is the same in each case. Mr. Twyman's Fig. 9 may mislead beginners on this point, which is of importance, and has been emphasised by Gerlach.

In conclusion one may express the hope that much wider use will be made in this country of these modern methods of spectrum analysis. It may be as well to point out that a small quartz spectrograph, with a prism of base about 23 mm., is by no means difficult to make, and is sufficient for many purposes, giving, as it does, a spectrum about 4 in. long. The one on which all the accompanying spectrograms were taken cost under £15, including the spherocylindrical condensing lens, and was made and adjusted by myself.

REPORT OF THE CHIEF INSPECTOR OF FACTORIES AND WORKSHOPS*

In his Annual Report for 1926, the Chief Inspector of Factories deals with safety organisation, dangerous trades, and questions of sanitation and health in industry. In the "Safety" section mention is made of various explosions due to dust and several accidents due to explosions of acetylene, and the limited number of factories in which fire drill is practised. The use of celluloid is extending, and there have been some cases in which fire-proof stores were not provided. No remark is made about the observance of the Regulations in chemical works. There are now 183 potteries with lead glaze certificates, and 171 with low solubility glaze certificates. It is stated that constant supervision is necessary to keep all exhaust draught plants in potteries up to the standard. The National Council of the

Pottery Industry has issued a circular to members on the prevention of dust by the provision of impervious flooring. Little trouble has been given by the vehicle painting regulations, owing to the increasing use of leadless varnish paints and the growth of the cellulose spraying process, though the provision of exhaust cabinets for large articles presents difficulties.

A general increase in the use of labour-saving appliances, such as overhead runways, conveyors, elevators, and so on, is noted.

The report of the Senior Medical Inspector gives the following table, showing the incidence of industrial poisoning or disease now notifiable by medical practitioners:—

Disease and Industries	1924	1925	1926
Lead poisoning	486 (32)†	326 (13)	242 (28)
1. Smelting of metals	38 (1)	22	26 (1)
2. Plumbing and soldering	6	7	7 (3)
3. Shipbreaking	131 (1)	31	8
4. Printing	6 (1)	8	8
5. Tinning	3	4	2
6. Other contact with molten lead	23 (1)	17 (1)	16 (4)
7. White and red lead	20 (1)	19 (1)	13 (1)
8. Pottery	47 (18)	47 (5)	41 (14)
9. Vitreous enamelling	9	9 (2)	8
10. Electric accumulators	101	73 (1)	52
11. Paints and colours	15	8	10
12. Indiarubber	3	2	2
13. Coachbuilding	30 (4)	23 (1)	11 (2)
14. Shipbuilding	8 (1)	13	8
15. Paints used in other industries	24 (2)	11 (1)	10 (3)
16. Other industries	22 (2)	29 (1)	11
Phosphorus poisoning	—	—	—
Arsenical poisoning	6 (1)	6	5 (3)
Mercurial poisoning	5	5	4 (1)
Carbon disulphide poisoning	—	3	1
Aniline poisoning	—	31 (1)	33 (1)
Chronic benzene poisoning	—	—	1
Toxic jaundice	3	2 (1)	2
Epitheliomatous ulceration	123 (24)	160 (55)	187 (49)
Chronic ulceration	45	51	55
Anthrax	43 (4)	45 (9)	38 (3)
1. Wool	19 (1)	25 (4)	15 (2)
2. Horsehair	4 (1)	5 (2)	8 (1)
3. Handling of hides and skins	16 (2)	16 (5)	12
4. Other industries	4	1	3

† Figures in brackets relate to deaths. Fatal cases not reported in previous years are included as both cases and death.

Conditions in the use of carbon disulphide in the manufacture of viscose are reported as satisfactory; the single case reported occurred in the manufacture of the disulphide itself. "Aniline poisoning" includes cases due to intermediates such as dinitrobenzene, di- and tri-nitrotoluol, as well as to the manufacture of aniline. Hot weather has some effect on the incidence of aniline poisoning, and some firms avoid the manufacture as far as possible during the warmer months. Under "toxic jaundice" is included jaundice produced by arsenuretted hydrogen gas, from which one case occurred in the manufacture of salts of zinc. The 55 cases of chronic ulceration were as follows:—bichromate manufacture, 2; dyeing and finishing, 33; chrome tanning, 2; french polishing, 7; manufacture of chrome dyes, 5; other industries, 6. Of the 187 cases (49 fatal) of epitheliomatous ulceration, 49 were due to pitch, 27 to tar, 2 to paraffin, and 109 (35 fatal) to mineral oil; of the total, 88 cases occurred in mule spinning.

It is remarked that there are few liquids employed in industry which will not, if used regularly over a long enough period, produce dermatitis in certain individuals, and the same is more or less true of dust. Special inquiries were made as to the occurrence of dermatitis among bakers, biscuit makers, alkali workers and indoor horticultural workers. Of the reported cases of dermatitis, 52 (12.1%) were due to alkalis, but in 1926 no

* H.M. Stationery Office, Cmd. 2903. Pp. 139. Price 2s. 6d.

case of dermatitis from alkali works was reported, many of the cases being due to the use of alkalis as cleansing agents. Of the 7 cases due to "accelerators" in vulcanising rubber, 3 were considered to be due to hexamethylenetetramine, which is said to react with phosphoric acid in the sweat to form acetaldehyde, which breaks down in the presence of oxygen to produce formic acid.

The reported cases of gassing are shown in the following table; the figures in brackets give the number of fatal cases:

	1924	1925	1926
Carbon monoxide ..	107 (10)	118 (10)	101 (6)
(a) Blast furnace ..	24 (1)	25 (6)	9
(b) Power ..	25 (4)	34 (1)	32 (2)
(c) Coal ..	36 (2)	26 (2)	26 (1)
(d) Other ..	22 (3)	33 (1)	34 (3)
Carbon dioxide ..	5 (2)	10 (2)	4
Sulphuretted hydrogen ..	11 (4)	4	3
Sulphur dioxide ..	10	3 (1)	2
Chlorine ..	20	12	13
Nitrous fumes ..	10 (1)	10 (2)	5 (1)
Ammonia ..	1	5	5 (1)
Benzol, naphtha ..	26	3 (1)	4 (1)
Arsenuretted hydrogen ..	3	2 (1)	1
Other (ether, acetone, nickel carbonyl, etc.)	28 (4)	35 (8)	17 (1)

‡ Appears also under "Toxic jaundice," on Table 1

MINING AND METALLURGY IN CANADA

The eleven established fields in Alberta can supply the province with 480,000,000 cu. ft. of natural gas daily. The total amount of natural gas sold in Alberta yearly is about 9,119,000,000 cu. ft. In the fields being explored for oil there is a very great wastage of gas. The Turner Valley field alone is responsible for a daily loss of 38,000,000 cu. ft. The conservation of gas is one of the problems which confronts the provincial and federal governments.

The Britannia Mining and Smelting Co., Ltd., is now recovering and selling the iron pyrites associated with concentrate tailings formerly dumped into Howe Sound. They are passed through the mill and separated. The purchasers are chemical and pulp companies of British Columbia, and sulphuric acid manufacturers of California. Texas and Japanese sulphur is disappearing from the Pacific coast market.

The report of the Granby Consolidated Mining, Smelting & Power Co., operating in Northern British Columbia, at Anyox, and also Allenby, for the year ending December 31, 1926, shows a net profit of \$1,871,911 after deducting expenses and taxes; and interest equivalent to \$3.41 a share on stock, compared with \$1,107,234, or \$3.41 a share, in 1925. The Anyox plant produced 38,252,614 lb. copper at a cost of 8.5 cents per lb., excluding bond interest, depreciation and depletion; and 18,001,627 lb. copper, at an operating cost of 11.6 cents a pound, from the Allenby plant, a total of 52,254,251 lb. The silver production from both properties was 499,611 oz. The net current assets were increased during the year from \$2,369,189 in 1925 to \$3,607,724, of which \$2,818,996 were in cash and finished or partially finished metals. During the year, by development, 1,401,020 tons of high grade ore were added to reserve, whilst the ore treated amounted to 1,720,508. Diamond drilling at Bonanza gave an additional quantity of good grade ore, but this was not carried into reserve.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICE

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, will be available shortly. The reprints will be in JOURNAL format, with paper cover, and the price will be 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent at once to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

CALENDAR OF FORTHCOMING EVENTS

Aug. 20. NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, Newcastle-upon-Tyne. Annual Meeting at 2.30 p.m.

Aug. 31. BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Annual Meeting (97th year) at Leeds. The following is a selection from the programme:

Sept. 1. *Morning*.—"Relations between the spectra emitted by the atoms of the first row of the periodic table in all stages of ionisation," by Prof. R. A. Millikan. "Co-ordination compounds," by Dr. N. V. Sidgwick (Presidential Address), followed by discussion: (Prof. G. T. Morgan, Prof. C. K. Ingold, Dr. S. Sugden and Dr. F. G. Mann). "Effects of some radiated and non-radiated sterols on the cellular constituents of the blood," by Col. C. I. Bond. "The direct and indirect oxidases," by Prof. H. S. Raper. Discussion on Lubrication: (Dr. T. Stanton, Sir W. B. Hardy and others). "Fading of dye-stuffs," by Dr. S. G. Parker. "The physiological role of the water-soluble vitamins of yeast," by Prof. J. C. Drummond. "Variations in respiratory mechanism amongst bacteria," by Prof. J. W. McLeod. "Moisture relations of colloidal fibres," by Dr. J. J. Hedges. "Action of pancreatic lipase I," by Dr. E. R. Dawson. "Action of pancreatic lipase II," by B. S. Platt. *Afternoon*.—Visit to Laboratories of the British Research Association for the Woollen and Worsted Industries. The papers include:—"Chemical aspect of wool research," by A. T. King. "Use of ultra-violet radiation in textile analysis," by H. R. Hirst. "Wool derivatives," by G. K. Fraser. Visit to the works of Wood Bros. Glass Co., Barnsley. "Some observations on the excretion of creatine," by Miss M. Hirst and Dr. C. G. Imrie, and "Contribution to the study of the oxidation of fatty acids in the body," by Dr. E. J. Wayne.

Sept. 2. *Morning*.—Discussion on the nature and formation of colloidal particles: (Sir Wm. Bragg, Prof. H. Freundlich, Prof. R. W. Gray, Dr. F. L. Usher, B. N. Desai and J. Ewles). Discussion on Coal, (1) Dr. C. H. Tander, followed by (2) Prof. J. W. Cobb, on "Our available coal supplies and their utilisation," (3) Prof. R. V. Wheeler, on "The chemistry of coal." "Utilisation of the internal heat of the earth," by J. L. Hodgson. "Requirements of the population in milk-fat (vitamin A) and the available supply," by Dr. W. Cramer. *Afternoon*.—Visit to the Department of Textile Industries, University of Leeds:—Exhibition of sheep, illustrative of

Dr. Dry's paper on "Mendelian breeding in the Wensleydale sheep." "The intra-cellular structure of the wool fibre," by J. B. Speakman. Visit to works of the Yorkshire Coking and Chemical Co., and of Messrs. Hickson and Partners, at Castleford. "The teaching and research work of soil chemistry," by Prof. N. M. Comber. Garden Party at Foxhill (Col. C. H. Tetley, Pro-Chancellor of Leeds University). (By invitation). "Warping" (illustrated by cinematograph films), by W. D. D. Jardine. *Evening*.—Discourse by Prof. R. A. Millikan on Cosmic Rays.

Sept. 5. *Morning*.—Discussion on the chemistry of hormones (Prof. G. Barger, Prof. H. S. Raper, Mr. F. H. Carr, Prof. J. C. Drummond, Prof. E. C. Dodds, Prof. J. Mellanby). Discussion on the production and distribution of milk; (Dr. A. G. Ruston, J. A. Venn, J. Wyllie, V. Laversage). "The polar properties of molecules," by Prof. P. Debye. "Problems of textile testing: (a) variability; (b) time effect," by F. T. Perce. "Nature of the action of sunlight on cotton," by Dr. Barr and Miss Hadfield. *Afternoon*. Visit to works of Messrs. L. B. Holliday & Co., near Huddersfield. "Luminous discharge in rare gases," by Prof. R. Whiddington. "The effect of light on chlorophyll," by Dr. H. Wager. Excursion to works of Messrs. J. Fowler & Co. "The oxygen relation of roots; some results of experiments," by Dr. W. A. Cannon. "Growth-promoting substances and the explanation of phototropism," by Dr. F. W. Went. "Effect of vitaglass on plant growth," by F. A. Sanders. "Metabolic effects of nitrogen," by Dr. W. H. Pearsall. "Influence of hydrogen-ion concentration on the swelling of plant tissues," by Dr. J. Ewing and Miss E. Roughton.

Sept. 6. *Morning*. "The coherence of X-rays and the J phenomenon," by Prof. C. G. Barkla. "Quantitative determination of the physical properties of artificial silk and their relationship to textile manufacture," by A. L. Wykes. "New developments in the study of acid catalysis," by Prof. H. M. Dawson. "Rapid colorimetric method for measurement of p_H ," by Miss W. J. Wadge and Mr. W. H. Newton. "Paper pulp from bamboo," by W. Raitt. Discussion on soil surveys: (Sir John Russell, Prof. G. W. Robinson, Prof. J. Hendrick, Prof. N. M. Comber, Dr. W. G. Ogg, Mr. C. G. T. Morison). "A new mass spectrograph and the whole number rule," by Dr. F. W. Aston. "Researches on menthones, menthols, and menthylamines," by Prof. J. Read. "Air conditioning," by Dr. E. Griffiths. Demonstrations: (a) Prof. B. A. McSwiney and Dr. Berenbloom—Apparatus for regulating p_H of solutions for smooth muscle experiments; (b) Miss W. J. Wadge—Methods for determining H-ion concentration; (c) Dr. H. W. Davies—Apparatus for oxygen and CO_2 administration. "Rancidification and oxidation of olive oil," by Dr. L. L. Lloyd. Discussion on plot technique: (Dr. R. A. Fisher, T. Eden, Dr. J. Tocher, A. Millar). "Note on a molecular theory of liquid viscosity," by Prof. E. N. da C. Andrade. "Co-ordination compounds of molybdenum," by Dr. W. Wardlaw. "Manufacture of viscose by parallel bobbin and centrifugal systems (illustrated by cinematograph film)," by Dr. A. Perl. "Transmission of power by belts," by H. W. Swift. "Effect of an electric field on the adsorption of ions at the interface of mercury and

solutions of electrolytes," by Dr. J. A. V. Butler. *Afternoon*.—Visit to works of Messrs. Rowntree, York. Visit to works of Messrs. Joseph Watson & Sons, Ltd., Leeds. "Influence of ultra-violet light on the structure of plants," by Miss A. Martin. "Influence of ultra-violet light radiation on the growth of plants," by Miss A. Westbrook.

Sept. 7. *Morning*.—"Repetition stresses on cast iron," by Prof. C. H. Bulleid.

The sectional officers for Section B—Chemistry are as follows:—

President.—Dr. N. V. Sidgwick, F.R.S. *Vice-Presidents*.—Dr. S. H. C. Briggs; Prof. J. B. Cohen, F.R.S.; Prof. R. W. Whytlaw Gray; Prof. J. F. Thorpe, C.B.E., F.R.S. *Recorder*.—Prof. C. S. Gibson. *Secretary*.—Dr. E. K. Rideal, and *Local Secretary*.—H. S. Patterson.

Sept. 2
to 12.

Sept. 6
to 9.

COKE OVEN MANAGERS' ASSOCIATION. Continental Tour. (See also p. 749.)

INSTITUTE OF METALS. Autumn Meeting to be held at Derby. On September 6, at 8 p.m., the Sixth Autumn Lecture on "Non-ferrous metals in modern transport" will be delivered by Dr. L. Atchison, in the Municipal Technical College. On September 7, a general meeting of members will be held at 10 a.m., and in the afternoon, at 2.30 p.m., visits will be paid to the Carriage and Wagon or Locomotive Works of the London, Midland and Scottish Railway Company, or Derby Crown China Works. On September 8, at 2.30 p.m., visits will be paid to the works of Messrs. Rolls-Royce, Ltd., or Messrs. Leys Malleable Castings, Ltd., or to Messrs. W. Bemrose & Sons, Ltd. (printing works). During the meeting the following papers will be read at the different sessions:—"Copper-magnesium alloys. Part II," by W. T. Cook and W. R. D. Jones; "Researches on intermetallic compounds. VI. The reaction between solid magnesium and liquid tin," by W. Hume-Rothery. "Age-hardening tests with elektron alloys," by K. L. Meissner. "Equilibrium diagram of copper-tin alloys containing from 10 to 25% of tin," by A. R. Raper. "Note on cathodic disintegration as a method of etching specimens for metallography," by C. S. Smith. "Protection of aluminium and its alloys against corrosion," by H. Sutton and A. J. Sidery. "Nature of the film produced by anodic oxidation of aluminium," by H. Sutton and J. W. W. Willstrop. "Grain growth in compressed metal powder," by C. J. Smithells, W. R. Pitkin and J. W. Avery. "The undercooling of some aluminium alloys," by Marie L. V. Gayler. "Constitution of alloys of aluminium with silicon and iron," by A. G. C. Gwyer and H. W. L. Phillips. "Effect of work and annealing on the lead-tin eutectic," by F. Hargreaves. "The system magnesium-cadmium," by W. Hume-Rothery and S. W. Rowell. "Constitution and physical properties of some of the alloys of copper, zinc and cadmium," by C. H. M. Jenkins.

Sept. 9. INSTITUTE OF BREWING, Research Fund Committee and Corporate Members. Visit to hop-growing districts in Kent. Luncheon will be held at Canterbury.

Sept. 12
to 14. INTERNATIONAL SOCIETY OF LEATHER TRADES' CHEMISTS. Bi-Annual Conference in London. (See CHEM. AND IND., August 12, p. 724.)

PERSONAL AND OTHER ITEMS

The Rev. T. B. Woodd has been elected Master of the Salters' Company, and Mr. W. N. Watson and Mr. G. C. R. Marshall of the Plaisterers' and Pewterers' Companies respectively.

Mr. Harold Moore, M.Sc.Tech., has been appointed consultant chemist to the National Lubricating Oil & Grease Federation.

Mr. J. D. Bernal, B.A., has been appointed University lecturer in crystallography at Cambridge.

Mr. G. Evans, C.I.E., M.A., has been appointed principal of the Imperial College of Agriculture, Trinidad. Mr. Evans has had wide agricultural experience in India and in Queensland.

Mr. J. V. N. Dorr, B.Sc., E.M., was recently awarded the degree of Doctor of Science by Rutgers University for his scientific attainments and the services he had rendered to the University, of which he is a governor. Dr. Dorr is at present in Europe visiting the Dorr organisations in London, Berlin, and Paris. He will return to New York at the end of September.

The Morehead medals of the International Acetylene Association have been presented at a banquet in New York to M. E. Fouché, who developed the first successful oxy-acetylene torch for cutting and welding, and to Mr. A. Davis, who contributed to the design of the medium pressure acetylene generator and of many accessory parts which are at the foundation of generator practice in the United States.

Mr. H. Skinner, president of the Pharmaceutical Society of Great Britain and Mr. T. Marns, a member of council, have left England en route for Canada and the United States, where they will study Canadian and American pharmaceutical legislation and conditions.

Prof. Bergmann, director of the Kaiser Wilhelm Institute for Leather Research at Dresden, is the new president of the International Society of Leather Trades Chemists.

A new beet-sugar factory is to be built during the autumn at Blunham, near Bedford.

The late Mr. S. H. Smith, who invented one of the first anti-gas compounds for use in the earlier forms of gas-mask during the war, left £4,045.

Judge E. H. Gary, the chairman and chief executive officer of the United States Steel Corporation, who was the leader of the amalgamation movement which reorganised the United States steel industry, has died at the age of 80.

The death is announced of Mr. C. A. Grasselli, president of the Grasselli Chemical Company, one of the largest chemical manufacturing firms in the United States.

The death is announced of Prof. B. B. Boltwood, professor of chemistry at York University, who was a prominent investigator in the field of radioactivity, and the discoverer of "ionium."

The death is announced of the distinguished physiologist, Prof. A. Kossel, who was emeritus professor of physiology and director of the Institute for Protein Research at Heidelberg. His early work was devoted to the constitution of the nucleic acids, and later, when

investigating the proteins of fish roe, he discovered histidine and developed the classical method for the quantitative separation of the hexone bases. One of his most distinguished pupils was H. D. Dakin, with whom he carried out important investigations on arginase. With his death biochemistry loses one of its foremost workers.

Mr. F. G. Skelton, late of Skelton Brothers, soap manufacturers, who died on March 5, left £53,168, with net personalty £44,562.

The late Prof. D. A. Gilchrist, until recently Professor of Agriculture at Armstrong College, Newcastle, left £22,442, with net personalty £22,015.

The late Mr. E. D. Gravill, managing director of William Hill, Ltd., manufacturing chemists, left £14,057, with net personalty £8913.

Coke Oven Managers' Association—Continental Tour

The following Itinerary has been arranged for the Continental tour of the Coke Oven Managers' Association: September 2.—Leave London, Liverpool Street, 20.30; Sail from Harwich, 22.00. September 3.—Arrive Hook of Holland, 5.30; Leave Hook of Holland, 7.20; Arrive Essen, 11.33. September 4.—Visit German Otto installation at Dahlhausen, also a new battery of 72 ovens under construction at Bruchstrasse. September 5.—Visit to Bruckhausen works of Messrs. Thyssen by the invitation of the Koppers Co., also the Koppers Silica Brick Works at Dusseldorf. September 6.—Leave Essen, 11.17; Arrive Cologne, 12.56; Depart Cologne, 14.10; Arrive Brussels, 19.20. September 7.—Visits to the State Mines at Heerlem (Holland) by the invitation of the Coppee Co., and (in the afternoon) to the Maurice Mine. September 8.—Visit the Piette installation at Alliance Monceau, near Charleroi, at the invitation of the Semet-Solvay & Piette Co., Ltd.; in the afternoon visit the new Becker installation at Chateaucneau, near Charleroi, at the invitation of the Woodall-Duckham Co. September 9.—Visit the Carl Still benzol plant at Jette-St.-Pierre, Brussels, in the morning; in the afternoon leave Brussels, 16.52; arrive Lille, 20.10. September 10.—Visit the synthetic ammonia works at Waziers, near Douai, by invitation of Messrs. Simon Carves, Ltd.; in the afternoon proceed by charabanc to Ostend. September 11.—Visit the synthetic ammonia installation and new Semet-Solvay battery at Ostend in the morning; the afternoon and evening will be free. September 12.—Depart Ostend, 10.30, via Dover for London. Arrive London, 16.30.

Research Association of British Paint, Colour, and Varnish Manufacturers

The Research Station and Laboratories of the above Association will be officially opened at an inaugural luncheon, to be held at the Clarence Hotel, Teddington, on September 21 at 1 p.m., which will be attended by a number of distinguished guests.

Potash from Palestine

Mention was recently made in CHEMISTRY AND INDUSTRY (July 22, 1927, p. 659) of the invitation of the Colonial Office and the Palestine Government for tenders for concessions to recover the vast chemical resources of the Dead Sea. It is now understood that

negotiations between the Crown Agents for the Colonies and certain British principals have reached an advanced stage, but no public announcement can be made until certain questions of detail have been settled. The realisation of the project is likely to have an important influence on economic conditions in Palestine. If it results in a large export trade in potash, it is probable that the Hedjaz railway which runs straight through Transjordan territory from north to south will eventually link up the Dead Sea with the Gulf of Akaba, and thereby create a trade route to India and the Far East, independent of the Suez Canal with its heavy dues. It is estimated that the quantities of salts in the Dead Sea, in millions of metric tons, are as follows: -Potassium chloride, 2,000; magnesium bromide, 980; sodium chloride, 11,900; magnesium chloride, 22,000; calcium chloride, 6,000. For practical purposes the supply of potash may be considered inexhaustible. The salts will be extracted by a system of evaporation and crystallisation in three principal stages. Firstly, the common salt will be crystallised out and the mother liquors drained off into the carnallite crystallising tanks. Secondly, the carnallite will be crystallised and the mother-liquor drained off and allowed to flow back into the Dead Sea unless required for the production of magnesium, calcium chloride, and bromide. Thirdly, the carnallite will be dissolved in water and concentrated in a pan until the potassium chloride crystallises out, first, in very pure crystals—probably until at least 50% of the total potash has separated—after which sodium chloride will come down with it. When the stage is reached that the final potassium chloride product would be less than 80% purity, were evaporation to be continued, the mother-liquor will be run off for crystallisation of the second fraction in a second potash pan. The potash will then be piled to drain and exposed to the sun and air until the salt is sufficiently dry to handle. For every ton of 80% potash, five tons of common salt will be produced, and if the production of potash ever reaches 100,000 tons, the disposal of 500,000 tons of salt will have to be considered. For every 100,000 tons of potash produced, 40,000 tons of bromide will be returned to the Dead Sea, the greater part of which will be in the second mother-liquor after the crystallisation of the carnallite. Three possible means of transport from the Dead Sea to the Mediterranean coast have been under consideration: a railway constructed up the Jordan Valley to join the Damascus-Haifa railway at Beisan; an aerial ropeway to Jaffa over the Judean hills; and a rope railway to Beisan or Jerusalem. As it has been decided to build a regular port at Haifa, it is anticipated that an electric railway will be constructed from the Dead Sea to Beisan, to join up with the existing line from Damascus to Haifa.

The Dating of Patents

The Committee appointed by the President of the Board of Trade to inquire into the dating and sealing of patents has issued its report. The Committee considers that no change is desirable in the existing practice in the United Kingdom as to the dating and sealing of patents. If, however, for any reason it should be considered expedient to make a change, the Committee recommends that such change should be limited to an alteration in

the term of the patent whereby the fixed portion of the monopoly period would run from the filing of the complete specification.

Survey of Empire Oils and Minerals

In order to assist in the development of the mineral resources of the Empire, an investigation, financed jointly by the Australian Government and the Empire Marketing Board, is to be undertaken into the methods of surveying for oils and minerals within the Empire. The work will be conducted under the guidance of a competent expert, and will probably take two years to complete. Within the Empire there are large areas of proved metalliferous value, in which the natural outcrop of the rocks is obscured by an overlying blanket of recent geological age, which in many cases is comparatively shallow, but renders the task of the geologist and of the prospector both difficult and expensive. During recent years certain methods, known as geophysical methods, have been evolved for detecting the possible existence of minerals or oils without the necessity of boring. Other methods have also been suggested, and to a certain extent tested, and it is thought that if complete information as to the possibilities and limitations of these methods, both individually and in conjunction, could be obtained, the development of the mineral resources of the Empire might be greatly assisted.

Tar Products in the Black Country

During the last few years research has been proceeding with a view to the fuller commercial exploitation of tar products at the works of the South Staffordshire Mond Gas Company at Dudley Port, and as a result of a recent investigation of the potentialities of their by-products, the company sought Parliamentary powers for giving wider scope to their activities which would enable them to manufacture and deal in chemical products which, it was claimed, would open up a new era in certain directions (cf. CHEM. AND IND., July 22, 1927, p. 671). It is stated that the tar derived from the manufacturing processes at Dudley Port is quite different from that which is obtained from the manufacture of town gas. As a result of investigation of its properties, a substance was produced which was found to be superior to creosote as a preservative of timber, was an effective protection against the ravages of the white ant, and was a preservative against dry rot. Another discovery of the research staff was that by blending different varieties of bitumen and reducing them to a colloidal state, a paint could be obtained which resisted corrosion in iron and steel. Another derivative provided a powerful germicide, which, being non-poisonous and non-irritant, is free from the objections to ordinary coal-tar disinfectants. Preparations are being made for turning these new discoveries to commercial use, thus bringing about important industrial developments in the Black Country.

The Constitution of Lead

In a letter to *Nature* (Aug. 13, 1927), Dr. F. W. Aston states he has succeeded in obtaining the mass spectrum of ordinary lead, using its tetramethyl compound. The three principal lines are 206 (4), 207 (3), 208 (7), the relative intensities (roughly expressed by the figures in brackets) being in good agreement with

the atomic weight, 207.2. Indications were obtained that other isotopes, 203, 204, 205, may be present in small proportions, but certain proof will only be available when mercury can be eliminated from the discharge. The mercury lines were more intense than any previously obtained, and indicate the presence of a seventh isotope, present to the extent of 0.04%.

Gaseous Helides

Mr. D. M. Morrison writes from the Cavendish Laboratory, Cambridge, to *Nature* (Aug. 13, 1927) to record evidence for the formation of gaseous helides when helium, excited by an electrodeless discharge, was passed over a strong radioactive source of radium B and radium C. It is considered probable that gaseous helides analogous to Paneth's hydrides can be formed.

Patents in the Irish Free State

After October 1, when the new Patents and Trade Marks Act comes into force in the Irish Free State, British patents and trade marks will no longer hold force unless fresh patents and trade marks are taken out in that country. British patents granted before December 6, 1921, will, however, be continued on the Irish register, if a copy of the patent or mark is lodged in Ireland and renewal fees paid. British patents and marks granted after December 6, 1921, and before the passing of the Act, will be granted, subject to search in the Irish register.

Soapstone Industry in Canada

Canadian sulphate pulp mills use some 2,500 tons of soapstone a year in the form of sawn blocks and bricks for building the furnaces used in recovery of the alkali or black liquor from the digestors, as soapstone is the only natural product known that will satisfactorily resist the action of the molten alkali. Since the recovery of such alkali is of great moment in kraft-mill practice, it follows that soapstone is a very important material to the pulp mill operators.

Prior to 1922 little attention had been directed towards developing a domestic supply of soapstone, and the requirements of the mills were met entirely by imported stone. In 1922 the Mines Branch in a published report (Memorandum Series No. 4) drew attention to what appeared to be a promising deposit of soapstone in the Lake of the Woods region, in Western Ontario. Following this, two companies were formed to exploit soapstone in this region, but these have not so far commenced operations. A third company, however, started work in 1924 in the same district.

In the Province of Quebec, however, the most active development has been undertaken, operations here having been helped by the fact that many of the largest kraft mills are situated in the Province, within a relatively short rail haul from the deposits. Production has, in the main, been confined so far to a single operator, the Robertsonville Soapstone Quarry Company, which has opened up a number of small quarries in the eastern portion of the serpentine belt, with which are associated the principal asbestos mines. Work is at present confined to a single quarry, where the stone has been found to be of superior quality to that hitherto worked. It is the intention of the company to undertake operations on a larger scale, and to grind the quarry waste, making products suited to the roofing and foundry trades.

Starting with an initial production of 167 tons in 1922, the industry had grown to 768 tons in 1925, with the probability that 1926 will show a still further increase. The greater proportion of the output hitherto has come from the Province of Quebec.

While a certain amount of soapstone continues to be imported from the United States and from Scandinavian countries, it is gratifying to note that Canada seems now well on the way to filling her requirements in respect of this material from within her own borders.

Nitrogen Fixation in the U.S.A.

A large nitrogen-fixation factory is to be built at Hopewell, Va., by the Atmospheric Nitrogen Co. at a cost of over 5 million dollars for the steam-electric power plant alone.

U.S. Potash Output in 1926

Potash produced in the United States in 1926 amounted to 46,324 short tons of crude potash salts containing 23,366 short tons of potash (K_2O), according to the U.S. Bureau of Mines. Sales by producers amounted to 51,369 tons of crude potash, containing 25,060 tons of K_2O . Potash materials of domestic origin sold by producers in 1926 were valued at \$1,083,064 f.o.b. plants. About 26,000 tons of crude potash, with an available content of 9000 tons K_2O , remained in stock at December 31, 1926. The production was chiefly from natural brines in California and distillery residue from molasses in Maryland. Small amounts were also obtained from steel plant dust in Pennsylvania, alunite in Utah, and glauconite in Delaware.

Salt in the U.S.A. in 1926

The production of salt in the United States in 1926 was 7,371,600 short tons, valued at \$25,056,012, a decrease of 1% in quantity and 4% in value. The salt content of the brine used in producing chemicals was 3,037,820 short tons, an increase of 8%. Bromine recovered from natural brines amounted to 1,245,760 lb. (\$426,837), a decrease of 2%, whilst 82,340 s.t. (\$1,710,405) of calcium chloride was recovered, representing an increase of 21%.

Soil Oxygen

At the Washington meeting of the International Congress of Sciences, Dr. L. M. Hutchins (U.S. Department of Agriculture) described an apparatus with which he determines the oxygen-supplying power of the soil. Nitrogen is passed through a porous porcelain vessel buried in the soil and the outgoing gas is passed through a solution which changes colour in accordance with the amount of oxygen which has passed through the porous porcelain and mixed with the nitrogen.

Chromium-plating in the U.S.A.

The General Chromium Corporation has been formed by the old General Chromium Corporation, the General Motors Corporation, the Union Carbide & Carbon Corporation, and the Vacuum Pan Co. to consolidate patents, research laboratories, experience and facilities for the process of chromium plating known as "Duro-Chrome." A plant is now being operated at Detroit, Michigan, for commercial plating work, and research work is being carried out in the laboratories of the participating concerns.

REVIEWS

CHEMICAL REFLECTIONS. By STEPHEN MIALL. Pp. 39.
London: Ernest Benn, Ltd., 1927. Price 1s.

We have here a reprint in pamphlet form of thirty of the weekly editorials which have appeared in this JOURNAL during the last four years. All who have appreciated the articles will be glad to see them issued in a collected form. The only likely complaint is that the form is hardly worthy of the substance, and probably many readers will think that, without going to the excesses of ragged-edged hand-made paper and expensive fonts of type, we might yet have had, at no seriously increased price, something looking a little more like a book of essays. There would have been a better chance for the collection to get outside chemical circles. Undoubtedly there is a growing desire among the lay-public to learn more about the ways of the scientific world, and it is a desire that should be met. There is a great deal in the present collection to enlighten and entertain such readers. Further than this, constant complaint is made that science cannot get itself put into any passable sort of literary currency. A young Oxford writer discussing recently whether history should be an art or a science said that "if by being called a science history was condemned to be written about like other sciences by total illiterates he did not agree." It would be good for this young man to read the articles before us. At the same time we must admit that they are of a type that is not common within scientific circles. They are indeed remarkable most of all for their originality and individuality in the use of literary art for associating the interests of science and applied science with the general topics that interest most mankind. The articles are highly distinctive, and we can hardly expect that the qualifications for doing this kind of thing as it is done by Dr. Miall will often be found. But all those who are intent upon making the work and the aims of science better known to the multitude may at least take a leaf out of his book. We certainly need to improve our literary ways and acquire more of the art of explaining ourselves to those who do not understand the language of science. We do not mean to suggest that there has been any studied artifice or severe mental exertion involved in writing the articles before us. They have, on the contrary, the character of spontaneity, and will be valued most by his friends for reflecting so vividly the personality of the author as he is known in the intimacy of private life.

A survey of the titles of the articles now reprinted suggests a make-up of our Editor hardly less complex than that of Gilbert's heavy dragon. He writes upon gardens, holidays, the general election, the English language, education, the art of writing, science and religion, and his chemistry ranges over the whole science and its applications. Like Silas Wegg with poetry he "drops" with sudden ease into languages ancient and modern, and like Silas can, if necessary, connect his commentary with the Rise and Fall of the Rooshian Empire. He seems to take pleasure in holding over us the threat of irrelevance or indiscretion.

It would be improper to proceed in this place with any criticism or appraisal of the editorial articles.

What has been said above was not intended to be more than impartially descriptive. The articles are provocative in many ways. They are a very notable feature of our JOURNAL, and give rise to a good deal of discussion. They import an element of liveliness unusual in scientific periodicals. They raise questions of policy and opinions on which opinion may differ, but everyone will acknowledge the absence of dogmatism, and the readiness of the Editor to give space to his critics, as well as the sincerity and kindness pervading everything that comes from his pen.

A. SMITHIELLS

A SHORT HAND-BOOK OF OIL ANALYSIS. By DR. A. H. GILL. Eleventh edition, revised and enlarged. Pp. 293. London: J. B. Lippincott Co., 1927. Price 18s.

It is quite clear that any book which runs through ten editions, and of which an eleventh is required, has fulfilled a useful purpose. This one has, however, certain defects which are possibly explained by a statement on the wrapper that it is "one of the few chemical books which is simple enough to be taken up without immediately previous preparation in the intervals of an engineer's work."

The major portion of the book is given over to the testing of motor spirits and lubricants. The methods given are based on the American standard methods, and these are well described, many useful comments being made. As the methods involved are, of necessity, mostly physical ones, it may be possible for chemical engineers to carry them out "without immediately previous preparation."

In the case of the fatty oils, however, a different conclusion must be reached. The examination of fatty oils is often of such difficulty that experienced workers have to use the utmost caution in giving definite reports. Where experience is lacking this section of the book will not be of much assistance, but it may provide a useful summary if used under skilled supervision. This, possibly, is the idea the author has in mind, as he is the Professor of Technical Analysis at Massachusetts, and the Preface states that the book was originally written for the author's own classes. There is need of some revision, however, even for this purpose, in several such cases, for example, as the recommendation to measure Harius iodine solution and N/2 alcoholic potash from a burette to weigh "one or 5 c.c. of oil carefully measured from an accurately calibrated pipette" in order to determine accurately its specific gravity—and certain descriptions of tests such as the Valenta, where we find "Enough oil is poured into a test-tube to fill it to the depth of about one inch, the exact height being marked by the thumb, an equal quantity of glacial acetic acid is poured in, that is, until the acid reaches the point indicated by the thumb," and where no reference is made to the valuable work of Fryer and Weston.

The book is almost free from misprints; it is attractively bound and well printed on good paper. The rough surface of the paper has, however, resulted in many of the diagrams being somewhat poorly reproduced.

G. D. ELSDON

COMPANY NEWS

SOUTH METROPOLITAN GAS COMPANY

The South Metropolitan Gas Company announces a dividend of 5% per annum, less tax, on the ordinary stock, payable on September 3. For several years the interim payment has been the same as above.

WALKERS PARKER & CO.

The directors state that the trading results for the past half-year of this lead and shot manufacturing company have been unsatisfactory, and show only a small profit. It has, however, been decided to continue the interim dividend of 6d. per share, less tax, payable September 30, in view of the amount of undivided profits accumulated in previous years.

THE INTERNATIONAL NICKEL COMPANY

The earnings of this company for the six months ended June 30, 1927, amount to \$4,217,162, against \$4,267,576 for the first half of 1926; other income gave \$40,020, against \$85,888, making the total income \$4,287,183, compared with \$4,353,464. Administration and general expenses absorbed \$304,001, reserved for Federal and franchise taxes \$326,024, leaving net operating income of \$3,657,157, compared with \$3,597,162. Depreciation and depletion took \$799,706, and Orford works property expense was \$54,820, the profit on the period thus being \$2,802,630, against \$2,774,689. Preferred dividends absorbed \$267,378, and common dividends \$1,673,384, leaving \$861,868, against \$833,927.

THE STANDARD CHEMICAL COMPANY

The report of the Standard Chemical Company for the year ended March 31, 1927, shows profits of \$194,979, compared with \$34,835 for 1925-26. After deducting \$30,303 for interest on bonds and debentures and \$160,000 for depreciation (as compared with \$75,000 last year), net profit was \$4,676, compared with net loss of \$73,580. During the year the funded and mortgage debt was reduced by \$61,846, and current liabilities by \$54,813, making a total reduction of \$116,660. The current assets show an increase of \$112,872. Total sales were \$1,634,657, and 40,182 cords of wood were carbonised, an increase of \$117,262 and 428 cords respectively over the previous period. In consequence of the improved financial position of the company, coupled with the recent amendment to Dominion Companies Act, the directors are now in a position to recommend a scheme of capital readjustment.

TAYLORS (CASH CHEMISTS) TRUST, COMPANY

Announcement is made of a first interim dividend of 10% on the deferred ordinary shares, payable on August 31. The company has an authorised capital of £1,000,000, of which £120,000, in 2,400,000 deferred shares of 1s. each, was issued in March last.

KAHLBAUM A.-G.

The C. A. F. Kahlbaum A.-G., which amalgamated with the Schultheiss-Patenthöfer Brauerei A.-G. in 1926, has now amalgamated with the Hartwig Kautowicz A.-G., a firm which is connected with the wine and spirit trade, to form a new company, the Hartwig Kautowicz-C. A. F. Kahlbaum Co.

MARKET REPORT

This Market Report is compiled from special info received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.

Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.

Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.

Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.

Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 80s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.

Ammonia Alkali.—£8 15s. per ton, f.o.r. Special terms for contracts.

Bisulphite of Lime.—£7 10s. per ton, packages extra.

Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.

Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)

Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.

Copper Sulphate.—£25—£25 10s. per ton.

Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.

Nickel Sulphate.—£38 per ton d/d.

Nickel Ammon. Sulphate.—£38 per ton d/d.

Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.

Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.

Salt Cake.—£3 15s.—£4 per ton d/d. bulk.

Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.

Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.

Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.

Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.

Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.

Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot

£8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod.

Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.

Arsenic Sulphide, Yellow.—1s. 9d. per lb.

Barytes.—£3 10s.—£6 15s. per ton, according to quality.

Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.

Carbon Bisulphide.—£20—£25 per ton, according to quantity.

Carbon Black.—6½d. per lb., ex wharf.

Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.

Chromium Oxide, Green.—1s. 1d. per lb.

Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.

Lamp Black.—£35 per ton, barrels free.

Lead Hyposulphite.—9d. per lb.

Lithopone, 30%.—£22 10s. per ton.

Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride.—4d. 7d. per lb., carboys extra.

Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.

Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep.—6s.—6s. 3d. per lb.

Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9—£9 5s. per ton. Grey, £15 per ton. Liquor, 9d. per gal. 32° Tw.

Charcoal.—£6—£9 per ton according to grade and locality.

Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.

Red Liquor.—9d.—10d. 16° Tw. per gal.

Wood Creosote.—1s. 9d. per gal., unrefined.

Wood Naphtha.—Miscible, 4s.—4s. 1d. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.

Wood Tar.—£4 10s.—£5 per ton and upwards, according to grade.

Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carbolie.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 6d.—2s. 8d. per gal.

Acid Cresylic, 99/100.—2s. 9d.—2s. 10d. per gal. 97/99.—2s. 1½d.—2s. 3d. per gal. Pale, 95%, 2s.—2s. 1½d. per gal. Dark, 1s. 9d.—1s. 10d. per gal.

Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.

Benzole.—Crude 65's, 10d.—10½d. per gal., ex works in tank wagons; Standard motor, 1s. 3d.—1s. 3½d. per gal., ex works in tank wagons; Pure, 1s. 6d.—1s. 7d. per gal., ex works in tank wagons.

Toluene.—90%. 1s. 4d.—1s. 9d. per gal. Pure, 1s. 7d.—2s. per gal.

Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 2s. 5d. per gal.

Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Standard specification, 7½d.—7½d. per gal. Middle Oil, 9d.—10d. per gal. Heavy, 8½d.—8½d. per gal. Salty, 7d. per gal., less 1½%.

Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/160, 1s. 2d.—1s. 4d. per gal. Solvent 95/160, 1s. 4d.—1s. 5d. per gal. Solvent 90/190, 1s.—1s. 4d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.

Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.

Pitch, medium soft.—88s. 9d.—92s. 6d. per ton, f.o.b. according to district.

Pyridine.—90/140.—5s. 9d.—7s. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.

Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.

Acid H.—3s. 3d. per lb. 100% basis d/d.

Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.

Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilio.—9d. per lb. 100% basis d/d.

Aniline Oil.—7½d. per lb., naked at works.

Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.

Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—4½d. per lb.

m-Cresol 98/100%.—2s. 7½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—2s. 3d. per lb.

Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.

Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.

Dinitrochlorobenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

α-Naphthol.—2s. per lb. d/d.

β-Naphthol.—11d.—1s. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb. d/d.

β-Naphthylamine.—3s. per lb. d/d.

p-Nitraniline.—1s. 8d. per lb. d/d.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb. d/d.

R. Salt.—2s. 2d. per lb. 100% basis d/d.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—7½d. per lb., naked at works.

p-Toluidine.—2s. 2d. per lb., ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 4d.—2s. 5d. per lb.

Acid, Benzoic B.P.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—20 cwt. lots. Cryst. 40s. per cwt. Powder 44s. per cwt. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 7½d.—1s. 8d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 5d. per lb. Technical 11½d.—1s. per lb.

Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Amidol.—9s. per lb. d/d.

Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—11s. per oz. for English make.

Barbitone.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth

Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—

8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—

8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb.

Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Sub-

chloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—

7s. 9d.—8s. per lb. Extra and reduced prices for

smaller and larger quantities respectively; Liquor

Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.

—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—20 cwt. lots. Crystal 24s. per cwt. Powder 26s.

per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 6d. per lb. Potassium. 1s. 10d.—2s. 1d. per lb. Sodium.—2s. 1d.—2s. 4d. per lb. Granulated $\frac{1}{2}$ d. per lb. less. All spot.

Calcium Lactate.—1s. 2 $\frac{1}{2}$ d.—1s. 3 $\frac{1}{2}$ d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 6d. per lb., duty paid.

Chloroform.—2s. 3d.—2s. 7 $\frac{1}{2}$ d. per lb., according to quantity.

Creosote Carbonate. 6s. per lb.

Ethers. Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2 $\frac{1}{2}$ d.; 1s. 2d.; 1s. 1 $\frac{1}{2}$ d.; 1s. 0 $\frac{1}{2}$ d.; 720 tech.—1s. 5 $\frac{1}{2}$ d.; 1s. 5d.; 1s. 4 $\frac{1}{2}$ d.; 1s. 3 $\frac{1}{2}$ d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3 $\frac{1}{2}$ d.; 2s. 3d.; 2s. 2d.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiaicol Carbonate.—5s. per lb.

Hexamine.—2s. 4d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., bulk 2s.—2s. 3d. per gal.; Winchester, 2s. 11d.—3s. 6d. per gal.; 20 vols., bulk 3s. 6d.—4s. 6d. per gal.; Winchester, 5s.—6s. per gal.

Hydroquinone.—2s. 11d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate. B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—3d.—4d. per lb., 22s. per cwt.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £82 10s. per ton, less 2 $\frac{1}{2}$ %; Heavy Commercial £21 per ton, less 2 $\frac{1}{2}$ %; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 10s. 6d.—12s. 9d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials, R.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fino, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonal.—9s. 6d.—9s. 9d. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—2s. 9d.—3s. per lb.

Phenazone.—4s. 3d.—4s. 6d. per lb.

Phenolphthalein.—6s.—6s. 3d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2 $\frac{1}{2}$ % for ton lots.

Potass. Citrate.—R.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferriocyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 5d. per lb., according to quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins (1000 oz. lots).

Rosoroin.—3s. 9d.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 9d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 8 $\frac{1}{2}$ d.—1s. 10d. per lb. Crystal, 1s. 9 $\frac{1}{2}$ d.—1s. 10 $\frac{1}{2}$ d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.

Sulphonal.—6s. 6d.—6s. 9d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.

Thymol, Puriss.—10s. 6d.—11s. 6d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.

Aubepine (ex Anethole).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. per lb.

Citronellol.—13s. 9d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—6s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. 6d. per lb.—(ex Shui Oil) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. 6d. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—18s. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.

Camphor.—75s. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—7s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure—6s. per lb.

Eucalyptus, 75/80%.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%, 22s. 6d. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—10s. 6d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 70s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 17s. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Oct. 11th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on August 26th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Chem. Fabr. Milch. Production of emulsifying and wetting agents. 20,358. Aug. 2. (Ger., 2.8.26.)

Cox. Centrifugal separators. 20,484. Aug. 3.
Drying Systems, Inc. Drying-ovens. 20,703. Aug. 5.
(U.S., 5,826.)

Eley. Furnaces. 20,298. Aug. 2.
Hannuch. Refrigerating-compounds. 20,563. Aug. 4.
Koff. Apparatus for mixing etc. liquids etc. 20,645.
Aug. 5.

Kolitsch. Separation of solid materials. 20,407. Aug. 2.
(Austr., 14,826.)

Manchester Oxide Co., Ltd., Clayton, and Scholefield.
Catalysts. 20,511. Aug. 4.

Wüst. Furnaces. 20,690. Aug. 5. (Ger., 6,826.)

I.—Complete Specifications

2158 (1926). Gilchrist & Co. Treatment of liquids.
(247,512.)

11,132 (1926). Schucker. Apparatus for the hydrogenation
of liquids and semi-liquids. (274,952.)

11,210 (1926). Altenheim (Klem). Separation of liquids
from solids. (274,958.)

12,640 (1926). Dessauer. Apparatus for quantitative
analysis with the aid of Röntgen or cathode rays. (252,207.)

24,435 (1926). Trocknungs-, Verschweißungs- und Vergas-
ungs-Ges., Homgmann, and Bartling. Annular ovens or
furnaces with rotary hearths. (275,041.)

3467 (1927). Holmes, Henshaw, and Holmes & Co., Ltd.
Apparatus for bringing liquids and gases into intimate
contact. (275,092.)

*15,622 (1927). Steam Production Corp. Furnaces.
(275,177.)

*15,698 (1927). Piron. Distillation process. (275,178.)

*18,523 (1927). Rosenheim. Adsorbing-agent. (275,203.)

*19,531 (1927). Meyerhofer. Furnaces. (275,222.)

*19,944 (1927). Maschinfabr. Grevenbroich. Drying-
apparatus. (275,239.)

*20,079 (1927). I.-G. Farbenind. Supplying heat in
high-pressure reactions. (275,248.)

*20,358 (1927). Chem. Fabr. Milch. Producing and
employing purifying, emulsifying, and wetting agents.
(275,267.)

II.—Applications

Asiatic Petroleum Co., Barton, and Egerton. Fuel for
internal-combustion engines. 20,806. Aug. 6.

Ault and Wiborg Co. Treating hydrocarbons. 20,517.
Aug. 3. (U.S., 282,27.)

Bellay. Gas generator. 20,764. Aug. 6. (Belg., 11,826.)

Cezanne. Gas-producers. 20,467. Aug. 3.

Crawford, King, Lander, and Simmatt. Treatment of coal
etc. 20,595. Aug. 4.

Gardner. Manufacture of carbon. 20,403. Aug. 2.

Ges. f. Lände's Eismaschinen, and Soc. Anon. Métall. de
Sambé. Separation of benzol etc. from cokery gas etc.
20,513. Aug. 3. (Ger., 4,826.)

I.-G. Farbenind. Production of active masses containing
carbon. 20,354. Aug. 2.

Marchand. Apparatus for treating heavy hydrocarbons.
20,653. Aug. 5. (Fr., 5,826.)

Marion Steam Shovel Co. Production of fuel from oils etc.
20,376. Aug. 2. (U.S., 15,122.)

Parkes and Robinson. 20,722. See III.

II.—Complete Specifications

11,195 (1926). I.-G. Farbenind. Manufacture of active
carbon. (251,636.)

11,212 (1926). Tinker. Distillation of crude oils.
(274,959.)

19,637 (1926). Vickers, Ltd., and Berger. Combustible
compositions for pyrotechnic, smoke- and flame-producing
and other like purposes. (275,021.)

7742 (1927). Northrup. Conversion of heavy hydro-
carbon oils into lighter oils. (275,120.)

*4916 (1927). Suida. Recovery of concentrated acetic
acid and other products in carbonisation of wood.* (275,158.)

III.—Applications

Ges. f. Lände's Eismaschinen and Soc. Anon. Métall. de
Sambé. 20,513. See II.

Parkes and Robinson. Removal of tar acids from ammonia
liquor etc. 20,722. Aug. 5.

III.—Complete Specification

11,212 (1926). Tinker. See II.

IV.—Applications

Carmichael (I.-G. Farbenind.). Manufacture of sulphur
dyestuffs. 20,610. Aug. 4. Manufacture of vat dyestuffs of
anthraquinone series. 20,415. Aug. 2.

I.-G. Farbenind. Manufacture of amidated sulphurised
benzanthrone derivatives. 20,409. Aug. 2. (Ger., 2,826.)
Condensation products of anthraquinone series. 20,583.
Aug. 4. (Ger., 4,826.)

Imray (Soc. Chem. Ind. in Basle). Manufacture of azo
dyestuffs. 20,582. Aug. 4.

Johnson (I.-G. Farbenind.). Production of aromatic
amines from nitro compounds. 20,575. Aug. 4.

IV.—Complete Specifications

11,196 (1926). I.-G. Farbenind. Manufacture of disazo
dyestuffs. (251,637.)

11,311 (1926). Durand & Huguenin. Manufacture of
acid dyestuffs of the rhodamine series. (251,644.)

11,321 (1926). Carmichael (I.-G. Farbenind.). Manu-
facture of leuco-oxyanthraquinones. (274,966.)

15,586 (1926). Imray (I.-G. Farbenind.). Manufacture of
dyestuffs. (274,999.)

*30,872 (1926). Fabr. de Prod. Chim. Rohner. Manu-
facture of dyestuffs. (275,147.)

*19,493 (1927). Geigy A.-G. Manufacture of azo dye-
stuffs. (275,220.)

*19,986 (1927). I.-G. Farbenind. Manufacture of stable
diaz-salt preparations. (275,245.)

*20,194 (1927). I.-G. Farbenind. Manufacture of azo
dyestuffs. (275,258.)

*20,409 (1927). I.-G. Farbenind. Manufacture of amid-
ated sulphurised benzanthrone derivatives. (275,271.)

V.—Applications

Bemberg, A.-G. Production of artificial silk. 20,602.
Aug. 4. (Ger., 5,826.)

British Dyestuffs Corp., Adams, and Shephardson. Manu-
facture of products from lignin sulphonic acid. 20,490.
Aug. 3.

Elod. Production of cellulose esters. 20,617. Aug. 4.
(Ger., 9,826.)

Hetherington & Sons, Ltd., and Carle. Production of
artificial filaments etc. 20,308. Aug. 2.

I.-G. Farbenind. Application of cellulose ethers etc.
20,708. Aug. 5. (Ger., 23,122.)

Wright. Manufacture of artificial silk. 20,601. Aug. 4.

V.—Complete Specifications

8426 (1926). Brysilka, Ltd., and Schubert. Washing and
conditioning artificial silk. (274,928.)

10,691 (1926). Kershaw, Barrett, Parker, and Bleachers
Assoc., Ltd. Treatment of cellulosic materials. (274,940.)

24,585 (1926). Courtaulds, Ltd., Shedden, Delph, and
Baguley. Manufacture of artificial silk. (275,042.)

VI.—Applications

Chem. Farb. Milch. 20,358. See I.

Flesch. Application of highly sulphonated oils in the
textile industry. 20,572. Aug. 4. (Ger., 261,27.)

Moreton, and Prufix, Ltd. Waterproofing textiles etc.
20,656. Aug. 5.

Schoenfeld. Wet treatment of textile threads. 20,717.
Aug. 5.

VI.—Complete Specifications

1388 (1926). I.-G. Farbenind. Treatment of fibrous materials and textiles. (246,468.)

*19,711 (1927). I.-G. Farbenind. Producing yellow dyes on cellulose esters or ethers. (275,230.)

*19,986 (1927). I.-G. Farbenind. *See* IV.

*20,358 (1927). Chem. Fabr. Milch. *See* I.

VII.—Applications

Anderson, Cash, and Stephens. Manufacture of titanium oxide. 20,422. Aug. 2.

Gareau. Production of alumina, soda, and hydrochloric acid. 20,522. Aug. 3.

Gülker. Production of hydrogen. 20,432. Aug. 2. (Ger., 30.7.26.)

Mond (I.-G. Farbenind.). Production of alumina etc. 20,567. Aug. 4.

VII.—Complete Specifications

1330 (1926). Soc. L'Air Liquide. Manufacture of formates. (246,186.)

2666 (1926). Fielding. Manufacture of sulphuric acid. (274,918.)

2667 (1926). Fielding. Production of sulphuric acid from sulphur dioxide. (274,919.)

7966 (1926). Meyerhofer. Decomposing salts of complex hydrofluoric acids. (249,860.)

25,249 (1926). Wiley and Mensing. Granular caustic alkali (275,044.)

6220 (1927). I.-G. Farbenind., and Stalib. Converting oxides into anhydrous fused chlorides. (275,116.)

10,669 (1927). Urbain Corp. Recovery of phosphorus and hydrogenated compounds thereof in the form of phosphoric acid. (269,908.)

*29,350 (1926). Wittek. Extracting metalloids from their compounds. (275,145.)

*4916 (1927). Suida. *See* II.

*20,432 (1927). Gülker. Producing hydrogen (275,273.)

VIII.—Complete Specifications

25,900 (1926). Marlow. Tunnel ovens or kilns for tiles, pottery, etc. (275,048.)

8609 (1927). British Thomson Houston Co., Ltd. Producing silica articles. (268,780.)

IX.—Complete Specifications

11,170 (1926). Colas Products, Ltd., and Levy. Bituminous paints etc. (274,955.)

32,251 (1926). Schantz. Preserving wood. (264,473.)

X.—Applications

Coley. Manufacture of zinc. 20,348. Aug. 2. Apparatus for reduction of ores etc. 20,512. Aug. 3.

Warren and Warren. Coating with metals. 20,387. Aug. 2.

Zähler & Schiess & Co. Lead coating. 20,317. Aug. 2. (Ger., 30.8.26.)

X.—Complete Specifications

11,146 (1926). Strasser. Coating iron or iron alloys with metals. (255,417.)

16,273 (1926). Zwiebel. Protecting iron or steel melts in furnaces or converters. (275,002.)

30,706 (1926). Fourment. Treatment of ores, oxides, metals, etc. (265,548.)

4112 (1927). Lucas. Purifying iron scale. (275,099.)

*20,349 (1926). Wittek. Reducing ores. (275,144.)

*19,608 (1927). Siemens & Halske A.-G. Electrical depositing of chromium. (275,223.)

*19,807 (1927). General Electrical Co., Ltd., and Weintraub. Metallic coatings. (275,233.)

XI.—Applications

Bosch A.-G. Electric storage batteries. 20,447. Aug. 3. (Ger., 11.1.27.)

British Thomson-Houston Co., Martin, Smith, and Warren. Insulating material. 20,514. Aug. 3.

Neale. Selenium cells. 20,743. Aug. 6.

Schuster. Voltaic cells. 20,584. Aug. 4. (Ger., 5.1.27.)

XI.—Complete Specifications

10,318 (1926). Kodak, Ltd. Electrical deposition of organic materials. (251,271.)

11,888 (1926). Wade (Philips Gloeilampenfabr.). Oxide cathodes. (274,981.)

17,021 (1926). Haddon and Burnett. Accumulator plates. (275,010.)

3133 (1927). Wreschner and Loeb. Manufacture of a preparation which emits β -rays. (265,600.)

7311 (1927). Pechkranz. Electrolyser diaphragms of the filter-press type. (271,043.)

*19,608 (1927). Siemens & Halske A.-G. *See* X.

*20,081 (1927). Siemens & Halske A.-G. High-frequency induction furnaces. (275,249.)

XII.—Applications

Flesch. Production of sulphonated oils etc. 20,573. Aug. 4. (Ger., 23.12.26.)

Overstraten. Extracting fatty materials from waste waters. 20,493. Aug. 3. (Belg. 6.8.26.)

XII.—Complete Specifications

10,692 (1926). Kokatnur. Hydrolysis or saponification of glycerides or other esters. (251,290.)

10,966 (1926). Jirotko. Production of margarine and like edible fats. (274,949.)

11,132 (1926). Schueler. *See* I.

XIII.—Applications

I.-G. Farbenind. Colouring lacquers. 20,352. Aug. 2. (Ger., 13.8.26.) Varnishes. 20,707. Aug. 5. (Ger., 23.12.24.)

XIII.—Complete Specifications

4598 (1926). Pollak. Manufacture of condensation products of urea or its derivatives and formaldehyde. (248,729.)

11,170 (1926). Colas Products, Ltd., and Levy. *See* IX.

31,038 (1926). Giovagnoli. Submarine paints. (262,486.)

*19,844 (1927). Rostschutz-Farbw. Liebreich. Manufacture of rust-preventing oil paints. (275,234.)

XV.—Applications

Clifford. Dehairing skins etc. 20,502. Aug. 3.

Flesch. Use of sulphonated oils in tanning. 20,574. Aug. 4. (Ger., 27.12.26.)

Robinson. Treatment of leather. 20,714. Aug. 5.

XV.—Complete Specification

13,945 (1927). Botson. Treatment of hides and skins preliminary to tanning. (272,195.)

XVI.—Applications

Johnson. Production of fertilisers. 20,680. Aug. 5.

Tyrer. Manufacture of fertilisers. 20,408. Aug. 2.

XVI.—Complete Specification

11,541 (1926). Saccharin-Fabr. A.-G., and Klages. Preserving seeds from attack by pests etc. (274,974.)

XVIII.—Complete Specification

3357 (1927). Hansen, and Nathan. Pasteurising beer. (275,090.)

XIX.—Applications

Robertson. Preserving perishable products. 20,578. Aug. 4. (N.Z., 24.8.26.)

Verity. Preserving etc. eggs etc. 20,744. Aug. 6.

XIX.—Complete Specifications

10,966 (1926). Jirotko. *See* XII.

*16,862 (1927). Food Chillers, Ltd. Conservation of meat, eggs, fruit, etc. (275,184.)

XX.—Applications

Chem. Fabr. vorm. Schering. Obtaining germ gland hormones. 20,727. Aug. 5. (Ger., 11.9.26.)

Flesch. Production of sulphuric esters of poly-oxy fatty acids. 20,571. Aug. 4. (Ger., 14,327.)

I.-G. Farbenind. Production of acetaldehyde from gaseous mixtures. 20,353. Aug. 2. (Ger., 28,926.) Manufacture of diamino-propanols. 20,472. Aug. 3. (Ger., 3,826.)

Imperial Chemical Industries, Ltd., and Horsley. Production of esters. 20,452. Aug. 3.

XX.—Complete Specifications

45,98 (1926). Pollak. See XIII.

10,092 (1926). Kokatnur. See XII.

11,213 (1926). Crawford and Willson. Production of hydroxylic compounds. (274,960.)

19,782 (1927). Canadian Electro Products Co., Ltd. Manufacture of lactic acid esters. (257,907.)

19,782 (1926). Canadian Electro Products Co., Ltd. Manufacture of lactic acid esters. (257,907.)

32,057 (1926). Canadian Electro Products Co., Ltd. Manufacture of hydroxy acid esters. (264,143.)

16,995 (1927). Hoffmann-La Roche & Co. Manufacture of a glucoside of *Adonis Vernalis* L. (265,941.)

*16,513 (1927). Eichellbaum and Atenburg. Increasing efficiency of preparations of animal organs. (275,183.)

*18,924 (1927). Chem. Fabr. vorm. Schering. Manufacture of iodine-substituted benzonitriles. (275,213.)

XXII.—Complete Specifications

19,637 (1926). Vickers, Ltd., and Berger. See II.

*19,682 (1927). Guthke. Manufacture of explosives. (275,228.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Austria and Succession States*: Drugs, perfumery (116). *Belgium*: Semi-finished metal products other than iron (117). *British India*: Steel boiler-plates, copper rod, copper tubes (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *British West Indies*: Drugs, chemicals (111). *Bulgaria*: Tin (A. 5022). *Canada*: Gas and oil cookers (Canadian Trade Commissioner, The Canadian Building, Trafalgar Square, London, S.W.1). *Germany*: Perfumery (118). *Holland*: Boiler materials, brass (121). *Hungary*: Electrical insulating materials (mica, mica-nite, synthetic resin, ebonite) (122). *Near East*: Drugs, perfumery (116). *New Zealand*: Steelwork (B.X. 3685–8); Newsprint (B.X. 3706). *South Africa*: Porcelain insulators, steel, iron (114); machine oil (B.X. 3692); electrically-driven centrifugal pump (A.X. 5021). *Switzerland*: Raw materials for chocolate factories and confectioners (127). *Turkey*: Constructional steelwork (128); galvanised iron wire (A.X. 5025).

Dried Milk Regulations

The Minister of Health is about to make regulations amending the Public Health (Dried Milk) Regulations, 1923, so far as they relate to the labelling of dried milk. The regulations will apply to all dried milk intended for sale for human consumption in England and Wales. Copies of the draft regulations can be purchased from H.M. Stationery Office, or through any bookseller (price 1d.). Any representations on the subject should be addressed to the Secretary to the Ministry at an early date.

Gas-making Plant

The Spalding Urban District Council has placed an order with the Woodall-Duckham Vertical Retort & Oven Construction Co. (1920), Ltd., for a further installation of Woodall-Duckham continuous vertical retorts. The new installation will comprise 6 unit retorts, and includes the necessary coal and coke-handling plant, and is arranged so that a waste heat boiler can be added at a later date. This is the second Woodall-Duckham continuous vertical retort plant to be erected at Spalding.

The Newmarket Gas Company has also placed an order with the Woodall-Duckham Vertical Retort & Oven Construction Co. (1920), Ltd., for an installation of Woodall-Duckham continuous vertical retorts. The installation comprises 6 unit retorts. The plant will be complete with coal and coke-handling plant and waste heat boiler, and will be similar in all respects to the continuous vertical plant recently erected for the Wisbech Lighting Co.

News from Advertisements

A single cylinder vacuum drying machine is for sale (p. v).

An old-established chemical business is for sale (p. v).

A private technical secretary is required by a chemical engineer (p. v).

Half-gallon and 1-gallon stone jars are offered for delivery in Great Britain and Ireland (p. v).

Situations are required by two young men (p. v).

There are 107 firms represented under the various headings in our Buyers' Guide.

PUBLICATIONS RECEIVED

THE INDUSTRIAL CHEMISTRY OF THE FATS AND WAXES. By T. P. Hilditch, D.Sc., F.I.C. With an introduction by E. F. Armstrong, D.Sc., LL.D., F.R.S. Pp. xv + 461. London: Baillicre, Tindall & Cox, 1927. Price 18s.

FLAME AND COMBUSTION IN GASES. By W. A. Bone, D.Sc., Ph.D., F.R.S., and D. T. A. Townend, Ph.D., D.I.C. Pp. xvi + 548. London: Longmans, Green & Co., Ltd., 1927. Price 32s.

BIBLIOGRAPHY OF PERIODICAL PUBLICATIONS ON PAPER-MAKING AND ALLIED SUBJECTS DURING 1925. Paper-makers' Association of Great Britain and Ireland, 1912 (Incorporated). December, 1925. Pp. 48. London: Papermakers' Association, 26, Farringdon Street, E.C.4. Price 5s.

REPORT OF THE DOMINION CHEMIST. By F. T. Shutt, M.A., D.Sc., for the Year ending March 31, 1926. Division of Chemistry. Dominion of Canada, Department of Agriculture, Dominion Experimental Farms. Pp. 102. Ottawa: F. A. Acland, 1927.

ALUMINIUM BRONZE POWDER AND ALUMINIUM PAINT. By J. D. Edwards. Pp. 104. New York: The Chemical Catalog Co., Inc., 1927. Price \$3.0.

ABRIDGED SCIENTIFIC PUBLICATIONS FROM THE KODAK RESEARCH LABORATORIES. Vol. X., 1926. Pp. 247 + xxvi. New York: Eastman Kodak Co., 1926.

ALLEN'S COMMERCIAL ORGANIC ANALYSIS. Vol. V. Edited by S. S. Sadtler, S.B., E. C. Lathrop, A.B., Ph.D., and C. Ainsworth Mitchell, M.A., F.I.C., and other contributors. Pp. xii + 700. Fifth edition, revised and in part rewritten. London: J. and A. Churchill, 1927. Price 30s.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

VOL. 46 NEW SERIES

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No. 34

EDITORIAL

The Empire Mining and Metallurgical Congress

THREE years ago the First Empire Mining and Metallurgical Congress was held in Wembley under the presidencies of the Prince of Wales and the late Viscount Long. The glories, though not the results, of the British Empire Exhibition have faded, its stadium has gone to the dogs, but the success of the First Empire Congress seems likely to be surpassed very greatly by that of the Second Congress, which opened in Montreal this week under the presidency of Sir Robert Horne. It is unanimously agreed that the choice of Canada as the home of the Congress this year was an exceedingly happy one. Canada is still in festive mood, for the celebrations of its Diamond Jubilee have not yet ended, and Canadian hospitality is famous. No country in the world, as Sir Robert Horne said at the opening ceremony, has made such rapid progress as Canada during the last twenty years in the development of mining and metallurgy. Gold, silver, nickel, cobalt, copper, lead, zinc, as well as coal, asbestos and many other minerals are produced in Canada. There are many electrochemical and electrometallurgical processes of a unique character, and there will be variety of interest more than enough to satisfy even the most exacting visitor. Numerous papers will be read, in which the wisdom of the Empire will be focussed on important subjects, and there will be visits, trips and tours of a variety and extent that will try even the most hardy. One cannot but envy those who are able to enjoy such a survey of the industrial and mining achievements and possibilities of the Dominion, and applaud the public-spirited action of Sir Robert Hadfield, who has provided two travelling scholarships to give two more delegates the opportunity of attending the Congress, as we have already recorded. We shall publish a special article about the Congress, and we look forward to its publication, for we know that Canada has a royal way of organising such meetings.

Synthetic Perfumes

In the manufacture of perfumes and perfumed products synthetic materials are being largely used to-day, and the artist perfumer no longer condemns them out of hand. It may be that natural flower extracts are essential to the production of the most subtle and delicate perfumes, but the "synthetics" may be successfully blended with natural perfumes and amongst themselves, whilst in many instances new odour notes may be created with their aid. Thus it is that a large industry has sprung

up for the manufacture of many perfuming materials without which the soap maker and the manufacturer of perfumed toilet requisites would find it difficult to supply the ever increasing demands for their wares. It is not too much to claim that the synthetic perfumes industry, like the synthetic dyestuffs industry, was born in this country, for in the late 'sixties of the nineteenth century Sir W. H. Perkin first made coumarin and noticed its characteristic odour of new-mown hay. As in the case of synthetic dyestuffs, however, it was left largely to others to develop the industry, and the names of Harman, Tiemann, Reimer, Wallach and Bauer come readily to mind in this connexion. It was not until comparatively recent years that manufacturers in this country began to follow the lead of German and French rivals, and although much progress has been made it is probable that we have not caught up in this field so much as in the case of dyestuff and fine chemical manufacture. It is true, to cite a few instances, that we are producing enough coumarin for our own requirements and have an exportable surplus, and that vanillin, ionone, many flavouring and perfuming esters, aldehydes, ketones and alcohols are to be ranked amongst British-made organic chemicals. We believe that the manufacture of artificial musks of the Bauer type is soon to begin in this country, and there can be little doubt that fine chemical manufacturers are able to produce most of the standard synthetics. It is also true that British firms have shown commendable enterprise in developing the manufacture of synthetic thymol and synthetic menthol, which have both fulfilled all expectations even when compared with their natural analogues. At the same time we confess to a feeling of regret that British chemists have not taken a leading part in fundamental research in the domain of synthetic perfuming materials. Synthetic vanillin and ionone were discovered in Germany, the artificial musks were discovered in France, and the German, French, Swiss and Dutch makers have advanced our knowledge of synthetic perfumes by elaborate research programmes. Perhaps the most recent instance is to be found in the determination of the constitution of the true odorous principle of natural musk—which is, of course, not at all akin to the well-known "artificial" musks except in odour—and the consequent production of a true synthetic musk. It is not unfair to compare this synthesis with the famous synthesis of thyroxine by Dr. Harington.

If the British industry of synthetic perfume-making is to develop to a worthy position, much more attention

will have to be given to fundamental scientific research, possibly along the broad lines of determining the relation between odour and chemical constitution. This is a field of study which at present is full of contradictions in spite of the intensive work of the Swiss school under Ruzicka and the American under Bogert, to mention but two outstanding instances the like of which, we fear, is not to be found in this country.

The demand for synthetic perfuming materials is growing, and many British users place large orders abroad. We must not be content to follow in the wake of our foreign rivals, but must strike out for ourselves and, upon the basis of fundamental research, produce new and original synthetics.

A Question of Transmutation

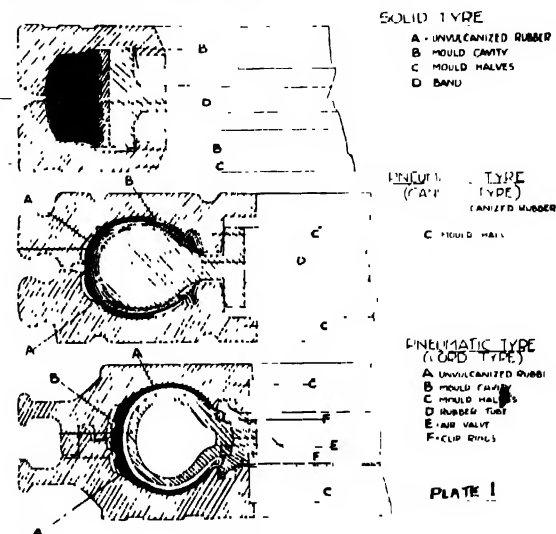
* Recently *The Times*, in an article on the centenary of the death of that amazing visionary, William Blake, remarked that, 'compared to the average Englishman, he corresponds to what chemists call a 'hypothetical radical,' such as ammonium, known and recognised in combination, but never isolated.' It is not the place here to pay tribute to the genius of Blake either as a poet or as an artist, though we are glad to find that it is becoming more usual to drive home a point, even in discussions of literary subjects, by means of a chemical allusion. Further, the quotation has no connexion with our title, unless in an inverse sense, for the alchemist was probably always an isolated worker. This supposition, however, cannot be upheld, as there is an active Alchemical Society in France, complete with a president and other officers, which is still actively pursuing the will o' the wisp of transmutation. M. Jollivet-Castelot, the President of the Société Alchimique de France, indeed, in the pursuit of pure scientific truth, as he calls it, claims to have realised an age-long dream by transmuting silver into gold. The method he has revealed consists in melting, with the aid of the usual fluxes, and at a temperature of 1100°, a mixture of 6 grams of silver, 2 grams of golden sulphide of antimony, and a gram each of orpiment and tin, all chemically pure, with certificates of analysis from a well-known firm. The ingot obtained on cooling is treated with nitric acid, and the insoluble residue is washed with distilled water and ammonia, and then treated with aqua regia. The final filtrate was found to contain 20 milligrams of gold, which, as M. Jollivet-Castelot remarks, is an imposing yield from only 6 grams of silver. The process should, he thinks, be capable of industrial application, though he wilfully puts aside such a base motive from his considerations. We should have mentioned a useful hint of procedure, one which seems to give the true alchemical atmosphere, for, during the heating of the mixture, which required one hour, M. Jollivet-Castelot on two occasions threw small pinches of golden sulphide of antimony into the melt. The author has made his method public, and now, at last, riches are within our grasp. But is the method all? Surely the successful alchemist would have appropriate incantations? And, suppose the silver were of the current alloyed brand, would one obtain metals of the platinum group? Alas, we do not know, and until we do know our happiness has departed.

THE MOULDING AND VULCANISATION OF RUBBER ARTICLES*

By H. WILLSHAW

In dealing with this subject, owing to the fact that moulding and vulcanisation are for all purposes the final operations that are applied to rubber articles, the author has considered it advisable to describe briefly the condition that the unvulcanised article bears before presentation for moulding; and, although the description deals chiefly with tyres, it is hoped that the following examples will give the reader sufficient knowledge to enable him to understand the moulding and vulcanisation of rubber goods in general.

The articles of most importance affecting the rubber industry are pneumatic and solid tyres, tubes, and so forth, all of which call for either steam, hydraulic or air pressure, in conjunction with heavy plant, to effect the requisite final moulding.



Vulcanisation and moulding are produced in one operation, applied pressure and heat being necessary.

Most moulded rubber articles are produced from unvulcanised components, which are shaped and assembled by various previous processes to bear a definite volume relation to the mould in which they are finally shaped and vulcanised.

The foregoing can, perhaps, be more clearly explained by specific examples of three types of tyres, as illustrated on Plate I.

It will be observed that the cord type of pneumatic tyre differs from the description of the two previous tyres inasmuch as the rubber tube has to remain inflated during vulcanisation, such pressure being the means to produce the equalising reaction of the rubber during its expansion. Generally this pressure is round about 200 lb. per sq. in., and the most economical means of introducing and maintaining this pressure inside the rubber tube is by what is known as central or continuous inflation. Briefly explained, it may be said that the air under pressure is carried into the autoclave after the

* Paper read at a Meeting of the Chemical Engineering Group, November 10, 1926.

hydraulic pressure is applied through a central steam pipe with tappings along its length for connexion to the rubber tubes, now located inside the moulds, as shown on Plate II.

Types of pressure vessels

In selecting the most suitable type of pressure vessel for his purpose, the engineer will, of course, be guided by the type of article which has to be vulcanised and by the time taken to effect such vulcanisation.

Where this period of vulcanisation is a lengthy one, there is no doubt that the most suitable type of pressure vessel is that illustrated on Plate II—the autoclave.

Autoclave.—This is a steam vessel designed generally

economically employed. These may be of either the horizontal or vertical type, each type having its particular merits.

Plate III illustrates one of the horizontal type, as now used in the vulcanisation of motor-cycle or light-car tyres. The most important point to note in connexion with this vulcaniser is that the use of hydraulic pressure is completely eliminated.

The vulcaniser consists of upper and lower steam chests wherein are housed the mould halves. The upper steam chest is hinged, thus permitting the tyre—pre-assembled in the manner shown on Plate I—to be placed in the bottom half of the steam chest, which is a fixture.

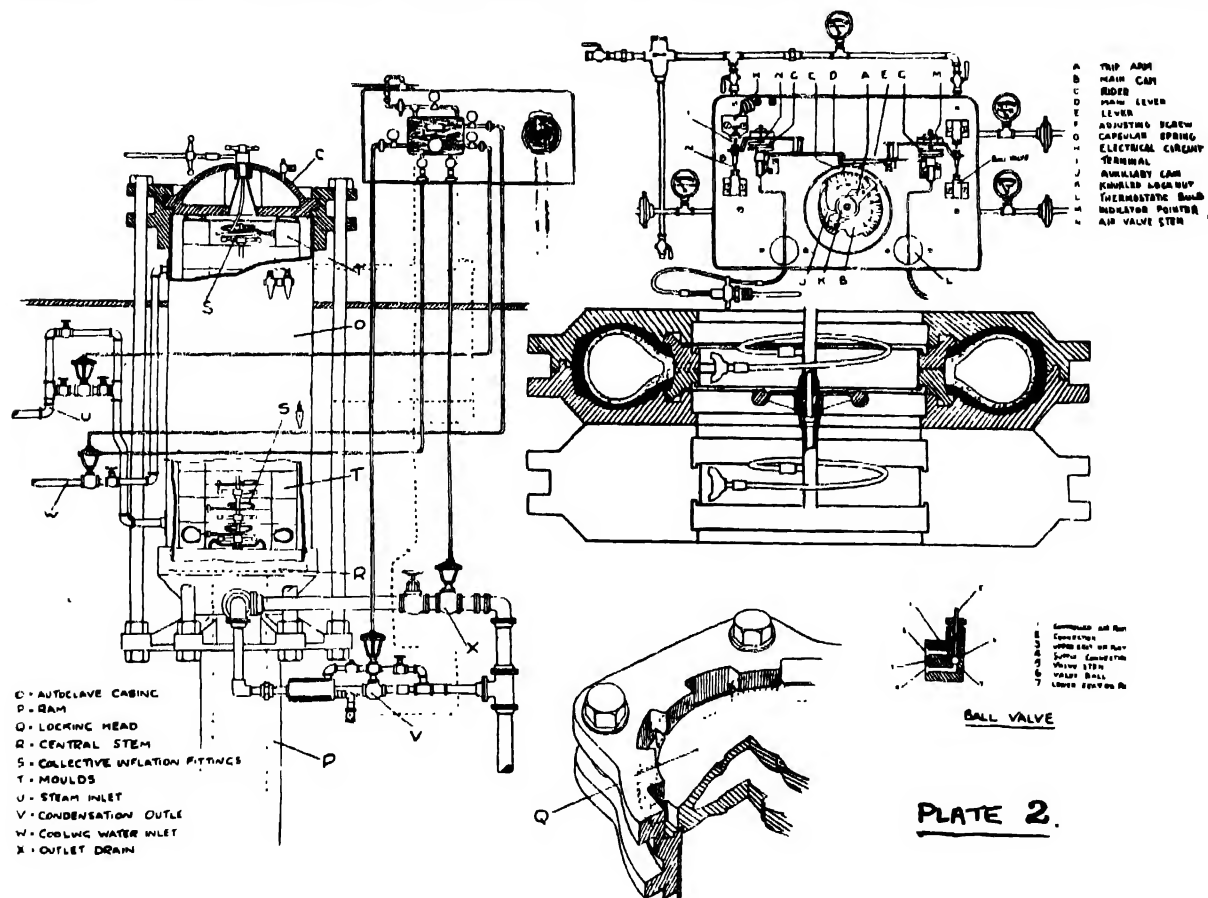


PLATE 2.

for a working pressure of 100 lb. per sq. in., although actual pressures usually range from 40 to 100 lb. per sq. in., in the interior of which works an hydraulic ram operated by pressure varying from 1600 lb. to 2240 lb. per sq. in.

The diameter of the ram varies according to the total pressure required, and it may be of interest to know that for solid tyre vulcanisation this diameter ranges from 24 in. to 32 in., whilst for pneumatic tyres the range is from 12 in. to 20 in.

The head of the autoclave is designed so that by rotation it can be locked in position to take the thrust of the ram as and when required.

Individual vulcaniser.—Where the period of vulcanisation is shorter, individual vulcanisers can be more

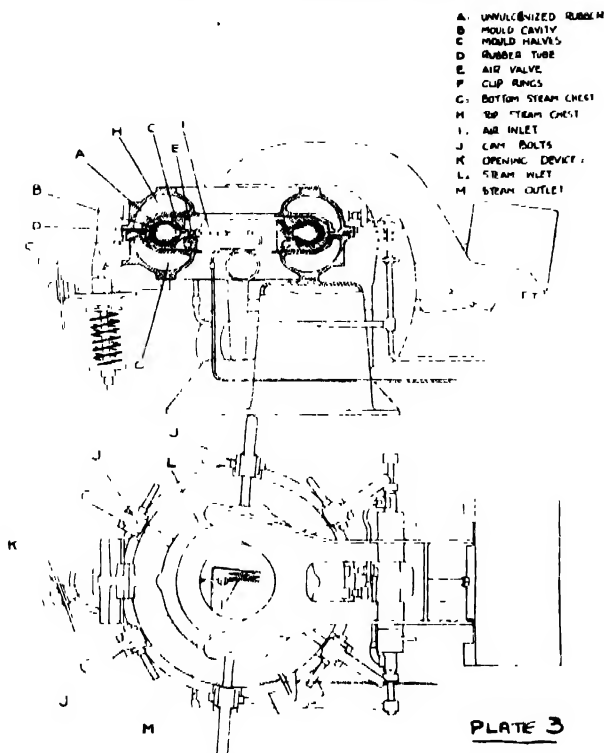
Before moulding, the hinged steam chest is lowered and locked into position by either swing bolts, or, as illustrated, by cam-locking gear. This completed, the connexion for the supply of the air pressure to the rubber tube is made and the air then admitted.

Vulcanising press.—Plate IV illustrates an example of a vulcanising press of the vertical type where hydraulic pressure is again utilised. This type of press is used where the period of vulcanisation is comparatively short, as with cycle tyres.

The two halves of the mould are bolted together against a steam chest, or are themselves chambered for the circulation of steam.

The hydraulic ram on its upward stroke forces the bottom half of the mould upwards and at the same time

expands the solid core segments in order to effect the moulding of the tyre before vulcanisation. The return stroke, of course, reverses these movements and allows the vulcanised tyre to be withdrawn easily.



With this class of article, recent developments have tended to make the operation almost entirely automatic, and the writer believes that before very long the whole operation will be automatic with the exception of merely placing the assembled uncured tyre in the vulcaniser.

Moulding

Since the results produced by the various types of presses described are practically identical, it is considered that a brief description of the conditions existing at the time of moulding in any one of them will be sufficient for the purpose.

Referring to Plate II, it will be followed that with the autoclave head removed, the ram is suitably raised to allow the moulds to be placed one on top of the other, nearly to the full depth of the autoclave casing or steam vessel, following which the head is placed in position and locked.

Low-pressure water (generally around 300 lb. per sq. in.) is used for the ram movements referred to, and the ram is raised by suitable valve operations until the thrust is taken up by the head and then the moulds.

When this has occurred, the high-pressure water is applied by the same valve, in order to give the necessary pressure to close the moulds and to keep them closed against either the expansion of the rubber or the internal pressure in the rubber tubes.

This means that the rubber is displaced gradually to obtain the mould impression.

There is, however, a compacting or additional compression necessary to produce a suitable vulcanised rubber, and this is produced by the rubber itself during vulcanisation.

Vulcanisation

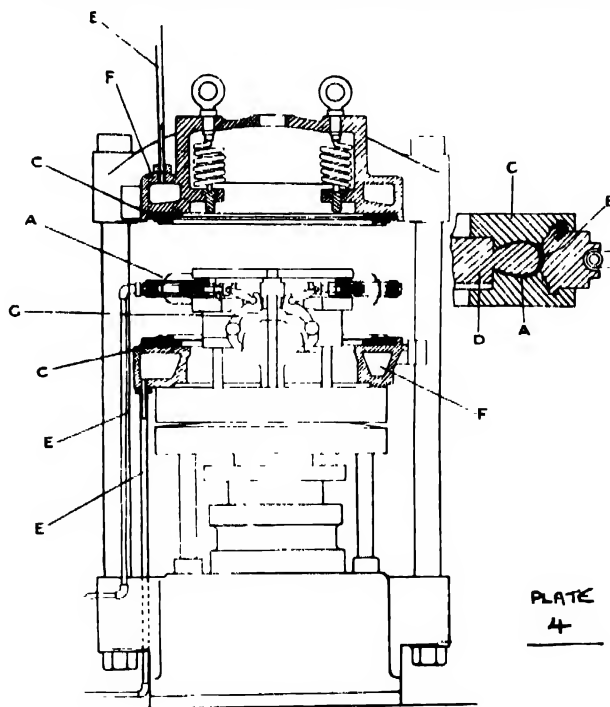
The number of articles vulcanised by open steam pressure is gradually being reduced in favour of curing in some form of mould, as it is realised that a compression of the rubber against the expansion occurring during vulcanisation is necessary to give a vulcanised article of consistent formation.

It is well known that to effect vulcanisation, sulphur (already compounded in the uncured rubber) unites with the rubber on reaching a temperature of about 115° C. Therefore, in order to effect correct vulcanisation of autoclave vulcanised articles steam must be admitted to the vessel after the hydraulic pressure is applied.

In a modern installation the admission and regulation of steam is controlled by means of air-operated diaphragm valves and thermostats, referred to later on.

The effect of heat on the unvulcanised rubber causes it to expand with considerable effect, the expansion being determined to some extent by the rubber content of the compound used.

As for all practical purposes the unvulcanised rubber



when heated up is incompressible, it becomes easier to understand the condition that prevails in the autoclave at the commencement of vulcanisation, when the rubber, displaced by the effect of the ram, is expanded

by the heat from the steam admitted, in an endeavour to open the mould and release any excess.

It has previously been stated that the potential expansion is proportional to the rubber content of the compound used, and it will be followed that, before any release of rubber can occur, a compression of everything inside the moulds takes place, equal to the total load upon the ram, thereby resulting in compacting the rubber against the mould, producing an exact impression of the mould.

Why pressure is necessary

As is generally known, unvulcanised rubber contains, to a varying extent, very small air cells, and is sometimes, to the naked eye, porous, whilst if vulcanised without pressure it becomes very porous.

To obtain complete consolidation, correct pressure is necessary in order to disperse this porosity throughout the entire rubber mass, and so give an uniform condition together with the requisite physical properties.

In addition, for the rubber article to bear correctly all the markings of the mould, a proper determination of hydraulic and, where required, air pressure is necessary, to equalise the pressure set up within the moulds due to the rubber itself during vulcanisation.

It is always a check on whether the article has had the correct pressure to note the surplus of rubber that is expelled during the vulcanisation, which is referred to as "spew." This should be as thin as possible, as it will be realised that if the moulds are open the "spew" will be much thicker than is desired, and the shape of the article will be affected.

Control of temperature during vulcanisation

It has been previously mentioned that the admission and regulation of steam is controlled by means of thermostats and air-operated diaphragm valves.

One of the greatest problems in connexion with the vulcanising of all rubber goods is that of producing uniform temperatures throughout the curing vessel, and in all installations a considerable amount of study and experimentation is made in order to produce, by suitable arrangement of the controlling thermostat and the condensate regulators, correct circulation.

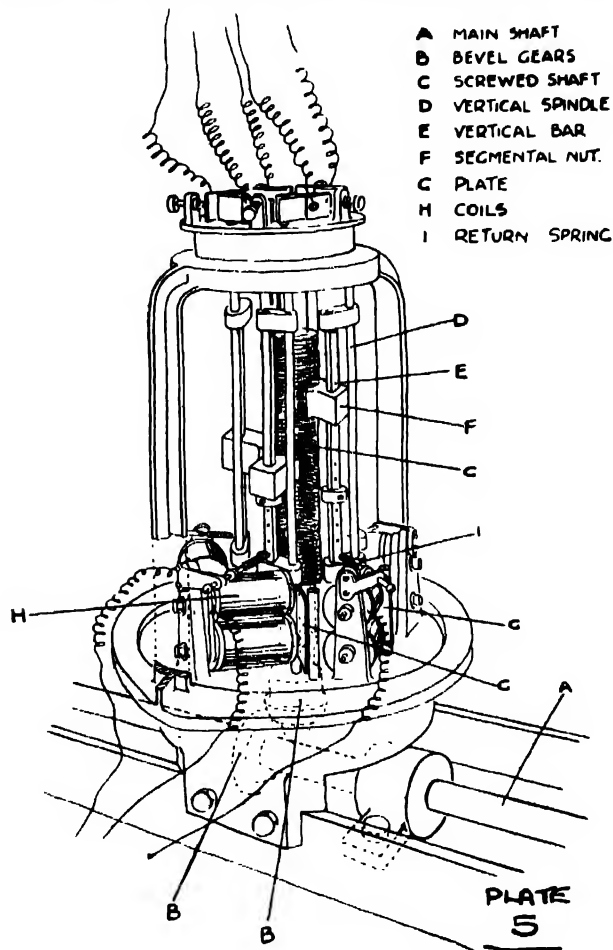
Perhaps it would be as well for a moment to dwell on the condition that occurs in a vertical vulcanising vessel where the above arrangement has not been carried out correctly, in which case the controlling valve simply admits steam to the vessel, displacing and driving to the bottom of the vessel the air that was previously in the vulcaniser before the admission of the steam. If the air is allowed to remain undisturbed, a very noticeable effect on vulcanisation will occur, as those articles that are in the lower zone will not be vulcanised as well as those that are in the steam under more or less better conditions.

An ideal vulcanising condition is where there is a definite circulation of steam or heat, but, owing to the high cost of steam, it is necessary to arrange for the ideal conditions of minimum steam consumption and uniform temperatures to be obtained.

The importance of time control

Where the vulcanising time is short, as with cycle tyres, or, further, a light-car tyre, to obtain correct vulcanisa-

tion it is necessary to ensure that the correct time of the tyre in the moulds is observed. This has brought about the development by one large company of a number of timing devices. Plate No. V illustrates one such device in which a screw-operated shaft, driven at a definite speed, drives by suitable gears a battery of screwed vertical shafts. Encircling each of these shafts at equal spaces are a number of vertical spindles, attached to each of which are two arms, which in turn support a square bar on which is attached a segmental nut, free to



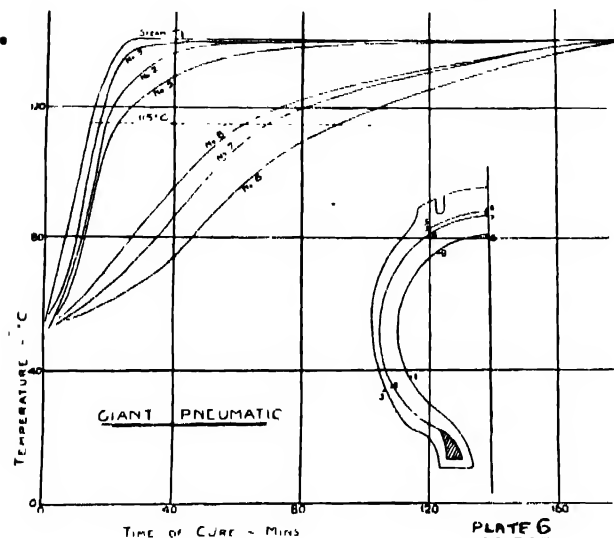
slide and capable of being set at any desired point on the bar.

To the bottom of each spindle is attached a metal plate, separated from a pair of magnetic coils by a small gap, whilst at the top is a smaller plate, insulated from the spindle, which operates the light switch as afterwards described.

Briefly, the action of this device is as follows:—The segmental nuts are set at the desired position according to the length of cure required. The closing of the vulcaniser completes an electric circuit which energises the coils and magnetic attraction causes the metal plate to move towards the coils. As this takes place the vertical spindle is turned, thus bringing the segmental nut into mesh with the vertical shaft. This causes the nut to travel upwards, and at the same time prevents

the metal plate from coming into actual contact with the coils. When the nut reaches the top of the shaft, which is recessed, the plate is pulled home against the coils. This further rotation of the spindle brings the nut into the recess and the top plate completes a separate electric circuit and lights a coloured lamp over the particular press in operation.

The opening of the press breaks the coil circuit, and under the influence of a spring the vertical spindle returns



to its original position, and the nut is thereby withdrawn from the recess and falls on to its stop. At the same time the top plate is moved away from its contact, thus breaking the lamp circuit.

By such means the operators on the vulcanisers are advised of the progress of events; but to keep check on the personal element, which cannot entirely be eliminated, an additional device is incorporated in the above-described timing gear whereby any particular vulcaniser can be checked by plugging into the particular circuit, thereby connecting it to a recording mechanism and producing a graphic record on a chart of the actual time of vulcanisation.

A further development in this direction consists in placing in the circuit a suitable mechanism, which in the case of the cycle press results in the hydraulic pressure being released at the exact time determined by the period of vulcanisation, thereby automatically lowering the press and leaving the tyre in such a way as to be readily removed.

Effect of temperature throughout cure

During the period of vulcanisation of tyres, the heat penetrates from outside to inside, so that the temperatures of the inner portions of the tyre lag behind those of the outer ones to a fairly considerable extent.

Plate VI illustrates a typical example of this temperature lag, and it will be followed from this how essential it is that the arrangement of the various component parts is such as to give uniform vulcanisation of the moulded article.

(To be continued)

WEIGHING IN THE CHEMICAL INDUSTRIES

By W. A. BENTON

(Concluded)

All self-indicating balances actually in use to-day depend for their operation on the yielding of a variable resistant in proportion to the load. Springs of various kinds have been used both in cheap and in very costly devices.

For certain special purposes where strictly maintained accuracy is not essential I should not hesitate to use a spring to-day; but in, I suppose, nine-tenths of the better-class technical and industrial instruments used throughout the world the variable resistant is not a spring, but a pendulum or bent lever. This resistant has been proved to be more reliable and more constant than the spring when used under the changing atmospheric and thermal conditions prevailing in industrial laboratories and factories.

The extension of a spring of the very best class under a given load varies with change of temperature. Such change produces two different effects, both of which are inimical to the accuracy of weighments. Firstly, the length of the spring is altered, causing a variation in the zero or no-load indication. Secondly, the specific elasticity of the steel is altered, causing an increasing variation in the indications from zero to maximum capacity.

It is possible to compensate perfectly the former of these variations, which, in the case of a symmetrical spiral spring can be shown mathematically to be always

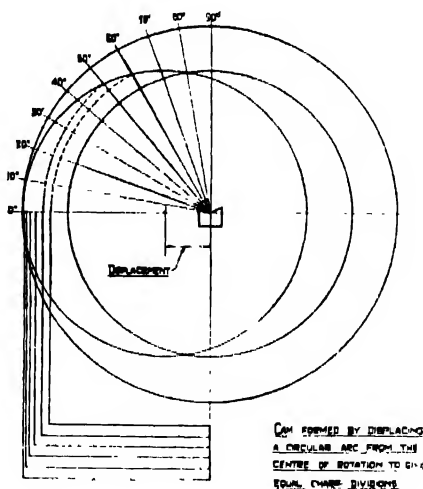


FIG. 10

The cam-operated pendulum resistant

The rate of change of the arm-lengths corresponds very closely with the rate of change of the pendulum moment-arms.

small, owing to the configuration of the elastic material in the form of an open spiral. The latter aberration is not so easily compensated, and has not been entirely obliterated on any commercial instrument with which I am acquainted. It would, however, be possible by several known devices to effect a rectification within any assignable limits. A much more serious objection

to spring resistants is the lag or hysteresis of the material—steel—of which the spring is made. Load a spring for a time with a heavy load, and then carefully remove the weight, or let the return of the spring and pointer be steadied by means of a dash-pot, as is necessary in all good commercial instruments, and it will often be found that the pointer will not exactly return to zero, or will not do so until after a certain time, or until the instrument has been subjected to some shock or vibration.

Now, while it would be quite possible to exaggerate the evil of this slight hysteresis in industrial weighing instruments, the defect is undoubtedly a very real one, and has resulted in the abandonment of the spring as a weighing resistant in high-class industrial instruments by nearly all the leading makers in Europe and America. The spiral spring has, however, one great advantage which no other known resistant shares in an equal degree: it conforms almost absolutely to Hooke's Law,

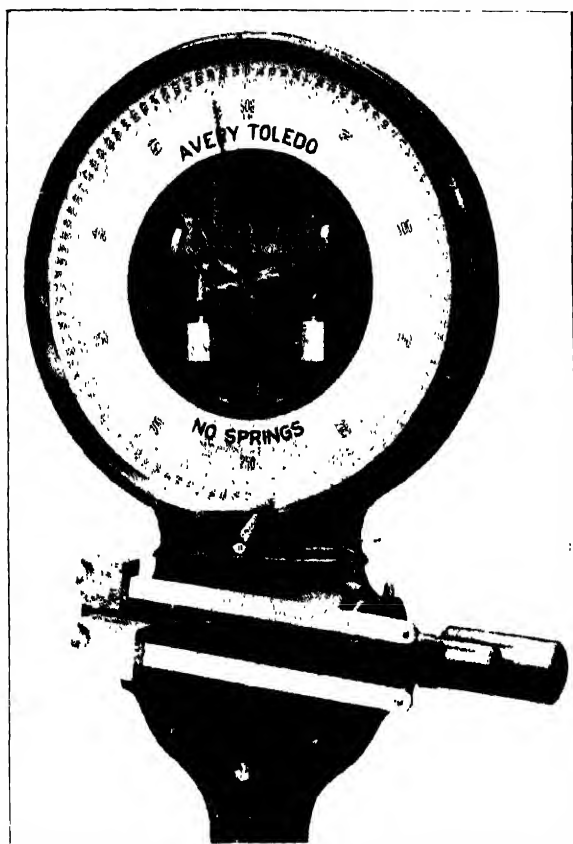


FIG. 11

Double-pendulum visible weigher

and gives equal chart divisions for equal increments of load.

This is not the case with the pendulum resistant, and in the weighing machines illustrated two devices are used to obtain the great practical advantages which result from equality of sub-divisions. The first method, exemplified in the semi-automatic platform machine,

is to reduce the angular movement until the arcs and sines (perpendiculars) of the angles are of practically the same length. This method always renders the instrument susceptible to slight changes of level. By using two pendulums rotating in opposite senses the tendency is overcome. Some of the machines illustrated embody opposed pendulums which serve this purpose.

The second method of obtaining equal graduations is by connecting the main weighing lever to the resistant

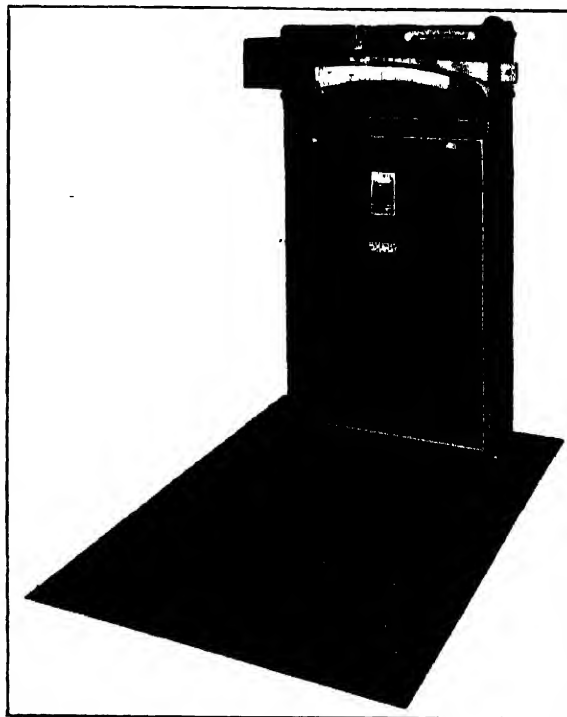


FIG. 12

Visible weigher platform machine

The deposition of the load moves a pointer which shows the "notch" on the steelyard in which the pole should be placed. As soon as this is done, the machine indicates in *cists.*, *grs.*, and *lb.*, to the nearest half-pound, the weight of the goods.

by means of a strap passing round a circular cam affixed eccentrically to the knife-edge axis of the pendulum. The diagram (Fig. 10) shows that this displacement effects a correction which almost completely compensates for the so-called circular aberration of the resistant.

Various mechanisms suitable for industrial use embodying these devices are shown in Figs. 11 and 12.

The advantage of a tare-bar and of tare-indicating devices will be readily understood by those engaged in industries in which receptacles have to be filled with a nett weight of a commodity or chemical substance. Very convenient and rapid weighers are available for practically all technical operations in which weighing is involved.

"Difference weighers" are particularly useful, as they permit the exact divergence of a load from a pre-determined weight to be automatically indicated in excess or deficiency.

Perhaps it may here be profitably pointed out that the advantages of self-indicating weighers—in which the handling of weights is either dispensed with or reduced to a minimum—are by no means limited to the increased speed of operation, or the saving of labour and its resulting fatigue. Careful study of the mistakes made by skilled and unskilled weighmen engaged in technical weighing on loose-weight and steel-yard machines shows that while the latter—the unskilled—make mistakes of all kinds, the former generally correctly balance the varying loads, but more or less often make mistakes in reading the weights, or the steel-yard indications, or both. That is a very important point, and one to which as a result of personal investigation, I have often called the attention of factory and laboratory superintendents.

In the case of self-indicating machines, it is very seldom that a weighman reads or records the dial readings incorrectly, and in the case of printing machines the human element is practically eliminated.

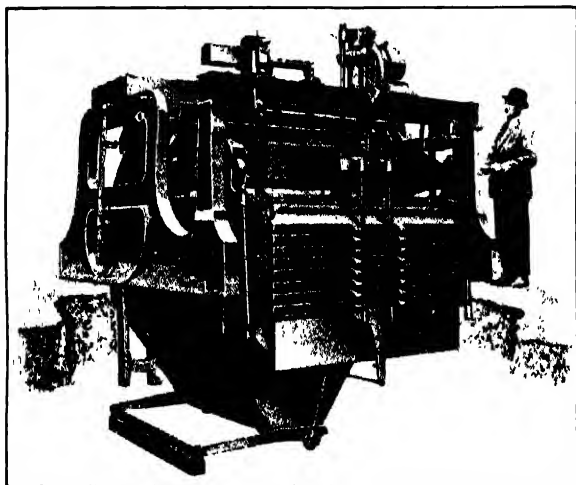


FIG. 13
A modern automatic feed-weigher

I invite anyone interested in the accuracy of industrial weighing oftentimes a question of immense financial or technical importance—to investigate for himself the conclusions just indicated. It will also be found that when weighing has for any reason to be hurried, and pressure is put upon an operator to hasten his task, the number of mistakes made is always much greater with the old-fashioned instruments than with the new.

One other remark before leaving this aspect of my subject: accurate and frequent weighing throughout any series of technical processes embodied in a chemical or metallurgical industry almost always results in the discovery and subsequent elimination of unsuspected sources of waste, and sometimes in the discovery of very surprising leakages. It would not be difficult to give instances of this, but lack of time compels me to pass on to another and quite different type of automatic weigher. I refer to the huge class of automatic and semi-automatic feed weighers.

If a substance can be induced to flow through a conduit, or fall down a chute, it can be automatically weighed. Thus, all liquids, except such very corrosive ones as present special problems in respect of the few substances available to resist their action, can be automatically weighed. So can all powders, granular and lumpy materials, all grains, berries, seeds, crystals, and most fuels, from coke-breeze to best lump coal.

The principles and devices embodied in most of the machines are very similar. In almost all the best machines equal-armed beams are used. The unbalanced pressure of the weights when the machine is empty causes the receptacle end of the beam to rise and open the valve or jaws admitting the substance to the weighing hopper. As the load approaches a balance the weight of the jaws, or the weight of a counterpoise on the beam in this position, causes the receptacle to fall and so cut off the main supply by closing the main feed valve. A small feed valve, however, remains open, constituting the "dribble" feed, and this is not closed until the loaded receptacle moves to the balanced position and permits the appropriate mechanism to close this little valve. At this stage in the cycle of operations, by raising a small lever called the compensating lever, and throwing it over, it is possible rapidly to test the accuracy of the weighing by noting whether the beam is properly balanced.

Left to itself the counterpoise will cause the receptacle to fall and release a detent which opens the emptying valve of the receptacle, or alternatively causes the receptacle to be overturned. When empty the receptacle resumes its former state or position, and the cycle automatically commences again. (Fig. 13.)

It is possible, and quite usual, to employ batteries of automatic or semi-automatic feed-weighers to supply the different constituents of a mixture, liquid or solid, or both, and to maintain quite accurately the relative proportions of the parts.

As to the accuracy of such weighments—modern machines give quite astonishing results, especially in the case of granular materials. An error of one-fifth of 1% should not be exceeded, and on a large number of weighments the total error, when it can be ascertained, will generally be found to be less than half the above. Even coal for boilers can be weighed if the conditions are reasonably good to within half of 1%. Remarkable results in checking boiler economies are now possible by combining closed water-weighers with coal weighers, so that for each boiler the coal consumption and accompanying water consumption can be ascertained either continuously or over any given period. Moreover, the machines can be made to record the coal and water consumptions on charts or on one and the same chart.

I feel very sure that eventually this will become a standard method of checking boiler-plant economies. It is direct. Its records need no interpretation. They give just what the engineer and the financial authority want to know, namely, water evaporated per pound of coal.

Too often the real facts—the vital facts—are hidden under a cloud of CO_2 readings, thermometer readings and the like, and what actually is happening with any particular boiler during ordinary use—as distinguished

from what happens on the occasion of a full-dress test—is entirely lost sight of.

The CO_2 recorder is a useful and indeed almost indispensable instrument in the hands of a skilled power-station engineer with a sound knowledge of the chemistry of combustion, but the blind faith shown by many engineers in the supposed inevitable relationship of high CO_2 readings with high boiler-plant economy is one of the strangest phenomena of recent years, and not very creditable to the engineering profession. A little knowledge of chemistry would have prevented some of

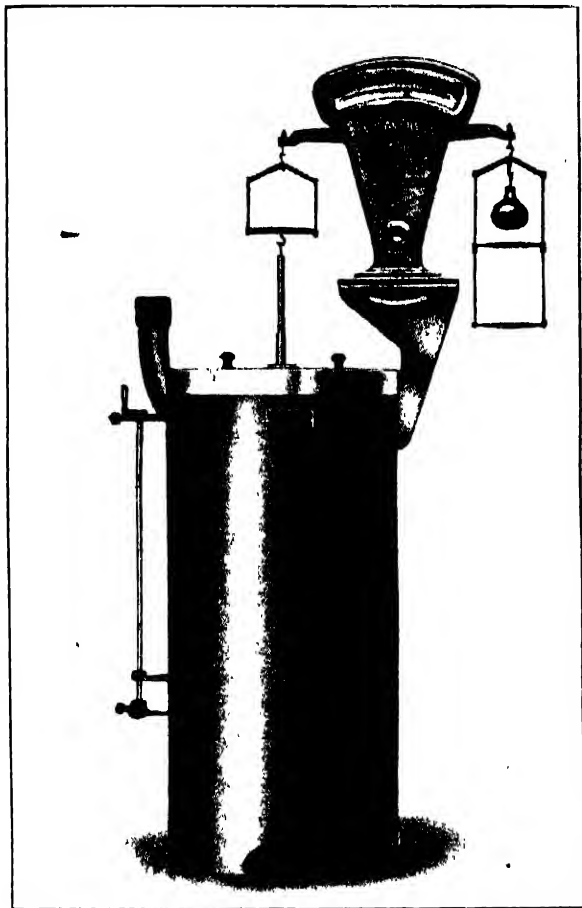


FIG. 14

The new Avery automatic steam condition-testing plant, for spinners, combers, and manufacturers

the more glaring absurdities that came under one's notice when engaged in general engineering practice. A very well-known consulting engineer told me some months ago that in a survey of a large number of plants he had been unable to find any understandable relationship between the CO_2 records and real boiler economies. Perhaps matters have somewhat improved during the last two or three years, but, personally, when I was engaged in that sort of work I never found a stoker so dull as not to be able to give his employer as high a CO_2 reading as the heart of man could desire—or his employer afford to pay for.

This is a digression, but not, I hope, quite out of place. Weighing is the real test, and sooner or later will come into its own, as is instanced by the equipment of recently-built stations.

A word is needed about an instrument called a *weighing totaliser*, now much used for weighing loaded trucks, or a succession of loads varying in individual amount. The weighments are made automatically and recorded, one weighment being added to another so that at any moment the total load passed over the machine can be known. This instrument in various applications is now much used in industrial concerns.

Another instrument of considerable technical importance is the *automatic steam-heated condition-testing plant*. This instrument (Fig. 14) is used chiefly in the woollen, cotton, silk, and artificial silk industries, but is also used by paint manufacturers and others. It enables the "condition" of "tops," yarn or the like to be rapidly ascertained. The material is weighed, and then hung from a self-indicating quadrant balance in a pre-heated steam-jacketed testing oven raised to a temperature of 240° Fahr. corresponding in the case of this particular instrument to a steam pressure of 35 lb. per square inch. The entire operation may occupy from 40 to 60 min., but may be reduced to about 30 by the use of an auxiliary oven. The amount of moisture extracted is automatically indicated by the pointer of the balance moving over a divided dial. The instrument is perfectly safe and very reliable. The steam chamber is hydraulically tested up to 160 lb. per square inch before being sent from the works.

This very brief and inadequate sketch of weighing instruments suitable for use in chemical industries must now close. It has only been possible to give a bare outline of the subject. Most industrial weighing propositions can now be dealt with by standard instruments, and, where this is not the case, a suitable device can almost always be designed—whether it be for automatically weighing molasses or weighing dynamite.

CANADIAN INDUSTRIAL NOTES

The net profits of the Royalite Oil Co., Calgary, Alta., amounted to \$535,496 for the year 1926. The revenue from the well for gas was \$307,776, and from naphtha \$898,361. Royalite well No. 4 produced 205,421 barrels of naphtha during 1926.

The Price Development and Refining Co. will commence the construction, at Wainwright, Alta., of a 10,000 barrels a day oil refinery. The first unit, for 1000 barrels, will be operating before September next.

It is reported that Anglo-Persian interests will take over British Petroleums, Ltd., the pioneer producers in the Wainwright field, Alta.

The Royal Crown Soaps, Ltd., of Vancouver, B.C., will add a new factory to its present establishment.

Another distillery will be erected at Sarnia, Ont., by the recently chartered Sarnia Wine and Cognac Co. Wines and brandies will be manufactured. Expert distillers are to be brought from the Rhineland district of Germany.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICE

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, will be available at the end of this month. The reprints will be in JOURNAL format, with paper cover, and the price will be 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent at once to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

CHEMICAL SOCIETY'S LIBRARY

The Library of the Chemical Society will close each evening at 5 o'clock from August 15 to September 10.

CALENDAR OF FORTHCOMING EVENTS

- Aug. 31 BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Annual Meeting (97th year) at Leeds. (*See CHEM. AND IND., August 19, p. 747.*)
- Sept. 2 COKE OVENS MANAGERS' ASSOCIATION. Continental Tour. (*See CHEM. AND IND., August 19, p. 749.*)
- Sept. 6 INSTITUTE OF METALS. Autumn Meeting to be held at Derby. (*See CHEM. AND IND., August 19, p. 748.*)
- Sept. 9. INSTITUTE OF BREWING. Research Fund Committee and Corporate Members. Visit to hop-growing districts in Kent.
- Sept. 12 to 14. INTERNATIONAL SOCIETY OF LEATHER TRADERS' CHEMISTS. Bi-Annual Conference in London. On Sept. 12, at 10 a.m., at the Leathersellers' Hall, St. Helen's Place, E.C.3, reception of members by Prof. D. McCandlish (president), supported by the Master of the Leathersellers' Company (H. C. Dove), and the presidents of the Society of Chemical Industry, Chemical Society, Institute of Chemistry, Society of Dyers and Colourists, British Association of Chemists, and the Royal Microscopical Society. At 1 p.m., Luncheon will take place at the Connaught Rooms, Great Queen Street, W.C., by invitation of the United Tanners' Federation and the Federation of Curriers, Light Leather Tanners and Dressers. At 3 p.m. a discussion will be held of Technical Agenda. On Sept. 13, at 10 a.m., the discussion will continue, also at 2.30 p.m., and at 7 p.m., Dinner will be held at the Hotel Cecil, Strand, W.C., by invitation of the Members of the British Section of the International Society of Leather Trades' Chemists. Sept. 14, at 10 a.m., the discussion of Technical Agenda will continue, and also at 2.30 p.m. The Chemical Industry Club, 2, Whitehall Court, S.W.1, has kindly granted facilities for members attending the Conference to have the use of the Club during the period of the Conference.
- Sept. 13. SOCIETY OF CHEMICAL INDUSTRY. Official Visit to the Shipping, Engineering and Machinery Exhibition at Olympia, London, W.
- Sept. 14. INSTITUTION OF SANITARY ENGINEERS. Visit to the Shipping, Engineering and Machinery Exhibition at Olympia.
- Oct. 7. SOCIETY OF CHEMICAL INDUSTRY. Manchester Section. Chairman's Address, by C. J. T. Cronshaw.

CORRESPONDENCE

THE COLLEGE MAN AND CHEMICAL INDUSTRY

SIR, - I have read with much interest the letter in your issue of August 12, signed "William Cullen," relating to the usefulness of the college-trained chemist in industry.

There is no doubt that many university men have been unsuccessful under the conditions prevailing in factories. The reason is generally summarised under the comprehensive title, "Lack of experience." Two main causes contribute to the failure of most chemists: (1) faulty training, (2) lack of personal direction.

The present university system was founded as an educational measure pure and simple, and numerous traditions have been handed down from generations of professors to their assistants. The general methods of teaching have improved, but only as a separate and individual item. There is no meeting place between industry and education as far as the chemist is concerned. The chemical teacher has, generally speaking, no practical knowledge of technical processes, and he is therefore incapable of dealing with industrial problems or imparting knowledge thereon. This is greatly to be deplored, as industrial processes are based on ordinary chemical principles, and are quite as interesting and educational as the highly academic problems which are most frequently discussed in the university centres. The knowledge which the student gains is generally without practical importance, and the young man's judgment of values is consequently faulty.

The British system of university education provides largely for the professional man. The system and spirit of research which dominate the German universities are not so highly developed in this country. The young trained chemist therefore has no self-reliance as compensation for his faulty education. It is grossly unfair to expect a young man of this type to do anything of practical value in a works without further assistance. The young graduate needs above all the guiding hand of experience, which he is only too frequently unable to obtain. The best position for a young chemist is as assistant to an older and more experienced man, but this, of course, is not always possible.

Many firms are of the opinion that the employment of a chemist will solve all their problems, and such firms are generally those which can offer the least assistance to the inexperienced man. Failure is inevitable under such conditions, and it very rarely happens that a young chemist is able to obtain the direction which he needs. Most firms do not know how to utilise the trained knowledge which the chemist has stored in his brain. The solution is difficult. Some universities have technical branches where the principles of various industries are well taught, and there is a general desire to utilise the instruction given in these departments as a portion of the educational system. This is excellent where specialisation is desired, but practically nothing is done for industry as a whole in the chemical department itself.

Every trained chemist needs some tuition in factory methods, and this he can acquire only from practical men. Every university should have one lecturer who has had at least five years' practical works' experience. Each

student should be compelled to make one chemical product on an economic basis, and such experiments should be run successfully for at least a month.

The spirit of the workshop should be grafted on to the highly academic and educational system of our universities.

A discussion on this subject before one of the learned societies would undoubtedly lead to interesting and profitable results.

Yours faithfully,

H. DRAKE LAW

PERSONAL AND OTHER ITEMS

Lieut.-Colonel L. F. Goodwin, commanding the Princess of Wales' Own Regiment (Professor of Chemical Engineering at Queen's University, Ontario), had the honour of receiving their Royal Highnesses, the Prince of Wales and Prince George, on their recent visit to Kingston at the beginning of August, when the Prince of Wales consented to visit the officers of the Regiment, of which he is Colonel-in-Chief.

Sir Oliver and Lady Lodge celebrated their golden wedding this week.

Mr. H. Talbot, M.I. Chem.E., B.Sc., A.R.C.Sc., General Manager of the Welsbach Light Co., Ltd., and until recently Hon. Secretary of the Chemical Engineering Group of the Society of Chemical Industry and a joint Hon. Secretary of the Fuel Section of the Society, has been appointed a delegate of the Society of British Gas Industries to the forthcoming Industrial Commission on Illumination, which will begin in Bellagio on August 31.

Prof. P. Baldi has been appointed to the chair of general and analytical chemistry at the Turin Technical Institute.

Dr. H. Stadlinger, a director of the Scheidemandel A.-G., and head of that firm's technical research laboratories, has replaced the late Herr Blucher on the editorial staff of the *Chemiker-Zeitung*.

The death is announced of Prof. Pulfrich, director of the section for scientific measuring instruments of the Zeiss optical firm, and the originator of the refractometer which bears his name.

The late Mr. F. Lloyd, chairman and governing director of Edward Lloyd, Ltd., papermakers, left £679,923, with net personalty £618,051.

Fastness of Dyestuffs to Light

The British Research Association for the Woollen and Worsted Industries, in a communication to the Journal of the Society of Dyers and Colourists, gives an account of the research work organised by its colour laboratories in relation to the fastness to light of dyestuffs on woollen and worsted fabrics, with the co-operation of leading scientists in all parts of the world. The results may be summarised as follows:—The experiments performed on fading of dyestuffs in the tropics, in town and country in England, and by artificial means, show that the present system of artificial fading does not agree in results with those given by sunlight, and that there was actually less

fading in the tropics than at country stations in England. The discrepancy was largely due to humidity conditions in the atmosphere around the patterns. As the colour loss increases with increase of humidity, a standard humidity must be prescribed for all fading tests. Under standard conditions, the loss of colour has a direct relationship, but is not directly proportional, to time of exposure. Therefore, sufficient time should be given to the exposure to allow the fading to be in excess of the initial, more rapid, fading action. An explanation is suggested for the statement that deeper shades are faster than pale shades. An increase in the ultra-violet radiation produces an increase of fading, the effect being intensified by increase of humidity. The general conclusion points to the necessity for observing standard conditions of light-intensity, temperature and humidity at the surface of the pattern during the test exposure. A new type of fading cabinet and a new colorimeter are described in the communication, which also mentions a new fading lamp, to be described later.

Sugar Beet Prices

As a result of negotiations with the representatives of the existing beet sugar factories, the Sugar Beet Committee of the National Farmers' Union has decided to recommend the following terms with regard to the price to be paid under a three years' contract for beets delivered during the next subsidy period (1928—30):—A fixed guaranteed price of 46s. per ton for beets of 15½% sugar content, plus an addition at the rate of 3s. for the first 1% above 15½%, and at the rate of 3s. 4d. for each additional 1%, the reduction in respect of beets below 15½% to be at the rate of 3s. for each 1%.

Platinum in Canada

Seven ounces of platinum have been won from placer gravels in Coalmont and the Upper Tulameen Valley in British Columbia. During the past year or two there has been considerable prospecting along the Tulameen valley for platinum and gold, but the annual report of the British Columbia Minister of Mines indicates that the results of placer-mining on the Tulameen have been disappointing as far as actual production of platinum and gold are concerned. Federal Government statistics indicate that in 1926 production in British Columbia of platinum totalled 50 fine ounces, as compared with 6 ounces in the previous year. Besides platinum, small quantities of related metals such as iridium, osmium, ruthenium and rhodium have been found in concentrates shipped from British Columbia to England for refining.

The New Ontario Oil Field

Ten producing wells have now been completed in the new Camden township oil field, in Kent County, Ontario, where the Vacuum Gas and Oil Co., Ltd., has been drilling for the past few months. The Ajax Oil and Gas Company has recently acquired new leases along the northerly extension of the field, and has let a drilling contract. The first well will offset the No. 1 Vacuum, which gave such large initial production, and is still one of the best wells in the field, being rivalled only by the No. 1 Eagle Well, stated to be producing over 30 barrels a day.

Asbestos in Cyprus

Speaking at the annual general meeting of the Cyprus Asbestos Co., Ltd., the managing director, Mr. F. C. Jenkins, said that the output of asbestos, already double that of last year, was expected to reach 12,000 tons a week before the end of the season.

The Sugar Trade of India during 1925-26

The output of sugar by modern factories and refineries in India in the year 1924-25, fell from the record figure of 94,800 tons in 1923-24 to 66,300 tons, a decrease due to the curtailed production of sugar both from cane and from refining gur. Factories making sugar direct from cane produced 33,745 tons as against 38,312 tons in 1923-24. Taking India's production of refined sugar by the indigenous process roughly at 50,000 tons, a total production of 116,300 tons of refined sugar is calculated for the year 1925-26 as against 144,800 tons in the previous year. India's imports of foreign sugar during the same period were the largest recorded since 1921-22, totalling 732,600 tons against 671,000 in 1924-25 and 717,600 tons in 1921-22, the record figures being 803,000 tons in 1913-14. Exports by sea in 1925-26 of palm and cane jaggery, including molasses, fell from 20,000 tons, valued at Rs. 47 lakhs, to 1900 tons, valued at Rs. 5 lakhs. Of this, the United Kingdom took the small amount of 19 tons, as compared with 17,600 tons in 1924-25. Exports of refined sugar for the same year amounted to 600 tons, valued at Rs. 2,18,625, against 1058 tons, valued at Rs. 1,55,357, exported in the previous year, the decrease being due to Ceylon taking only half the amount of sugar she required in 1924-25.

World Consumption of Fixed Nitrogen

In the fertilizer year 1926-27 (ending on June 30), the world consumption of nitrogenous fertilizers, expressed in terms of pure nitrogen, was 1,315,000 tons, compared with 1,206,000 tons in 1925-26, and 1,088,000 tons in 1924-25. The share of the Chilean nitrate industry was 271,000 tons compared with 323,000 tons in 1925-26, whereas the consumption of synthetic nitrogen compounds was 734,000 tons, as against 583,000 tons in 1925-26 and 450,000 tons in 1924-25. It would seem that if the output continues to rise to the same degree, there will be danger of a glut of nitrogen compounds, unless new markets are opened out. Most relief would be possible if the demand from India and China was encouraged. In fact, speaking before the Royal Commission on Agriculture in India, Mr. Speyer, the general manager of Nutram, Ltd., states that Imperial Chemical Industries, Ltd., would consider the erection of a plant in India to manufacture synthetic nitrogenous fertilizers. Close attention to the potentialities of the Eastern markets is being paid by other countries, particularly the United States.

World Production of Celluloid

According to the U.S. Trade Commissioner at Berlin, the world production of celluloid is estimated at 40,000 tons a year of which between 10,000 and 15,000 tons is produced in Germany. About half the German production is due to one company in Frankfurt.

Cellulose Acetate in the U.S.A.

The Celanese Corporation of America is planning the construction of an addition, to cost 2½ million dollars,

to its Amcelle, Md., plant, to produce cellulose acetate for use by the Celluloid Company, which the Celanese Corporation recently took over.

American Institute of Chemistry

The first annual session of the Institute of Chemistry, promoted by the American Chemical Society, has now concluded, after four weeks' work. Altogether 360 chemists, including a number from abroad, were present.

A New Photographic Developer

A paper by E. Gebauer-Fulnegg and E. E. Fleck (*B. J. Phot.*, August 19, 1927) suggests the use of amino-resorcinol (1:3-dihydroxy-4-aminobenzene) as a photographic developer. The hydrochloride of amino-resorcinol is very soluble in water, and is a developer of high energy, which does not produce fog even in the absence of bromide.

Para-cymene in the Paint Industry

Para-cymene, a by-product of the sulphite pulp industry, is formed during the digestion of spruce woods by the sulphite liquor, and is blown off, together with other volatile products, with the relief steam from the digesters. Recent work (*Chem. & Met. Eng.*, 34, 5, 1927) has shown that para-cymene is a satisfactory thinner for paints, varnish and lacquers, and as some 1,300,000 gals. could probably be recovered in the United States alone, it is suggested that recovery should be worth while, especially as the operation would be comparatively simple.

Amyl Alcohols from Gasoline

An interesting account has been published (*Chem. & Met. Eng.*, 34, 5, 1927) of the process by which the Sharples Solvents Corporation produces amyl alcohol from casinghead gasoline. The gasoline is fractionated to give a "cut" which is practically a pure mixture of normal and iso-pentane. This is chlorinated at 100° C. under pressure in a reaction unit, amyl chloride and hydrogen chloride being formed. The hydrogen chloride passes through a condensing system to a fused silica absorption plant developed by the Thermal Syndicate, Ltd., and the mixture of condensed amyl chloride and pentane is distilled, the pentane being returned to the system. The amyl chloride is purified by distillation, mixed with soda lye and hydrolysed in columns containing a catalyst, the alcohols thus produced being redistilled and fractionated to yield a mixture of amyl alcohol with its isomers. A certain amount of the product is converted into amyl acetate by acetylation with acetic acid, using sulphuric acid as the catalyst. Close attention to the various fractionations is necessary to ensure a product of high purity and uniform character.

Removing Rust from Piping

A method is described (*Chem. & Met. Eng.*, July, 1927) of removing rust from a system of piping by means of a strong, hot solution of hydrochloric acid (prepared by mixing commercial acid with hot water) which had been rendered inert to the metal by the use of an inhibitor. The action was limited to the dissolution of the rust, and the metal piping was not appreciably attacked. The inhibitor used was of a type originally used in pickling metals, and in view of the many organic substances

which have inhibitory properties, even when used in very small quantities, a wide field is open for choice. A later paper will show that inhibitors have a strong electrochemical effect in raising the hydrogen over-voltage, and they may be considered to act by forming over the bare cathodic metal a film which prevents the ready evolution of hydrogen.

Changes in U.S. Patent Law

A recent amendment to the United States Patent Law provides that notice must be given to the public that an article is patented either by fixing the word "Patent" and the number of the patent on the article, or, if this cannot be done, by fixing the like notice on the package. Articles patented prior to April 1, 1927, however, merely require the addition of "Patented," together with the date of the patent; in suits for infringement, proof of continuance of the infringement after notice of infringement was served will be required. The rates of patent fees have been established as follows:—Applications, \$20; issue of patent, \$20; reissue, \$30; filing a disclaimer, \$10; appeal from primary examiners, \$10; appeal from examiners in chief, \$20.

Commercial Testing and College Research Laboratories in the U.S.A.

The U.S. Bureau of Standards is too occupied with official work for it to make tests for private individuals if other laboratories can do the work, and it has accordingly prepared a "Directory of Commercial Testing and College Research Laboratories," which lists 207 commercial testing laboratories throughout the country, together with indications of the types of commodities they are prepared to test, in addition to a list of 143 college laboratories which are used for research work as well as instruction. The Directory gives an outline of a certification plan, in accordance with which there have been compiled 48 lists of manufacturers who are ready to certify to purchasers that material supplied on orders based on 48 U.S. Government master specifications complies with the requirements of these specifications. In this connexion the Bureau publishes a Directory of Specifications for over 6000 commodities, and points out the economy to be realised by their use. These publications are found to be of considerable utility to industry in the United States, and the provision of similar directories in this country deserves serious consideration, particularly in view of the increasing demand for standardisation.

New Spirit-Soluble Colours

It is announced that E. I. du Pont de Nemours & Co. has placed on the market a new series of spirit-soluble colours, the "Luxol" colours, which are soluble in methyl and ethyl alcohols, pyridine, furfural and diacetone alcohol; some are soluble in acetone. The production is made possible of a wide range of transparent coloured pyroxylin lacquers of exceptional fastness to light.

The I.-G. Farbenindustrie

We recently recorded the intention of the I.-G. to utilise aerial transport. The object of that decision now becomes clear, as the Höchst-am-Main branch of the I.-G. has dispatched, on the request of the Persian Government, 100,000 tubes of anti-cholera serum to Teheran by aeroplane, by way of Moscow.

The Times reports that two employees of the Höchst-am-Main branch of the I.-G. are alleged by the police to have stolen the "formulae" of certain proprietary articles made by the I.-G., including "pyramidon," for sale to a British firm. Pyramidon is a well-known antipyretic, dimethylamidoantipyrine, first patented in 1896 and 1897.

Reports of varying nature still continue to appear regarding the agreement between the I.-G. and the Standard Oil Co. of New Jersey. As far as anything definite can be deduced it would appear that the Standard Oil Co. is to utilise the I.-G.'s new method of refining "the products of coal distillation," which is said to be better and cheaper than the cracking process. The I.-G. has been working at its synthetic motor fuel process for some time, but none has appeared on the market, and some trials with it on a racing car are said to have proved disappointing. It is said that no agreement was made regarding the world rights of the new process, and negotiations concerning various European rights for the process if it proves successful—may be expected. The discussions are said to have related also to the manufacture of synthetic ammonia, glycol, and other products.

Recent statistics indicate that out of 12,392 stock companies in Germany, with an aggregate capital of 20,354 billion marks, the chemical industry comprises 620 companies, with a capital of 1853 billion marks, 81 of these companies being included in the I.-G., which represents 62% of the total capital. Of the chemical companies, 118, representing 82.7% of the total capital, are members of the "concerns," which are based on joint capital, arrangements for community of interests, and so on.

A new plant has been built at Wolfen to work up the copper pyrites residues from the works, which were formerly sold to the Mansfield A.-G.

Chromium Plating in Germany

At the end of 1925, chromium plating was employed in but two works in Germany, but during 1926, 23 new works were opened, most of which employed the "chromo-industrie" process, the remainder using the Liebreich process. Plating with chromium has been adopted on a large scale at Solingen for the production of cutlery, and the use of chromium-plated parts is spreading. The "chromo-industrie" process is said not to require technical handling, whilst it works with a very small current density, gives rise to but little free hydrogen, and forms a uniform, strong and finely-ground deposit.

New Use for Aluminium

The German Research Institute for Aluminium has found that containers made from aluminium that has been treated by a special process can be used to replace tinned containers for fruit, vegetables, oil, and so on. Aluminium prepared in this way is stated to be already in use by German food manufacturers.

Intellectual Property in France

By a ministerial decree dated May 12, and published on July 18 19, a committee of three legal experts has been appointed to examine legal questions concerning the rights and interests of writers, artists, and scientists

and of their works, and to prepare bills, decrees, and regulations relating to those questions. The committee has power to call upon expert advice.

Activated Charcoal

At an extraordinary meeting of the Société des Charbons Actifs Edouard Urbain in Paris on August 5, it was decided to increase the capital from 4 to 54 million francs by the issue of 184,000 A shares of 250 francs each, and of 40,000 plural-vote B shares of 100 francs each, the latter to be taken up by the Urbain Corporation of America. The concern has changed its name to "Charbons Actifs et Procédés Edouard Urbain, S.-A.," and will extend its work to the manufacture of all types of chemical products. The directors' report states that the Urbain Corporation will work the American market, whilst the French company will have the whole of the European market (except England), and will be entitled to use, by licence, all the patents and products of the American concern. The French company, which, in addition to activated charcoal, produces hydrogen and oxides of carbon, will extend its activities into the domain of organic high-pressure syntheses. To this end, it will co-operate with a friendly industrial group in the formation of the "Société Immobilière et Industrielle de Berre," which has already acquired an excellent site at Berre.

Petroleum in France

The French Ministry of Commerce announces that since the "Office National des Combustibles Liquides" began boring at Hérault, 9000 metric tons of petroleum have been extracted.

Chemical Industry in Spain

Active development is proceeding in Spanish chemical industry. The Industrial Resinera Ruth concern, of Bilbao, has obtained fiscal and other concessions in view of the manufacture of synthetic camphor, and has raised its capital to 2 million pesetas. A new oxygen factory has been established at Madrid; paint and varnish are to be made at Barcelona by the Pablo Scharlau concern; the Myrurgia firm is increasing its output of perfumes; and the Cia. Siderurgica del Mediterraneo, of Bilbao, is enlarging its factory and producing pure benzene and toluene for the dye and explosives industries.

Petroleum Monopoly in Spain

A State monopoly has been established in Spain of the importation, industrial manipulation, storage, distribution and sale of the liquid mineral combustibles and their derivatives which form Group 3 of Class I. of the current Customs Tariff. The monopoly, to be valid for 20 years, is to be administered by a company which is to be wholly Spanish.

Among the obligations imposed on the company are the following: (1) The encouragement of prospecting for natural petroleum in Spain; (2) the distillation of coal, lignite, peat, and shale, and the supply of benzol produced in gas works; (3) the purchase of national spirit for the manufacture of combustible liquids by mixing with petrol; (4) the establishment of stocks of fuel for commercial and military purposes; and (5) the purchase of oilfields abroad, particularly in Spanish America. Within five years the company is to acquire sufficient vessels to transport sufficient oil to meet

national requirements. At the end of the same period the refining industry must be in a position to supply 80% of national consumption. No duties of any kind will be levied on crude petroleum and its derivatives imported by the monopoly, and machinery etc. of a kind not made in Spain for the refining of oil, may be imported duty free. The text of the Decree-Law (in Spanish) may be seen at the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Third Census of Production (Engine and Boiler Packing and Asbestos Trades)

Below are given particulars of the output in the year 1924 of the establishments engaged in the manufacture of asbestos goods and engine and boiler packings and coverings. The figures relate to Great Britain only:—

Products, 1924	Quantity Tons	Selling Value £
Engine and boiler packing and coverings (not including asbestos or metallic packing):—		
Quantities stated	1700	227,000
Quantities not stated	125,000
Total engine and boiler packing and coverings not of asbestos	352,000
Asbestos manufactures (total)	2,717,000
Slag wool and silicate cotton	81,000
Metallic packings	103,000
Other products	327,000
Work done in applying compositions etc.	239,000*
Total value	3,819,000

* Amount received for work done

The aggregates shown above for the year 1924 are believed to cover the bulk of the output of the main classes of products specified, with the exception of metallic packings, to which supplementary amounts of importance may require to be added on the final summarisation of the returns covering the metal industries. The total value of asbestos manufactures and engine and boiler packings and coverings, so far as returned on schedules for this trade, was £3,253,000 in 1924, compared with £908,000 in 1912 and £577,000 in 1907. These sums are inclusive of the value of any part of the slag wool and silicate cotton shown above that was used for other purposes than engine and boiler packings.

Exports of asbestos manufactures in 1924 amounted to 13,960 tons, valued at £957,000, and net imports to 14,850 tons, valued at £231,000. The quantity of engine and boiler packings exported in the same year was 1220 tons, valued at £119,000, and net imports amounted to 87 tons, valued at £20,000. The net output of the factories and workshops engaged in the industry was £2,127,000 in 1924, and the net output per head of persons employed in 1924 was £320, compared with £166 in 1912 and £137 in 1907. The average number of persons employed in the trade in 1924 was 6641, as against 2349 in 1907. The total capacity of engines at work in 1924 in these trades was 5866 h.p., of which nearly 38% was in reserve or idle during the year. In 1912 the capacity was returned as 3729 h.p., and in 1907 as 2286 h.p. The capacity of electric motors at factories was not ascertained in 1907, but in 1924 motors aggregating 7630 h.p., driven by purchased electricity, were recorded. About 14% of the capacity of these motors was shown as in reserve or idle during the year. The capacity of electric generators in factories in 1924 was 2062 kw., in 1912, 1030 kw., and 172 kw. in 1907.

REVIEWS

THE DYEING OF COTTON FABRICS. By FRANKLIN BEECH. Third edition, revised and enlarged, by A. J. HALL, B.Sc. Pp. xii + 296. London: Ernest Benn, Ltd., 1927. Price 18s.

It would be impossible to transform Mr. Franklin Beech's once useful book on cotton dyeing into a volume of practical, as apart from historical, value to-day without robbing it of all resemblance to the earlier editions. Mr. Hall, in thus attempting the impossible, has achieved in full measure the evil result of applying a modern patch to an ancient garment.

In 1901, the date of the first edition, there was no doubt still some demand for a book on dyeing which consisted largely of mere recipes, with a connecting thread of theory and general statement and a little - a very little - chemistry. But nowadays our foreman dyer, even if not, as many are, a graduate of Leeds or Manchester, has usually had sufficient technical training to enable him to work out his own recipes when the properties and reactions of dyestuffs and materials have been lucidly conveyed to him. And though such ability were lacking, has he not shelves filled with the pattern cards and instruction books showered upon him by the colour makers? These not only tell him how to dye a bottle green or a nigger brown, but show him the exact shade of bottle or nigger produced; in brief, recipes without patterns are useless.

For a modern book on dyeing, the work is sadly out of proportion; undue space is devoted to the older dyes, Turkey Red, Logwood Black, etc., whilst the vat colours (except Indigo) are dismissed in two pages and the whole of the Naphthol A S series in nine lines.

The matter is carelessly put together and there are evidences of negligent proof reading. In a series of recipes (e.g. pp. 117-121), the indication which class of colours is being dealt with sometimes occurs in a headline, sometimes in the running text. The NH_2 group is indifferently amido or amino; amino-azo-benzene is scarcely recognisable as benzene-azo-aniline. In the section on union dyeing, Diamine Green G and Diamine Blue RW are given on one page as dyeing wool and cotton the same shade, on the next page they dye wool more deeply than cotton. Very few dyestuffs of any kind are mentioned which first appeared later than 1901, and only in the added chapters do modern British dyestuffs make their appearance.

This third edition is an error of judgment, but from internal evidence it may be gathered that if Mr. Hall were presented with a new fountain pen and sheets and sheets of blank foolscap and persuaded not to hurry he could write an excellent and up-to-date book on the dyeing of cotton fabrics.

REGINALD BROWN

DIE UNIVERSALITÄT DER GRAVITATION IN DEN GRÖSSTEN UND KLEINSTEN SYSTEMEN. By Dr. H. KOLLER-AREY. Pp. 104. Basle: Benno Schwabe & Co., 1927. Price 8 fr.

The author seeks to interpret physical phenomena exclusively with the aid of classical mechanics. He attempts to put the idea of "force at a distance" on a new basis by deriving a new law of gravitation, and claims

that the law is universally valid for both large and small systems. Colloid phenomena, sorption, osmosis, dissolution, and atomic structure are among the subjects discussed. Exactly what reception this book is likely to achieve from those qualified to appreciate it will doubtless be determined by the comparative ascendancy of their convictions and their curiosity. A. A. E.

SECOND EXPERIMENTAL REPORT TO THE ATMOSPHERIC CORROSION RESEARCH COMMITTEE OF THE BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION. By Dr. W. H. J. VERNON. Discussion held by the Faraday Society, March 30, 1927. Pp. 113-204. London: The Faraday Society, 13, South Square, Gray's Inn, W.C., 1927. Price 8s. 6d.

Dr. Vernon's first report was published in 1923. Since that date the work has steadily gone forward, and has led to further most valuable results, which are embodied in the second report.

The research has comprised tests, in indoor and outdoor atmospheres, of six materials, namely, copper, zinc, brass, aluminium, lead, and iron. The marked differences of behaviour observed among these different materials serves to show the complexity of the problem, and indicates how fruitless the task of unravelling the mysteries would have been if Dr. Vernon had adopted a less thorough policy than that actually pursued. As it is, one may fairly claim that the main facts of atmospheric corrosion have been established, and that investigators can now go on to devise methods for mitigation of the damage done by atmospheric attack. Indeed, the present report already suggests preventive measures. It is shown that by heating copper in air at 75-100° C., an oxide-film is produced which, although hardly visible to the eye, serves to protect the metal against tarnishing. It is also shown that the indoor corrosion of iron, which is largely due to suspended solid particles, can be reduced by screening with mushn. Evidence is brought forward of the value of lanoline treatment for the protection of brass.

In a short review it is impossible to give an idea of the wealth of information which can be gained by consulting the report. It must suffice to say that the report contains ten tables of quantitative data, and twenty-nine figures, mostly curves connecting the weight-increment with time. Some of the curves are of forms familiar in previous work, for instance, the parabolic and linear types, but the aluminium specimens yield some interesting new varieties of curves: The amount of corrosion slows off with the time, approaching asymptotically a limiting value, but in some cases the weight, having reached an almost stationary value, discontinuously leaps up again, probably owing to spontaneous cracking of the protective film. The practical importance of these observations is obvious; for details the reader must turn to the report itself. It is, however, impossible to omit an appreciation of the exceptional care which alone has made it possible to obtain such curves at all. The actual weight-increment was in one case as little as 0.000115 grams on a total weight of 50 grams, and it requires no special imagination to recognise the patience which has gone to produce work of this kind. U. R. E.

ADVERTISING, PRINTING AND ART IN COMMERCE. By J. F. PRESTON and E. ARCH. With a foreword by Sir R. A. HADFIELD, Bart., D.Sc., F.R.S. Pp. xvi + 301. London: Chapman & Hall, Ltd., 1927. Price 16s.

This admirable work forms a welcome addition to the recent publications dealing with the study of advertising. The authors have succeeded in presenting the essential facts in a clear and non-technical manner, and it is pleasant to find that they are not averse to the use of a gentle humor to aid the reader in grasping the subtleties of advertising.

The book is divided into three main sections, covering all the psychological and mechanical operations gone through from the customer's original wish to advertise until the appearance of the final printed advertisement. A close study of Sections 1 and 2 by business men who conduct their own advertising without the necessary experience would doubtless lead to a considerable improvement, both in their advertisements and in the results obtained from them.

The authors state that "trade advertising and trade support seem to us to be the most important of all marketing considerations," but the subject is hardly dealt with at all. It is to be hoped that at a later date a chapter will be added giving some detailed consideration to the questions of circulation, choice of journals, and "copy" in relation to advertising in trade journals.

A point of interest to the readers of this JOURNAL is raised in the early part of the book, where, in connexion with the question of fugitive inks, it is said "Here it is that the chemist can be of great service to the advertiser and the good cause of more beautiful publicity matter."

The book is excellently printed, and contains a large number of illustrations which are clear and to the point.
V. R. R.

COMPANY NEWS

COMMERCIAL SOLVENTS CORPORATION

Rapid progress is being made by this company, which was incorporated in 1919 and purchased the Government's plants and research laboratories at Terre Haute, Indiana. The chief manufactures are butanol (normal butyl alcohol), acetone, solvents required for the manufacture of lacquers, varnishes, films, motor-car and other finishes, artificial silk textiles, artificial and patent leathers, drugs, dyes, etc. Butanol is the most important of the company's productions, and is a substitute for fusel oil. The success of this product made it necessary to enlarge the output capacity, the 1927 additions to plant resulting in a further increase in capacity to the extent of 40%. The profit for 1926 amounted to \$1,152,127, compared with a profit of \$650,385 for 1925, a profit of \$701,612 for 1924, and a loss of \$115,526 for 1923.

INTERNATIONAL PAINT AND COMPOSITIONS CO., LTD.

The usual interim dividend has been declared of 3%, less tax, on the preference shares, and 3% interim dividend, less tax, on the ordinary shares.

PINCHIN, JOHNSON AND CO., LTD.

*An interim dividend has been declared on the ordinary shares of 10% actual, less tax, being the same as the interim for the previous year.

RHODESIAN AND GENERAL ASBESTOS CORPORATION, LTD.

The profit for the year ended March 31 last amounted to £244,858 (against £223,241 for the previous year), plus £83,795 brought in. A final dividend has been recommended of 10%, less tax, making 20%. An interim dividend has also been declared on account of the year ending March 31, 1928, of 5%, less tax. During the year a large amount of capital expenditure had been incurred, principally at the Shabanie mine, with a view to increasing the production. When the new plant etc. is in full operation, it is estimated that the output from the Shabanie mine will be increased by 75-100% over the quantity produced during the year ended March 31, 1927. In view of the satisfactory mine developments and the necessity for further additions to the machinery and plant, it has been decided to increase the capital by the creation of a further 50,000 shares.

AGUAS BLANCAS NITRATE CO., LTD.

The eighteenth ordinary general meeting was held on April 29, Mr. W. J. Welch presiding. The year's trading had resulted in a loss of £7350, to which must be added the cost of closing down oficinas and subsequent stoppage expenses. Science had produced several formidable competitors, containing, in some instances, a greater number of units of nitrogen than their commodity, but lacking other elements which time was proving were of considerable value in purifying and enriching the soil. The chairman believed that soon it would be found that the sole use of synthetic sulphate of ammonia—their greatest competitor—might not prove so helpful as was anticipated. Germany had admitted that the returns of crops generally had fallen off, due, it was alleged, to the non-employment of nitrate of soda. Before the war that country consumed from 700,000 to 800,000 tons of the Chilean commodity, but since 1914 the whole of her nitrogen requirements had been met by synthetic sulphate of ammonia. He was of the opinion that in the near future Germany would again turn to nitrate of soda. It would be impossible for the company to resume working operations until the Chilean Government came to the assistance of the industry. In the meantime, they thought it would lead to more economical working later, and help to mitigate the present labour troubles in Chile, if they started extracting caliche on a large scale. Consequently they had instructed their agents to ask the Government to advance the company £50,000 for that purpose.

LONDON AND THAMES HAVEN OIL WHARVES, LTD.

An interim dividend has been declared on the ordinary shares of 5%, free of tax, being the same as for several years past.

CALICO PRINTERS' ASSOCIATION

The net profit for the year ended June 30, 1927, was £223,497 (against £216,228 for 1926), after providing £508,336 (against £511,960) for maintenance, depreciation, repairs, renewals, and upkeep, and £128,000 (same) for debenture interest. With £131,111 brought forward, there was an available balance of £354,608. The directors recommend payment of the balance of the preference dividend, and also a dividend of 7½%, less tax (same), on the ordinary shares, leaving £52,998 to be carried forward.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 —£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£8 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.

Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9—£9 5s. per ton. Grey, £15 per ton. Liquor, 9d per gal. 32° Tw.
 Charcoal.—£6—£9 per ton according to grade and locality.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d. 16° Tw. per gal.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 4s.—4s. 1d. per gal., 60% O.P. Solvent, 4s. 3d. per gal., 40% O.P.
 Wood Tar.—£4 10s.—£5 per ton and upwards, according to grade.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 4½d.—2s. 8d. per gal.
 Acid Cresylic, 99/100.—2s. 9d.—2s. 10d. per gal. 97/99.—2s. 1½d.—2s. 5d. per gal. Pale, 95%, 2s.—2s. 3d. per gal. Dark, 1s. 9d.—2s. 2d. per gal.
 Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.
 Benzole.—Crude 65's, 10d.—10½d. per gal., ex works in tank wagons; Standard motor, 1s. 3d.—1s. 3½d. per gal., ex works in tank wagons; Pure, 1s. 6d.—2s. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 4d.—1s. 9d. per gal. Pure, 1s. 7d.—2s. per gal.
 Xylol.—1s. 3d.—2s. per gal. Pure, 2s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 9d.—10d. per gal. Heavy, 8½d.—8¾d. per gal. Standard specification, 7½d.—7¾d. per gal. Salty, 7d. per gal., less 1¼%.
 Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/160, Country, 10½d.—11d. per gal.; London, 1s. 2d.—1s. 4d. per gal. Solvent 95/160, 1s. 4d.—1s. 5d. per gal. Solvent 90/190, Country, 10d.—11d. per gal.; London, 1s.—1s. 4d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.
 Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—90s.—93s. per ton, f.o.b. according to district.
 Pyridine.—90/140.—5s. 9d.—7s. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.
 Acid H.—3s. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.
 Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—2s. 7½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene. 9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol. 11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline. 1s. 8d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate. 1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P. Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric. 1s. 6½d.—1s. 7½d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogalllic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 3d.—1s. 4d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 5d. per lb. Potassium.—1s. 10½d.—2s. 0½d. per lb. Sodium.—2s. 1d.—2s. 3d. per lb. Granulated ½d. per lb. loss. All spot.
 Calcium Lactate.—1s. 2½d.—1s. 3½d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate. 6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730.—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., bulk 2s.—2s. 3d. per gal.; Winchesters, 2s. 11d.—3s. 6d. per gal.; 20 vols., bulk 4s.—4s. 3d. per gal.; Winchesters, 5s.—6s. per gal.
 Hydroquinone.—2s. 11d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 22s. per cwt.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 9s. 6d.—12s. 9d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonol.—9s. 6d.—9s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—2s. 9d.—3s. per lb.
 Phenazone.—4s. 3d.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins (1000 oz. lots).
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 8½d.—1s. 9d. per lb. Crystal, 1s. 9d.—1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—6s. 6d.—6s. 9d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.
 Aubepine (ex *Anethole*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. 6d. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex *Bois de Rose*) 15s. per lb.—(ex *Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(ex *Bois de Rose*) 18s. 6d. per lb.—(ex *Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. 6d. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 8d. per lb. Vanillin.—17s.—18s. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anisc.—3s. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.
 Camphor.—75s. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—7s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%, 22s. 6d. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 17s. 6d. per lb. Japanese, 8s. 3d. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Oct. 18th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Sept. 1st. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Burt, Boulton, & Haywood, Ltd. Grinding-machines. 21,297. Aug. 12.

Comyn. Apparatus for separating liquids. 21,068. Aug. 10.
 Duckham, and Woodall-Duckham, Ltd. Tunnel kilns. 21,299. Aug. 12.
 Filtration Engineers, Inc. Filter-cake treating devices. 21,039. Aug. 9. (U.S., 4.11.26.)
 Frankl. Separation of gaseous mixtures. 21,206. Aug. 11.
 Gray. Furnaces. 20,888. Aug. 8.
 Harter. Apparatus for exothermic catalytic gas reactions. 20,869. Aug. 8. (Ger., 10.8.26.)
 Johnson (I.-G. Farbenind.). Purification of gases. 21,105. Aug. 10.

I.—Complete Specifications

2890 (1926). Cabot. Colloidally-dispersed material. (246,874.)
 11,294 (1926). Sandberg. Heat-exchanging device. (255,418.)
 11,808 (1926). Sweetland. Filters. (275,333.)
 18,239 (1926). Nyrop. Apparatus for atomising and drying liquids. (275,404.)
 26,746 (1926). Soc. L'Air Liquide. Carrying out exothermic chemical reactions. (208,722.)
 6126 (1927). Industrial Associates, Inc. Spray-drying. (272,859.)
 *16,619 (1927). Vernay. Thickening filtering-apparatus. (275,573.)
 *17,391 (1927). Electrolux, Ltd. Evaporators. (275,576.)
 *19,187 (1927). Soc. L'Air Liquide. Carrying out exothermic chemical reactions. (275,592.)
 *20,176 (1927). Bisch. Continuous kilns. (275,616.)
 *20,703 (1927). Drying Systems, Inc. Drying-ovens. (275,650.)

II.—Applications

Akt. Separator-Nobel. Separating paraffineous constituents etc. from oils. 21,349. Aug. 13. (Sweden, 24.8.26.)
 Arnold (Standard Development Co.). Manufacture of hydrocarbons. 20,902. Aug. 8. Treatment of hydrocarbon residues etc. 20,957. Aug. 9.
 Berridge. Gas-producing furnaces. 21,340. Aug. 13.
 Capiau, Gauquier, and Lahaut. Removing graphite incrustations from coke ovens etc. 21,072. Aug. 10.
 Florentin, Kling, and Matignon. Obtaining light hydrocarbons from organic compounds. 21,203. Aug. 11. (Fr., 17.12.25.)

I.-G. Farbenind. Hydrogenation of carbonaceous materials. 20,890. Aug. 8. (Ger., 7.8.26.) Production of liquid etc. hydrocarbons etc. 20,891—2. Aug. 8. (Ger., 7.8.26.) Production of liquid etc. hydrocarbons. 20,966. Aug. 9. (Ger., 9.8.26.) Destructive hydrogenation of carbonaceous materials. 21,181. Aug. 11. (Ger., 11.8.26.)

Turnbull. Separating-apparatus for treating coal etc. 20,830. Aug. 8.

II.—Complete Specifications

5736 (1926). Longhi. Splitting fluid hydrocarbons. (275,281.)
 11,423 (1926). Roessler & Hasslacher Chem. Co. Carbonaceous material. (251,982.)
 11,817 (1926). Parker. Fuel. (275,334.)
 4130 (1927). Still. Recovery of by-products in coke oven or like plants. (266,004.)
 10,178 (1927). Bataafsche Petroleum Maatsch., and Rudolf. Treatment or cracking of sludge residues. (270,274.)
 *435 (1927). Plassmann. Low-temperature distillation furnace. (275,546.)
 *18,491 (1927). Soc. Internat. des Proc. Prudhomme-Houdry. Manufacture of synthetic liquid fuels. (275,585.)
 *20,513 (1927). Ges. f. Linde's Eismaschinen. Separation of benzol etc. from cokery or other gases. (275,633.)
 *20,663 (1927). Marchand. Treatment of heavy hydrocarbons. (275,642.)

*20,890 (1927). I.-G. Farbenind. Destructive hydrogenation of carbonaceous materials. (275,662.)

*20,891 -2 and 20,966 (1927). I.-G. Farbenind. A.-G. Manufacture of hydrocarbons and derivatives. (275,663-4 and 275,670.)

III.—Applications

Arnold (Standard Development Co.). 20,902 and 20,957. See III.

McDermott. Purification of benzol etc. 21,362. Aug. 13.

III.—Complete Specifications

• 11,608 (1926). Cross. Producing mixed phenols and related compounds. (275,313.)

*20,513 (1927). Ges. f. Linde's Eismaschinen. See II.

IV.—Applications

Beuss. Manufacture of dyestuffs. 20,989. Aug. 9. (Austria, 2,10,26.)

British Dyestuffs Corp., and Mendoza. Manufacture of intermediate compounds etc. 21,098. Aug. 10.

Soc. of Chem. Ind. in Basle. Dyestuff preparations etc. 21,008. Aug. 9.

IV.—Complete Specifications

6056 (1926). Brit. Alizarine Co., Ltd., Dawson, and Beghin. Manufacture of dyestuffs. (275,283.)

9424 (1926). Carpmael (I.-G. Farbenind.). Manufacture of vat dyestuffs containing sulphur. (275,292.)

11,319 -20 (1926). Carpmael (I.-G. Farbenind.). Manufacture of compounds of the naphthosulfam series and of dyestuffs therefrom. (275,301.)

11,664 (1926). Marks (Du Pont de Nemours & Co.). Catalytic oxidation of hydrocarbons. (275,321.)

17,163 (1926). Durand & Huguenin A.-G. Manufacture of mordant dyestuffs. (275,086.)

20,507 (1926). British Dyestuffs Corp., Shepherdson, and Tatum. Anthraquinone dyes and dyeing therewith. (275,421.)

30,655 (1926). I.-G. Farbenind. Manufacture of indigoid dyestuffs. (262,457.)

*19,985 (1927). I.-G. Farbenind. Manufacture of triaryl-methane-dyestuffs. (275,609.)

*20,087 (1927). I.-G. Farbenind. Manufacture of azo-dyestuffs. (275,613.)

*20,583 (1927). I.-G. Farbenind. Manufacture of condensation products of the anthraquinone series. (275,636.)

V.—Applications

Chamagne. Treatment of marine algae. 21,135—6. Aug. 11. (Fr., 11,8,26.)

Czapek, Weingand, and Wolff & Co. Production of films etc. from viscose etc. 21,314. Aug. 12. (Ger., 13,9,26.)

Ellis (Soc. Fabr. Soie Rhodaseta). Manufacture of artificial threads etc. 21,099. Aug. 10.

I.-G. Farbenind. Manufacture of cellulose derivatives. 20,863. Aug. 8. (Ger., 6,8,26.) Manufacture of cellulose esters of inorganic acids. 21,007. Aug. 9. (Ger., 26,10,26.)

Imray (I.-G. Farbenind.). Manufacture of ethers of earl hydrates. 21,006. Aug. 9.

Vles. Preparing artificial silk. 21,080. Aug. 10.

Want. Preparing artificial silk. 21,258. Aug. 12.

V.—Complete Specifications

8276 (1926). Dreyfus. Manufacture of cellulose derivatives. (275,286.)

22,615 (1926). Erste Bohmische Kunstseidefabr. Manufacture of artificial textile threads. (258,582.)

*20,493 (1927). Overstrullen. Extracting and purifying fatty materials from washing waste waters. (275,627.)

*20,602 (1927). Bemberg A.-G. Production of artificial silk. (275,637.)

*20,617 (1927). Elöd. Production of cellulose esters. (275,641.)

*20,708 (1927). I.-G. Farbenind. Application of cellulose ethers or esters. (275,653.)

*20,863 (1927). I.-G. Farbenind. Manufacture of cellulose derivatives. (275,660.)

VI.—Application

Lord, and Tootall Broadhurst Lee Co. Mercerising textile fibres. 20,816. Aug. 8.

VI. Complete Specifications

11,543 (1926). Imray (I.-G. Farbenind.). Dyeing cellulose acetate silk. (275,307.)

11,731 (1926). Carpmael (I.-G. Farbenind.). Dyeing and printing with ice colours. (275,326.)

12,928 (1926). I.-G. Farbenind. Dyeing cotton with vat- and azo-dyestuffs. (252,384.)

13,256 (1926). Calico Printers' Assoc., and Whitfield. Ornamentation of artificial silk fabrics. (275,357.)

13,710 (1926). Winter and Jordan. Apparatus for bleaching, dyeing, etc. yarns or fabrics. (275,363.)

14,757 (1926). British Dyestuffs Corp., Horsfall, Lawrie, and Hill. Dyeing cellulose esters and ethers. (275,373.)

14,799 (1926). Haberkorn. Protection of fibrous materials during chemical treatment. (275,374.)

20,507 (1926). British Dyestuffs Corp., Shepherdson, and Tatum. See IV.

7458 (1927). Durand & Huguenin. Products for dyeing or printing. (267,952.)

7939 (1927). Durand & Huguenin. Dyeing animal fibres. (267,986.)

*5381 (1927). Soc. Chim. Usines du Rhône. Colouring cellulose esters and ethers. (275,553.)

VII.—Applications

Blumenfeld. Preparation of titanium etc. compounds. 20,987. Aug. 9. (U.S., 9,8,26.)

Büsching. Denitration of waste acid mixtures. 21,044. Aug. 9. (Ger., 3,9,26.)

Chem. Fabr. Gross-Weissandt, and Seidler. Preparation of large sal-ammoniac crystals. 21,046. Aug. 9. (Ger., 10,8,26.)

Crosland. Kilns for calcining lime etc. 21,239. Aug. 12. Evans. 20,827. See X.

Grothe, and Metallhütte Magdeburg. Treating copper etc. containing lyes. 21,209. Aug. 11. (Ger., 11,8,26.)

I.-G. Farbenind. Recovery of copper from liquors by precipitation. 21,346. Aug. 13. (Ger., 14,8,26.)

Neill. Preparation of iron compounds from solutions of iron. 21,045. Aug. 9.

Traun, and Traun & Solme. Container for hydrofluoric acid etc. 21,073. Aug. 10. (Ger., 18,1,27.)

VII.—Complete Specifications

29,390 (1926). Rhenania-Kunheim Ver. Chem. Fabr. Production of solid ammonium carbonate. (275,459.)

29,998 (1926). White (Dwight & Lloyd Metallurgical Co.). Treatment of carbonate materials. (275,463.)

*17,627 (1927). Titan Co. Akt. Dissolving titaniferous materials in acids. (275,578.)

*17,628 (1927). Titan Co. Akt. Treatment of titaniferous materials. (275,579.)

*17,629 (1927). Titan Co. Akt. Utilising titanium materials containing iron. (275,580.)

*20,987 (1927). Blumenfeld. Preparation of titanium and like compounds. (275,672.)

VIII.—Applications

Johnson (I.-G. Farbenind.). Production of silica. 21,104. Aug. 10.

United States Metals Refining Co. Magnesite refractories. 21,343. Aug. 13. (U.S., 8,6,26.)

VIII.—Complete Specification

*7890 (1927). Hartford-Empire Co. Glass furnaces. (275,555.)

IX.—Applications

Dowdeswell. Asphaltic paving-compounds. 20,838. Aug. 8.
Kobiolke. Preserving timber etc. 20,976. Aug. 9.

IX.—Complete Specifications

13,732 (1926). Westrum. Manufacture of bituminous concrete. (275,364.)
26,803 (1926). Bia, and Granville de Bielize. Manufacture of artificial marble. (275,448.)
4509 (1927). Aerni. Manufacture of artificial stone. (266,364.)
7393 (1927). Ackermann, and Scheidhauer & Gessing A.-G. Manufacture of bricks. (267,948.)

X. Applications

Dufour and Metzner. Obtaining low-fusion dental alloys. 21,215. Aug. 11.
Evans. Utilisation of waste iron pickle. 20,827. Aug. 8.
Grah. Chromium plating. 21,191. Aug. 11.
Grothe, and Metallhütte Magdeburg. 21,209. See VII.
I.-G. Farbenind. Magnesium alloys for pistons of internal-combustion engines. 20,920. Aug. 8. (Ger., 13.8.26.) 21,346. See VII.
Jackson (New Jersey Zinc Co.). Reduction of zinciferous materials. 20,909. Aug. 8.
Klopsch. Protective treatment of iron etc. 21,108. Aug. 10.
Mond (Norddeut. Chem. Fabr. in Harburg). Recovering lead etc. from lead-sulphur compounds. 20,919. Aug. 8.
Schrobsdorff. Producing alloys of refractory carbides. 21,260. Aug. 12. (Ger., 12.8.26.)
Soc. Anon. des Acieries et Forges de Firminy. Protection of metals in cementation process. 21,286. Aug. 12. (Fr., 7.9.26.)
Taylor. Electrodeposition of metals. 21,195. Aug. 11.
Vogel. Pickling iron etc. 21,302. Aug. 12. (Ger., 8.9.26.)

X.—Complete Specifications

11,989 (1926). Harris. Refining and separation of metals. (275,344.)
12,192 (1926). Gustafsson. Producing metals in electric furnaces. (252,162.)
29,930 (1926). Gustafsson. Producing malleable iron and steel directly. (262,126.)
29,931 (1926). Gustafsson. Producing iron and steel. (262,127.)
*11,441, 11,445, 11,448 (1927). Guggenheim, MacGowan, and Smith. Flotation processes. (275,561-2.)
*19,653 (1927). Krupp A.-G. Operating shaft furnaces. (275,601.)
*20,231 (1927). Metallbank u. Metallurgische Ges. Converting tin ores. (275,618.)
*20,690 (1927). Wüst. Furnaces for treating iron with a low proportion of carbon. (275,646.)

XI.—Applications

Baesa. Production of nickel oxide electrodes. 20,853. Aug. 8.
D. P. Battery Co., Ltd., and Waddell. Secondary batteries. 21,363. Aug. 13.
Frost and Parrington. Manufacture of electrodes. 21,025. Aug. 9.
Stewart. Metallic filaments for electric lamps. 21,219. Aug. 11. (Ger., 18.9.26.)
Taylor. 21,195. See X.

XI.—Complete Specifications

12,192 (1926). Gustafsson. See X.
13,365 (1926). Marks (Munroe & Co.). Anode. (275,359.)
17,019 (1926). Burgess Laboratories, Inc. Galvanic cells. (255,067.)
17,020 (1926). Haddon and Burnett. Accumulator plates. 275,392.)

18,014 (1926). Krupp A.-G. Electric resistance furnaces. (257,896.)

19,816 (1926). Oldham & Son, Ltd., and Darby. Galvanic batteries. (275,418.)

26,913 (1926). Wade (N. V. Philips' Gloeilampenfabr.). Incandescent cathodes. (275,449.)

*20,059 (1927). Dufour. Electric furnaces. (275,611.)

XII.—Application

Industrial Spray-Drying Corp. Manufacture of soap product. 20,817. Aug. 8. (U.S., 25.5.27.)

XII.—Complete Specifications

*23,140 (1926). Metallbank u. Metallurgische Ges. Treating crude oils and fats. (275,536.)
*16,763 (1927). Harvel Corporation. Treating cashew nut shell and like oils. (275,574.)
*20,493 (1927). Overstraten. See V.

XIII.—Complete Specifications

502 (1927). Production of coats of lacquers, oil paints, etc. (275,477.)
*19,841 (1927). Bakelite Corp. Artificial resin compositions. (275,604.)
*19,989 (1927). Tauber. Coating and binding compositions. (275,610.)
*20,707 (1927). I.-G. Farbenind. Varnishes etc. (275,652.)

XIV.—Application

Dunlop Rubber Co., Ltd., Murphy, and Twiss. Production of sheet rubber etc. 21,262. Aug. 12.

XIV.—Complete Specification

6451 (1926). Grasselli Chem. Co. Vulcanisation of rubber substances. (249,113.)

XV.—Application

Geigy A.-G. Process for preparing tanning agents. 21,305. Aug. 12. (Ger., 16.8.26.)

XVI.—Complete Specification

*25,739 (1926). I.-G. Farbenind. Fungicide. (275,539.)

XVIII.—Complete Specifications

11,743—4 (1926). Distillers Co., Ltd., and Meyer. Manufacture of yeast. (275,328—9.)
28,897 (1926). Siemens & Halske A.-G., Engelhardt, and Engelhardt. Ageing of alcoholic liquors and the like. (275,454.)

XIX.—Applications

Kobiolke. Destruction of insect pests in food products etc. 21,001. Aug. 9.

Salerni. Manufacture of chocolate etc. 21,303. Aug. 12.

XIX.—Complete Specification

14,821 (1926). Bamford. Making aqueous emulsions of dried milk or milk powder. (275,375.)

XX.—Applications

Chem. Fabr. vorm. Schering. Manufacture of thymol etc. 21,221. Aug. 11. (Ger., 16.8.26.) Manufacture of disodium salts of sulphomethylaminomethylmercapto sulphonic acids. 21,018. Aug. 9. (Ger., 8.2.27.)
I.-G. Farbenind. Manufacture of 1-amino-3-dialkylamino-2-propanols. 21,300. Aug. 12. (Ger., 13.8.26.)
Soc. Chem. Ind. in Basle. Manufacture of condensation products from formaldehyde etc. 21,113. Aug. 10. (Switz., 11.8.26.)

XX.—Complete Specifications

3274 (1926). Carpmacel (I.-G. Farbenind.). Manufacture of alkoxyaminoquinolines. (275,277.)
6103 (1926). Johnson (I.-G. Farbenind.). Manufacture of organic compounds containing oxygen. (275,284.)
11,664 (1926). Marks (Du Pont de Nemours & Co.). See IV.
12,228 (1926). Synthetic Ammonia & Nitrates, Ltd., and Smith. Production of methanol and other oxygenated organic compounds. (275,345.)

12,059 (1926). *B&C*. Production of iodized pyridine derivatives. (252,707.)

14,666 (1926). Darrasse, Darrasse, and Dupont. Manufacture of synthetic camphor. (253,542.)

15,242 (1926). Mackert. Catalytic methylation of ammonia and organic amines. (275,377.)

28,042 (1926). Consort. f. Elektrochem. Ind. Manufacture of polymerised vinyl esters. (261,406.)

*19,071 (1927). Bunz and Rätz. Production of nitro-pyridine arsinic acids. (275,590.)

*19,649 (1927). Comp. de Bethune. Catalysts for the synthesis of alcohols. (275,600.)

*20,472 (1927). L.-G. Farbennind. Manufacture of unsymmetrically-substituted diamino-propanols. (275,622.)

XXI.—Applications

Carpmael (Powrie). Colour photography. 21,310. Aug. 12.

Marconi's Wireless Telegraph Co., Ltd. Sensitised papers etc. for picture etc. telegraphy. 21,360. Aug. 13. (U.S. 14,826.)

XXI.—Complete Specification

11,787 (1926). Thornton. Kinematograph colour films. (275,331.)

XXII.—Application

Büsching. 21,044. See VII.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number: *Australia*: Machinery for bottling and bottle washing, bottle and can labelling, filling machines, sauce preparation plant, cereal manufacturing and auxiliary machines, corking and sealing plant, beverage making equipment, etc. (130); caustic soda primary cells (B.X. 3717). *British India*: Oxy-acetylene cutting plant, hydraulic press, spring steel (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Dominican Republic*: Corrugated iron sheets (147). *Egypt*: Oil engines, pumps, pipes (143). *Peru*: Earthenware (149). *Portugal*: Heavy chemicals, fertilisers (141). *New Zealand*: Gift or gold and other suitable papers for covering fancy chocolate boxes (B.X. 3707); cast-iron water pipes (A.X. 5031). *South Africa*: Structural steelwork (A.X. 5057); steel boiler tube ferrules (A.X. 5055); copper and steel plates (A.X. 5058). *Turkey*: Galvanised-iron wire (A.X. 5025).

Safeguarding of Key Industries

The Board of Trade announces that the Treasury has exempted from duty under the Finance Act, 1926, imported ethylene glycol (glycol: alcohol ethylene), and glycol ethers, from August 19, 1927, to March 6, 1928. The Treasury Order will be published shortly.

News from Advertisements

The University of Manchester announces particulars of its chemistry courses and of admission to the research laboratories (p. vi).

The proprietors of the British patent relating to synthetic production of ammonia are desirous of negotiating with interested parties (p. vi).

A chemist with experience in inorganic preparations is required (p. vi).

A chemical laboratory assistant is required by the Experimental Department of the Fine Cotton Spinners' and Doublers' Association (p. vi).

A single cylinder vacuum drying machine is for sale (p. vi).

An old-established chemical business is for sale (p. vi).

Radium element. 20.98 milligrammes for sale (p. vi).

The City of Cardiff Education Committee announce particulars of their courses and open scholarships (p. vi).

A platinum basin, crucible and lid, are for sale (p. vi).

There are 111 firms represented under various headings in our Buyers' Guide.

PUBLICATIONS RECEIVED

AIDS TO BIOCHEMISTRY. By E. Ashley Cooper, D.Sc., A.R.C.S., and S. H. NICHOLAS, B.A., A.I.C. Pp. vii + 188. London: Baillière, Tindall & Cox, 1927. Price 4s. 6d.

SECOND EXPERIMENTAL REPORT TO THE ATMOSPHERIC CORROSION RESEARCH COMMITTEE (BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION). A Discussion held by the Faraday Society, March 30, 1927. Pp. 113—204. London: The Faraday Society, 13, South Square, Gray's Inn, W.C., 1927. Price 8s. 6d.

DIE WEIT DER VERNACHLÄSSIGTEN DIMENSIONEN. EINE EINFÜHRUNG IN DIE KOLLOIDCHEMIE, MIT BESONDERER BERÜCKSICHTIGUNG IHRER ANWENDUNGEN. By W. Ostwald. Tenth revised and enlarged edition. Pp. xv+325. Dresden and Leipzig: Th. Steinkopff, 1927. Price, bound, 12 r.m.

INDUSTRIE DER HOLZDESTILLATIONS PRODUKTE. By G. Bugge. Part XV. Technische Fortschrittsberichte. Fortschritte der Chem. Technologie in Einzeldarstellungen, edited by Prof. B. Rasseow. Pp. viii + 200. Dresden and Leipzig: Th. Steinkopff, 1927. Price, paper, 15 r.m.; bound, 16.50 r.m.

THE CANADA YEAR BOOK, 1926. THE OFFICIAL STATISTICAL ANNUAL OF THE RESOURCES, HISTORY, INSTITUTIONS AND SOCIAL AND ECONOMIC CONDITIONS OF THE DOMINION. Canada Dominion Bureau of Statistics, General Statistics Branch. Pp. xxxiii + 1057. Ottawa: F. A. Acland, 1927.

REPORT OF THE FOOD INVESTIGATION BOARD FOR THE YEARS 1925, 1926. Department of Scientific and Industrial Research. Pp. vi + 80. H.M. Stationery Office, 1927. Price 2s. 6d.

HISTORY OF THE EXPLOSIVES INDUSTRY IN AMERICA. By Arthur Pine Van Gelder and Hugo Schlatter. With an introduction by Charles E. Munroe. Pp. xxxviii + 1132. Prepared from data collected by and published under the direction of the Institute of Makers of Explosives. New York: Columbia University Press, 1927.

LATEX. SEIN VORKOMMEN, SEINE GEWINNUNG, EIGENSCHAFTEN SOWIE TECHNISCH VERWENDUNG. By Dr. E. A. Hauser. With an appendix of Patents. By Dr. C. Boehm von Boernegg. Pp. xii + 231. Dresden and Leipzig: Th. Steinkopff, 1927. Price, paper, 16 r.m.; bound, 17.50 r.m.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN. Edited by Prof. E. Abderhalden. Abt. 1, Chemische Methoden. Teil 2, 1. Hälfte, Heft. 2. German Chemical Methods. Diazotieren. By S. Edlbacher. Atzalkalischmelze Nitrieren. By E. Maschmann. Lieferung 234. Pp. 457—642. Berlin: Urban and Schwarzenberg, 1927. Price 10 m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, SEPTEMBER 2, 1927

No. 35

EDITORIAL

A Golden Wedding

PROFESSOR AND MRS. ARMSTRONG have this week celebrated the fiftieth anniversary of their wedding day, and were "At Home" to their relations and a few intimate friends at the house of their daughter, Mrs. Stephen Miall. They have played conspicuous parts in the history of modern British chemistry, and the celebration deserves therefore some notice. Professor Armstrong includes among his old students many who are well-known figures in chemical circles, for instance, Profs. Sir William Pope, Lowry, Forster, Lapworth and Philip. He has been intensely interested not only in chemistry, but also in his students, and his house in Lewisham was frequently visited by them not only while they were his students, but long after they had made their mark in teaching, in industry, or in research. His house has been a happy meeting place for chemists of all ages and many nationalities, and very many of these have on divers occasions, including this present one, shown their gratitude for the inspiration they owed to the professor and the hospitality they received from him and his wife. One of their daughters lives in America, and she and her family were not present on this occasion; but the other children and grand-children were present, all in good health and good spirits. The professor's children are, some of them, so well known as to require no introduction to the readers of this journal; the grand-children are on the whole not inordinately shy, nor reticent of their opinions, nor inclined without argument to accept the views of their seniors; some of them have a determination which verges on obstinacy. To what extent the characteristics of the young depend on heredity or on environment is a question which has puzzled all the pedagogues and psychologists, and is far beyond the intellectual level of a mere editor. We never knew the professor in his tender years, and cannot say whether he did as he was bid or did as he was bad. We have alluded to his singular gifts as a teacher; as a writer, he has advised his fellow creatures on many occasions and on many subjects; we think that he must have been profoundly

influenced by Carlyle and by Ruskin, followers in a way of the wise Socrates. If we had all followed the advice of Armstrong, or indeed of any of the other three great preceptors, the world would have been very different. People do not, however, take advice, and the professor has, often and often, urged them not to do as they are told. Whether the professor expects us to follow the path he points out or not, or whether he even wishes it, we hope he will long continue to exhort us, to instruct us, and to mingle his irony and humour with erudition and that long experience that doth attain to something like prophetic strain.

French Industrial Progress

Our esteemed contemporary *Chimie et Industrie* published some little time ago the second part of *Dix Ans d'Efforts Scientifiques et Industriels 1914—24*. This handsome volume of about 1500 pages is well written and well illustrated, and it gives a most interesting account of the economic organisation of France, of the colonial progress of France, and of the resources of the French colonies during the years in question, ending with an account of the principal fuel, mining, chemical, and transport companies in France. The French colonies are but little known to the average Englishman. They include, however, an enormous area in Africa, nearly half that continent being either French or under French administration; they include also a large colony in Indo-China, and a few small ones in India, the large colony of Madagascar, and a score of islands in the Pacific, in the Indian Ocean, and in the Atlantic. Those who wish to study the production of tobacco, cotton, olives, dates, vines, iron, zinc and lead, in the eastern (French) half of Africa will find full information about these, the railways over which they are transported, the ports whence they are shipped, and so on. The cattle and sheep in different countries, the native timber, the rubber plantations, the ravages of locusts and other insect pests are fully described, and the descriptions are enriched by many beautiful illustrations. In a later part of the volume will be found

accounts of the Kestner evaporators, De Dietrich & Cie, the Société Dorr, the Salerni Low Temperature Carbonisation, the Sharples Centrifuge, the Comptoir Français de L'Azote, the coal-mining companies of the north of France, the Société Le Nickel, the Schneider works, the Vieille Montagne, the Potash works of Alsace, the Etablissements Bertrand Produits Chimiques, the Usines Dior, the Etablissements Kuhlmann, Poulenc Frères, and the works of Saint-Gobain, Chauny et Cirey, which some of us visited in 1919, and shall not forget. Many other companies and works are described, and the whole volume is a worthy record of a great and successful industrial effort.

Beet Sugar

We hope it will not be long before an authoritative account is published of the work on the De Vecchis beet sugar process which is being carried out by the Institute of Agricultural Engineering in its laboratories at Oxford and small works at Eynsham, a few miles from Oxford, but in the meantime we may note with satisfaction the progress in the production of beet sugar by the older processes as revealed in the most recent official announcement of the Ministry of Agriculture and Fisheries. Although we cannot hope that the extent of ground under beet will increase in the future at the same geometrical rate of progression as in the last three years, we are glad to see an even better type of progress, namely, in respect of the actual working of the factories, fourteen of which were in operation during the season 1926-7 as compared with nine during the 1925-6 season. The acreage under beet during 1926-7 was about 130,000, as compared with 56,000 acres during the preceding season, but furthermore, in three important particulars—the yield of beets per acre, the average sugar content of the root, and the average amount of sugar extracted—a considerable advance is recorded by the Ministry. Almost a ton more beet root was grown per acre in 1926-7, the average crop being 8.63 tons per acre, whilst the average sugar content was almost 1% higher at 17.31% on the beets. The figure which reflects the growing efficiency of manufacturing operations, however, is that relating to the extraction of sugar, expressed as a percentage of the beets treated. Although the beets contained, as we have stated, almost 1% more sugar than in the previous year, nearly 2% more nett sugar was obtained, the actual figure being 13.83%. It is, therefore, not surprising that three times as much sugar was made in the 1926-7 season as in the previous season, whilst the acreage under beet cultivation has only increased some 2½ times.

We are disinclined to express any opinion as to the chances of the beet sugar industry in this country when the time shall come for the withdrawal of the subsidy, but the comparisons we have just made offer abundant cause for hoping that the industry will prosper under economic conditions which are bound to be difficult. The main factor would appear to be the supply of the roots at a price which the industry will be able to pay, but if the farmer profits sufficiently from his own continued experience with the beet crops, from the employment of specially prepared fertilisers and improved labour-saving devices, and from the help which the specialists in beet seed are able to afford, there would appear to be

no reason why the manufacture of beet sugar in this country should not be mutually profitable to both manufacturer and farmer.

There are several reasons why the work on the De Vecchis process is of special importance to the beet sugar industry, and in the forefront stands, in all probability, the fact that the making of sugar could be a continuous operation throughout the year, instead of being confined to a third or a quarter of the year. The effect upon overhead costs alone needs no stressing. The De Vecchis process embodies, of course, the fundamental stage of drying the beets and bringing them into such a general condition as will permit of long storage without detriment to the quantity or quality of their contained sugar. At the same time, the beets dried down by the elimination of 75% of their original content of water could be treated with water at any time suited to the factory operations to give a 50% solution of sugar. The troublesome problem of effluent disposal would be largely solved, so that one barrier would be removed from the path of the engineer.

We have noted above the increase in the amount of sugar recovered as such from the beets, and if this can be raised still higher an obvious decrease in the cost of the final product must result. It is an important phase of the De Vecchis process that the immediate dehydration of the fresh root brings about such an increased sugar return in the end. At present there is involved a considerable loss in sucrose between the uprooting of the crop and its treatment in the factory—17.31% of sugar in the beet, 13.83% of sucrose finally obtained during the 1926-7 season—due to the inverting action of enzymes, fermentation, insect pests, natural cellular respiration, and other causes. Cellular respiration alone is responsible for very large decreases in ultimate sugar yield, and we recollect that Dr. C. A. Browne, Chief of the Bureau of Chemistry, U.S. Department of Agriculture, recently estimated that the actual destruction of sucrose from this cause alone during the storage of beets between digging and slicing was responsible for an annual loss of five million dollars in the United States. Further, a similar monetary loss obtains in the factories, due to the inability to recover as much sugar on account of the presence of non-sugars formed and rendered soluble by metabolic changes taking place in the beets during storage.

If the De Vecchis process can supply dried and easily transportable beets to factories working all the year round, can conserve sucrose as such in the dried beet, can facilitate operations in the factory and help solve location and effluent disposal difficulties, it will go far to prepare the British sugar industry for the eventual economic struggle. Estimates of the cost of drying beets by an elaboration of the De Vecchis process already worked out in broad outline by the investigations of the Institute of Agricultural Engineering have been made which do not place the process in too unfavourable a light. We are sure that the British beet sugar industry, present and prospective, would welcome a full report of investigations made up to the present, even if finality cannot be claimed one way or the other. Such a report would considerably assist the definite formulation of next season's plans.

THE MOULDING AND VULCANISATION OF RUBBER ARTICLES

By H. WILLSHAW

(Concluded)

Generally, where a large mass of rubber, such as a solid tyre or rubber block and the like, is to be vulcanised, a slow heating or warming-up period is given, to bring the mass to a general temperature throughout, following which the temperature is raised to effect vulcanisation.

The articles cured on these lines have what is called "stepped" vulcanisations to distinguish them from those where the steam pressure immediately rises to a maximum vulcanising pressure, and is held there over a definite time.

Accelerators

Many rubber goods, especially such items as pneumatic and solid tyres, require a very lengthy period of vulcanisation, and in view of the heavy cost of this operation through this factor of time and the additional factor of expensive plant, every effort is made to reduce the time for vulcanisation.

The substances which have been used to reduce the time for vulcanisation are known as accelerators. Common forms are litharge, magnesium oxide, derivatives of aniline, etc.

If the material is thin, and where rubber mixings are used containing such active accelerators as xanthate, appreciable vulcanisation may take place at ordinary room temperatures, and with development along these lines, it is quite possible that with such articles, separate vulcanising operations may not be necessary.

On the chemical action of such accelerators the author does not propose to touch, but refers to them as a means whereby the chemist can co-operate with the engineer in reducing moulding costs.

Although the foregoing descriptions have referred to the moulding and vulcanisation of tyres, practically all rubber articles follow one of the processes described, as for example:—

Rubber heels and the like.—These are roughly shaped from unvulcanised rubber, placed in a plate mould, having cavities for 20–30 shapes, and the mould is placed between steam chests and vulcanised while hydraulic pressure is applied. The method for such articles very closely resembles the process described for solid tyres, although it must be understood that the moulding equipment is much lighter and does not call for the mechanical help required with heavy moulds.

Rubber toys, play balls and the like.—The manufacture of these classes of hollow rubber articles follows to a great extent the process and principles of moulding described for the present-day cord tyre, vulcanised against air pressure, while subjected to hydraulic pressure, or other means of mould closing. For example, rubber balls and toys are formed to rough shape from unvulcanised rubber and are inflated during vulcanisation by the introduction of pressure from an outside source, or are caused to expand against the mould during vulcanisation by the use of chemicals, such as ammonia

or ammonium nitrite, mixed with sodium chloride, which causes pressure amounting to several atmospheres to be exerted inside the ball during vulcanisation.

Naturally, in such cases as this, it is necessary to reduce the pressure by cooling before opening and emptying the mould.

Brief survey of present-day moulding equipment

Mould design.—Much has already been said about moulds in this paper, and a brief description of mould design and construction will here not be out of place.

On account of the repetition of heavy stresses which are set up during the moulding of a tyre, and the necessity to keep down the weight and thickness of moulds for ease of handling and to give maximum autoclave capacity, it has become the general practice nowadays to make moulds in steel. A further advantage of steel over cast iron or semi-steel, which were previously used, is the much better surface finish obtainable.

Steel castings generally are most suitable for moulds of intricate shape, as there is far less waste of material and machining than when steel forgings are used. The one drawback is that steel castings are more subject to surface blemishes. The weights of steel moulds for sizes generally moulded in autoclaves vary from 7 to 35 cwt. each, and it will be obvious that these weights would be greatly increased if cast iron were used.

As regards the design of the tyre mould, the first object is to get a perfectly-moulded tyre, which requires very careful machining work to gauges, so that the volume of the mould cavity and the shape are correct to close limits, and this is especially so in the case of tyres moulded on solid cores. One of the problems in tyre moulding is to ensure that all air is expelled from the mould, and for this purpose channels are cut from any isolated blocks in the pattern and from the shoulder of the tyre to permit the air to flow away to the joints of the mould. In some cases air holes are drilled through the sides.

Care is required in getting a correctly-proportioned spew groove at the joint of the moulds, this being very essential in the case of a solid tyre, to meet the two following conditions:—(a) To provide sufficient resistance to the outward flow of the rubber when the ram is forced back, and (b) to permit the ram to close the mould again by squeezing through the spew. In the case of the present-day pneumatic cord tyre, broad, flat surfaces are permissible, as there is no necessity for the mould to open, although this does actually occur, as there is always a little spew.

Deep-wearing surfaces on the spigots and bead ring joints are essential, otherwise wear rapidly takes place, causing a step on the joint of the tyre at the crown, due to the eccentricity of the two halves of the mould. At the same time, the depth of these joints must not be such as to interfere with the free opening of the moulds.

The outside shape of the moulds is determined by the requirements of the handling and conveyor system, but, apart from this, it is necessary to provide steam grooves on the backs of the moulds to ensure that the steam shall circulate between the mould surfaces with the consequent

necessary heating effect to the side of the tyre. These grooves also serve the purpose of inducing circulation in the pan.

Mould manufacture. Pattern cutting.—The initial machining operations on the mould follow the usual machine-shop practice, but it is general to use formed tools for the final finish of the tyre contour, leaving the mould ready for its particular pattern engraving.

This is done generally with an engraving machine employing copying mechanism based on the principle of the pantograph, but more and more frequently the pattern is being formed by riveting or welding on steel stampings, and sometimes white metal stampings or castings, methods which reduce the cost of the mould very considerably.

In some cases loose rings carrying the pattern are fitted into the mould; but when this is done it is very essential that care should be taken to prevent the pocketing of water from the steam under these rings, as the sulphur forms sulphuric or sulphurous acid during vulcanisation, and this rapidly attacks the joints between the mould body and the inserted ring.

Mould handling and conveying

Power conveyors.—Reference has been made to the efforts of the chemist towards reducing moulding costs; and now the work of the engineer comes under consideration.

The main problem confronting the engineer is that of making possible the rapid handling of moulds in and out of the vulcanising vessels or by the speeding-up of operations carried out on presses themselves wherein the mould is a fixture.

The moulds are fed by means of travelling apron or chain conveyors, and after vulcanisation are removed from the vulcanisers by suitable power means, to be conveyed to opening stations, where by hydraulic means they are opened, oyster fashion.

The upper half of the mould is then conveyed through its cleaning station by means of the overhead conveyor, whilst the lower half of the mould, travelling along its conveyor, has the vulcanised tyre ejected from it—again hydraulically—is cleaned, re-loaded with an unvulcanised tyre, and travelling along, meets its upper half, which is located accurately upon it, and both are conveyed to the autoclave for loading, thus completing the cycle.

Such an installation as that described has no extraordinary features about it, and similar conveyors are common throughout the country.

The combination, however, of a cable conveyor with a slat conveyor may be worth commenting upon, as the careful calculation of the exact speeds necessary is essential to ensure that the upper and lower halves of the mould meet as accurately as possible.

Since stoppages may occur on one or other conveyor, stop and start switches in easily accessible positions are so arranged that the two conveyors may be kept synchronised as regards movements.

Safety methods.—With such conveyor systems must be borne in mind the necessity of providing adequate safety controls, both for the protection of the operators concerned and for the maintenance of the conveyor.

Costs of moulding

It will be apparent from the various descriptions that the services required for moulding and vulcanising installations are of a very expensive character, and that the cost of steam, high-pressure water and high-pressure air means that the manufacturer has to exercise the utmost care in preventing unnecessary use of any of these services.

For example, the cost of an installation for a battery of 20 autoclaves, as that described, would be to-day around £50,000, exclusive of moulds.

In so far as the cost of moulds is concerned, this ranges from £15 to £25 for cycle moulds, which, of course, are of comparatively light weight, and from £30 upwards to £125 according to size for car and truck pneumatic tyre moulds.

If we consider that this initial expenditure on the moulds is spread over the whole of the tyres produced from each mould, it must be conceded that the actual cost per tyre, with the mould constantly in production, is comparatively small in the smaller sizes of moulds, as the following schedule will show, but for larger sizes it will be seen how heavy a charge is placed against moulding costs—more especially should the life of the mould, due to changes of design etc. be comparatively short.

	Weekly output Two 48 hr shifts		Yearly output.
Cycle moulds used in individual presses	600	1 000	30,000—50,000
Light-car moulds used in individual vulcanisers	100	200	7,000—10,000
Car and pneumatic truck tyres moulded in autoclaves	25	50	1,250—2,500
Solid tyres cured in autoclaves	20	30	1,000—1,500

In the case of the hydraulic service, it is general for low-pressure water to be used for all ram movements, which are necessary for the loading and unloading of the moulds from vulcanisers, and the high-pressure water is only used for final mould closing and onwards during the vulcanisation period.

As regards steam, the amount of steam required for a battery of 20 vulcanisers is approximately 10,000 lb. per hour. Also to complete this installation, 1000 cb. ft. of free air, together with 8000 gals. of high- and low-pressure water, are required, whilst cooling water consumes approximately 10,000 gals. per hour.

A further important point is the matter of floor space affecting floor charges. Such an autoclave installation as that described works out at 67 sq. ft. of floor area for every tyre moulded per hour.

It will be appreciated by the engineer that all this means heavy cost on the final production of rubber articles, and it is worth while comparing the vulcanisation of heavy goods described with that of similar articles which are now vulcanised in individual vulcanisers, where hydraulic pressure is eliminated and the amount of steam required for vulcanisation is reduced by approximately one-half, on account of the fact that there is less metal to heat up and the loss due to condensation is much less, whilst the installation of, say, 50 such vulcanisers will only represent a capital outlay of around £10,000.

In addition to the help that the chemist is giving with developments in the use of accelerators, with corresponding reduction in time required for vulcanisation,

the automobile engineer, by improving the springing of chassis and reducing the unsprung weight of the various component parts, is enabling the tyre manufacturer to utilise tyres of lighter construction and small cross-section, thus making possible the introduction and standardisation of individual vulcanisers to a greater extent than hitherto, with a consequent reduction of both capital outlay and moulding costs.

Bakelite, casoid, galalith and ceramic moulding

This paper would not be complete without making reference to other articles that are moulded, such as "bakelite" etc.

In the main, the moulding of "bakelite" has much in common with the moulding of rubber goods. The content of the mixed powder bears a definite relationship to the mould cavity. The main difference is that the powder can be poured into the mould direct or pressed beforehand into "tablet" form and then placed into the mould.

The mould design is similar to that described previously except that the smaller nature of the work enables the moulds to be economically housed in steam-heated platens, and also in the case of patterned moulds the pattern can be produced by hydraulic pressure from a master instead of being cut individually as in the case of the larger moulds.

With regard to moulding temperatures and pressures, these approximate very closely to those previously given, i.e., 300° to 350° F. and 1500 to 2000 lb. per sq. in. of mould surface.

During moulding—due to the pressure placed upon it—"bakelite" contracts to 25% of its original bulk, and therefore to obtain the best results it is essential to ensure that the hydraulic pressure is sufficiently high to obtain complete consolidation of the powder.

Small moulds which can be spaced in series on a platen are usually arranged so that between the two halves of the mould is a small space which is similar to the spew groove in the tyre mould, and into which any surplus powder is forced. These moulds are known as "flash" moulds.

Platens for moulds are so formed as to permit either of rapid heating or cooling, and the presses wherein these platens are fixed are usually designed so that the press on the lower portion of its opening stroke automatically ejects the "mouldings" from the moulds. More recent experience of this class of material has shown that where the "mouldings" are thin, the cooling of the moulds in the platens is unnecessary.

Casoid, erinoid, galalith.—These substances, which have a common base of casein material, have not as yet reached that stage of development wherein moulding is a definite process of manufacture, and judging from the experience gained in the handling of these substances, a fair amount of research work will have to be carried out before it can be said that moulding is a process which can be successfully performed on them.

At the present stage of developments the prepared casein substance is generally drawn to an approximate shape and pressed between steam-heated platens against hydraulic pressure approximating to 1½ tons per sq. in. of platen.

These materials, however, differ from rubber articles inasmuch as contraction takes place instead of expansion during the pressing operation, following therefore the characteristics of "bakelite" in this respect.

Subsequent to pressing, the casein material in its various shapes is subject to immersion in formalin solution which might be considered as analogous to the vulcanisation of rubber.

Ceramics.—There are a variety of ways in which clays are conducted through their moulding processes such as "throwing," "jollying," "pressing," etc., but the only one which may be said to come within the scope of this paper is that of "pressing."

Pressing is carried out in moulds which are designed similarly to those before described for "bakelite" and, like them, provided with grooves for the flash or spew.

The mould halves are mounted in steam-heated platens fixed in suitable fly or hydraulic presses. The pressure required varies according to the nature and volume of the work required, and may reach 5000 lb. per sq. in. on the ram.

The clay is taken from the press cloths, allowed partially to dry, and is then placed in a pulveriser from which it emerges in the form of a fine powder. This powder is poured to excess, since it contracts under pressure, in the lower half of the mould, the press closed and the surplus material forced into the flash grooves, whence it is usually trimmed off by the cutting edge on the top half of the mould.

Types of articles manufactured under this process are tiles, electric insulators, etc.

In conclusion, the author wishes to acknowledge the help given towards the compilation of this paper by Messrs. the Dunlop Rubber Co., Ltd., Messrs. the Darnall Lacquer Co., Ltd., Birmingham, and H. C. Young, Esq.

MINING AND METALLURGY IN CANADA

The Consolidated Mining and Smelting Co. at Trail has produced excellent electrolytic iron from the waste pyrrhotite of the Sullivan mine. The company has acquired chrome iron ore deposits at Rossland, evidently with the intention of manufacturing ferro-chrome alloys.

The Hollinger Consolidated Gold Mines, Ltd., recovered in 1926 gold of the net value of \$14,780,636. Dividends paid during the year amounted to \$5,805,000. The average value of ore milled was \$7.99, and the quantity was 1,932,559 tons. The cost of production was less than \$4.00 per ton.

The Canadian Bronze, Ltd., with headquarters in Montreal and subsidiaries at St. Thomas, Ont., Winnipeg and Calgary, and owned and directed by New York capitalists for the past thirty years, has passed into the hands of prominent Montreal industrialists and financiers. The company has always been the dominating producer in its industry, and operated as a close corporation.

The zinc output of Canada in 1926 was the highest ever recorded, being 74,969 tons, valued at \$11,110,413.

A lead-zinc field has been found west of Big Bunker Hill-Sullivan area, north of Sudbury, Ont. The St. Louis Smelting and Refining Company has a 70% interest in the new find. The field comprises about 2,200 acres.

CALENDAR OF FORTHCOMING EVENTS

- Sept. 2 COKE OVEN MANAGERS' ASSOCIATION. Continental to 12. Tour. (See CHEM. AND IND., August 19, p. 749.)
- Sept. 6 INSTITUTE OF METALS. Autumn Meeting to be held at Derby. (See CHEM. AND IND., August 19, p. 748.)
- Sept. 9. INSTITUTE OF BREWING, Research Fund Committee and Corporate Members. Visit to hop-growing districts in Kent. Luncheon at Canterbury.
- Sept. 12 INTERNATIONAL SOCIETY OF LEATHER TRADES' CHEMISTS. Bi-Annual Conference in London. (See CHEM. AND IND., August 26, p. 768.)
- Sept. 13. SOCIETY OF CHEMICAL INDUSTRY. Official Visit to the Shipping, Engineering and Machinery Exhibition at Olympia, London, W.
- Sept. 14. INSTITUTION OF SANITARY ENGINEERS. Visit to the Shipping, Engineering and Machinery Exhibition at Olympia.
- Sept. 20. IRON AND STEEL INSTITUTE. *Glasgow Meeting.*
21 & 22. Royal Technical College, Glasgow, commencing each day at 10 a.m. The following papers will be read: (1) "High frequency induction melting," by D. F. Campbell. (2) "Magnetic and other changes concerned in the temper-brittleness of nickel-chromium steels," by H. A. Dickie. (3) "Influence of cold-rolling and subsequent annealing on the hardness of mild steel," by C. A. Edwards and K. Kuwada. (4) "Influence of nickel and silicon on an iron-carbon alloy," by A. B. Everest, T. H. Turner, and D. Hanson. (5) "Effect of varying ash in the coke on blast-furnace working," by C. S. Gill. (6) "Constitution of silicon-carbon-iron alloys, and a new theory of the cast irons," by D. Hanson. (7) "Work-hardening of steel by abrasion," by E. G. Herbert. (8) "On the quantitative measurement of the cutting power of cutlery," by K. Honda and K. Takahasi. (9) "Use of silica gel as a medium for drying blast," by E. H. Lewis. (10) "Mechanism of tempering of steels," by T. Matsushita and K. Nagasawa. (11) "Economic and social development of the American iron and steel industry," by T. W. Robinson. (12) "Behaviour of mild steel under prolonged stress at 300 C.," by W. Rosenhain and D. Hanson. (13) "Testing machine for repeated impact, and a preliminary investigation on the effects of repeated impact on Lowmoor iron," by J. H. Smith and F. V. Warnock. (14) "Solution of carbon in α -iron and its precipitation," by J. H. Whiteley. (15) "Contribution to the theory of the blast-furnace process," by F. Wüst.
- Oct. 5. INSTITUTION OF SANITARY ENGINEERS. Opening Sessional Meeting.

FRANCO-GERMAN TRADE AGREEMENT

The commercial agreement signed by France and Germany on August 17 will have the effect that German goods entering France will, with minor exceptions, be subject to the present minimum tariff. The German goods which are thus affected include "a whole series of chemical products," dye-wood extracts, foodstuffs, etc. Most of the German exports will, however, be subject to the new minimum tariff which will result from the anticipated revision of the French tariff. French goods for which special concessions are granted include various textiles, glassware, iron, steel, copper and so on.

OBITUARY

EMERITUS PROFESSOR H. R. PROCTER, D.Sc., F.R.S.

It is with the deepest regret that we record the death, in his eightieth year, of Henry Richardson Procter, for many years Professor in the Leather Industries Department of the University of Leeds, and an original member of the Society of Chemical Industry. Born on May 3, 1848, at Lowlights, near South Shields, his childhood was spent at the old tannery house amidst pleasant country surroundings until at fourteen he went to Bootham School, York, where, even in those days, his scientific interests were encouraged. After leaving school he was apprenticed to the family business, at which he remained until his father's death in 1888, except for a period of study at the Royal College of Chemistry in Oxford Street. Whilst at the College, Procter acted for a time as research assistant to Frankland and Lockyer in some spectroscopic work, and received, though he did not accept, an invitation to join the eclipse expedition then proceeding to India. Procter always showed a keen interest in astronomy, and was, in fact, author of the article on the "Aurora" in the ninth edition of the *Encyclopædia*.

On his father's death, Lowlights was "tanned out" under Procter's supervision, and the old tannery is now an electricity works. He then joined as chemist the old tanning business of his relatives, Edward and John Richardson, at Elswick, Newcastle-upon-Tyne, remaining there for a year or two, until in 1891 he took charge of the newly-formed Leather Industries Department at the Yorkshire College, Leeds. It was at Leeds that he spent the most fruitful years of his life. His work there did not actually terminate with his official retirement at the age-limit of sixty-five (1913), but continued until about 1922. His last paper of note was on the colour measurement of brown solutions, and was published in the *JOURNAL* in 1923. During the war (1914-1918) Prof. Procter had to resume charge of the Leather Department until Prof. McCandlish came from America to take up the position.

Lately Prof. Procter lived in retirement at Newlyn, Cornwall, near his son and daughter-in-law, Mr. Ernest and Mrs. Dod Procter, the artists, in whose now famous work he took the keenest interest and pleasure. His death came peacefully on August 17, after several months' illness, during long periods of which he was only feebly conscious, if at all.

Prof. Procter's work may be reviewed under: (1) teaching; (2) research; (3) the foundation of the International Society of Leather Trades' Chemists. As a teacher his career began before he came to Leeds, for already in 1885 he published his "Text Book of Tanning," which broke new ground in the endeavour to apply science and particularly chemistry to every part of leather manufacture. When in 1891 the classes at Leeds were begun, Prof. Procter had to make a start with little to guide him save what was learned by a brief visit to tanning schools already open in Austria and Germany. Lecturing, the preparation of the slide collection, formation of the museum, supervision of laboratory and practical work all fell to him, and the early years at Leeds were very busy. The separate building forming the present Leather Department was opened in 1898. As a

teacher, whether in lecture or in his writings, Prof. Procter was always interesting. He had a very remarkable store of miscellaneous information on which he freely drew for illustrations and which was often of great service to his colleagues. Whilst at Leeds he published the "Principles of Leather Manufacture," the "Leather Industries Laboratory Book," and a little work, "The Making of Leather," all written in easy and luminous English and exhibiting a mind of no common order.

In research, Prof. Procter spent much time on tannin analysis, and took much the greatest part in developing the present method, which, considering the indefinite nature of the substances to be estimated, and of the necessary reagent, hide-powder, may be claimed to be a remarkable achievement in empirical analysis. Much more congenial were his long labours on the swelling of gelatin in acids. He early saw that there could be no adequate theory of tanning until gelatin swelling was understood, and from about 1900 to 1916 he gave the best of his energies to this problem. Convinced that the varying and apparently irregular phenomena of swelling could be explained, and reluctant to evade anything by referring to "colloidal" properties, he finally arrived at a quantitative and complete theory involving nothing but orthodox physical chemistry and the properties of elastic solids. The work, of course, has direct application to other proteins, and is one of the most convincing demonstrations that such substances behave in accordance with their chemical structure. During his lifetime Prof. Procter published over one hundred original papers, the first appearing in 1871.

The International Society of Leather Trades' Chemists, which has as its first object the unification throughout the world of methods of tannin analysis, represents the fulfilment of one of Prof. Procter's dearest hopes. Unfortunately, owing to the war, the present unity amongst leather trades' chemists is not what it was in 1913, but progress is again being made, and we shall probably in a few months see one method of tannin analysis in use throughout Europe and America. The expectation of this gave much pleasure latterly to Prof. Procter.

Much could be written about his personal qualities. Kindly and urbane in temperament, free from prejudice on almost every subject, generous in his appreciation of the efforts of others, he endeared himself to all who worked with him. Conversation with him was always interesting and stimulating, and his mental habit of going back every time to first principles brought a freshness into every discussion in which he took part. Sometimes he exhibited a charming and delightful naivete. He once said smilingly to the writer: "I believe that I am open to conviction, and, do you know, very few people are!" This was perfectly true, and one felt that he was impartially surveying himself with the same lucid and easy judgment that he brought to his scientific work.

F. C. T.

The mortar and pestle used by the late Sir Edward Frankland, F.R.S., during his apprenticeship to a druggist in Lancaster has been presented to the Lancaster Museum.

CORRESPONDENCE

THE COLLEGE MAN AND CHEMICAL INDUSTRY

SIR,—The statements made on this subject by various writers in your correspondence columns, during the last two years, may be partly summarised thus:—

(1) The need for closer co-operation between science and industry should remind us that something, more than has hitherto been attempted, must be done to make our graduate and diploma students in chemistry useful to the manufacturer. Failing a scheme of chemical works apprenticeship, similar to that forming part of the training of many engineering students, the best solution would be the establishment of works or technical laboratories in many of the colleges training students to graduate standard.

(2) All those acquainted with the position of chemical industry in England will agree with Mr. F. H. Carr that we develop too much one type of chemist. We have hitherto failed to realise that a link must be furnished between the pure research chemist on the one hand, and the engineer and business man on the other, in the person of the industrial chemist. More than training in pure research, we need training in industrial chemistry, and to this end we need a clear realisation of industrial chemistry as a definite province to which chemistry, engineering and economics contribute in roughly equal shares.

(3) Employers regard graduates as actually unsuitable for works control because they find them impractical. Recognition of the need for training in industrial chemistry as a definite separate branch of science must be our first step, and the provision of suitable colleges the second.

(4) The raw University graduate who has not been taught to think industrially is of little use to his employer until he has had time to readjust his mental values to the hard facts of profit making.

The subject has been reopened by Dr. W. Cullen and Dr. Drake-Law (both having academic and industrial experience), who repeat and amplify many of the above statements.

Mr. F. H. Carr's Streatfeild lecture of 1925, and the discussion following it on this subject, have been printed, read and—perhaps—forgotten; the only school devoted to applied chemistry in London (at Finsbury Technical College) has been closed, and teaching institutions in the London area continue to strive after academic qualifications and honours with unabated vigour.

I agree with Dr. Cullen that the industrialists who know what they require should come out into the open and give a lead to the universities and technical colleges. I also agree that it is impossible to make a start in putting things right unless our leading industrialists speak out in no uncertain tones, and I hope we may now hear the definite views of many of them. If they are not satisfied with the type of man they are now getting from our colleges, they ought to make a serious effort to have our present system of training modified, in some respects, to produce the type of man they require.

I am, Sir, etc.,

ARTHUR J. HALE

Sydenham Avenue, S.E.26

PERSONAL AND OTHER ITEMS

On September 6, the University of Leeds will confer honorary degrees upon Sir Charles Parsons (LL.D.), Dr. J. S. Haldane (D.Sc.), Prof. R. A. Millikan (D.Sc.), and Dr. N. V. Sidgwick (D.Sc.).

Mr. L. H. Sensicle, B.Sc., F.I.C., chief chemist to the Stella Gill Coke and By-products Co., Ltd., has been appointed chief chemist to the Newcastle & Gateshead Gas Co., Ltd., in place of the late Dr. G. Weyman.

Prof. A. E. V. Richardson, director of the Waite Institute, has been appointed the Commonwealth delegate to the Imperial Conference for the co-ordination of agricultural research, which will be held in London next October.

Dr. R. H. Clark, professor of chemistry in the University of British Columbia since 1916, has been appointed head of the Department of Chemistry of that University.

The death is announced at the age of 67 years of Mr. George Edward Wilson, for 15 years a member of the firm of Messrs. Albright & Wilson, chemical manufacturers, of Oldbury. For many years he took a deep interest in the social, industrial, and public life of Worcestershire, and of the Oldbury district in particular. He was an Alderman of the Worcestershire County Council. The funeral at Churchill on Friday last was largely attended. Those present included the following:—Directors of Messrs. Albright & Wilson: Sir Richard Threlfall, K.B.E., Mr. W. B. Threlfall, and Mr. J. Elliott H. Lloyd (who is also secretary to the firm), Mr. C. D. Sykes (general works manager), and Mr. A. A. King (works manager), Mr. P. N. Collyer (chief engineer), and Mr. G. Inglis (research chemist). Mr. W. A. S. Calder (Messrs. Chance & Hunt, Ltd.), also attended.

The late Mr. S. H. Holmes, J.P., chairman of Thomas Holmes & Sons, Ltd., tanners, of Hull, left £167,599, with net personalty £165,331.

Professor Armstrong's Golden Wedding

Professor Henry E. Armstrong, F.R.S., and Mrs. Armstrong celebrated their golden wedding on Tuesday, August 30, and many friends and relations met to greet them at the house in Hampstead of their daughter, Mrs. Stephen Miall. Professor Armstrong is in his eightieth year, and Mrs. Armstrong in her eighty-fifth year, and both of them are active and vigorous. Among those present were their daughters, Mrs. Miall and Miss Nora Armstrong, their sons, Dr. E. F. Armstrong, F.R.S., Dr. R. R. Armstrong, Mr. H. Clifford Armstrong, and Mr. H. L. Armstrong, and a number of grand-children; the scientific guests included Sir William Pope, Sir Richard Gregory, Mr. H. B. Baker, the president of the Chemical Society, Mr. F. H. Carr, the president of the Society of Chemical Industry, Professor W. P. Wynne, Dr. Vargus Eyre, Dr. R. Seligman, Mr. Foster Morley, Mr. E. V. Evans, and Dr. Heller. Prof. Wynne presented an address from old students from many parts of the world, and explained that his old students had purchased the portrait of Prof. Armstrong exhibited at the Royal Academy this year, and given it as a lasting record of their appreciation and affection. Mr. Williams, of the Chemical Industry Club, presented a bouquet from several admiring friends, and the postal authorities had a busy time delivering telegrams of congratulation.

A New Ammonium Nitrate Fertiliser

It is announced that Messrs. Nitram, Ltd., will shortly place a new fertiliser on the market known as "Nitro-chalk," which consists of a mixture of ammonium nitrate and dried Billingham carbonate of lime. The carbonate of lime used comes from the works of Synthetic Ammonia Nitrates, Ltd., and has been much used by farmers for dressing the land. The use of ammonium nitrate alone as a fertiliser has hitherto presented certain difficulties, but in the new form it is perfectly suitable for agricultural use. "Nitro-chalk" will contain about 10% nitrogen, and will, it is expected, be marketed at a price equivalent to that of ammonium sulphate based on the content of nitrogen.

British Gas Industry in 1926

The quantity of gas made in 1926 was 296,082 million cb. ft., and the quantity sold 276,569 million cb. ft. This was 4.3% in excess of that made in 1925, which again exceeded that made in 1924 by 3.1%. The increase in 1926 was due entirely to the increased make of water gas, a rather smaller quantity of coal gas being made in 1926 than in 1925. Only 16,564,000 tons of coal was carbonised in 1926, compared with 17,031,000 tons in the previous year; but 1,436,000 tons of coke for water-gas, and 97,703,000 gals. of oil were used in the later year, as against 1,153,000 tons and 61,383,000 gals. in 1925. In 1926 the residual products included 11,177,000 tons of coke and breeze and 187,546,000 gals. of tar, showing reductions of 221,000 tons and 6,613,000 gals. as compared with 1925. The total number of consumers in 1926 was 8,405,000, an increase of 2.5% over the 1925 total, and their average consumption increased by 2.0%. The number of consumers in 1926 supplied by companies totalled 5,098,000 (about 60%), and the number supplied by local authorities was 3,307,000. The length of gas mains in 1926 was 44,470 miles, an increase of nearly 3% on the length returned for the preceding year.

Specialised Information: A.S.L.I.B. Conference

It is expected that some 200 organisations will be represented at the Fourth Conference of the Association of Special Libraries and Information Bureaux which meets at Trinity College, Cambridge, during the week-end September 23—26. Following a reception by Sir J. J. Thomson, O.M., Master of Trinity, Sir Geoffrey Butler, K.B.E., Senior M.P. for Cambridge University, will deliver the presidential address, whilst among those giving papers are Sir Henry Lyons (Director, The Science Museum), Mr. A. E. Overton (Principal, Board of Trade), and Sir Richard Gregory (Editor of *Nature*). The subjects to be discussed at the Conference include such topics as the recent Report of the Public Libraries Committee, co-operation between libraries, and book selection in science and technology. Sectional meetings will be held on information and statistics in commerce and industry, on patent classification, and on information bureaux questions. The conference is open to all interested, whether members of the association or not. A copy of the detailed programme and other particulars can be obtained from the Secretary, A.S.L.I.B., 38, Bloomsbury Square, London, W.C.1.

With the assistance of the Carnegie United Kingdom Trustees the association is publishing in the autumn

a directory of sources of specialised information, edited by Mr. G. F. Barwick, late Keeper of Printed Books at the British Museum. The book is unique in character inasmuch as it records under thousands of subject headings the various centres in Great Britain and Ireland to which those in search of specialised information should turn.

Asbestos in South Africa

It is stated that Bell's United Asbestos Company, with its subsidiary Bell's Poilite and Everite Company, has decided to erect a new modern plant in South Africa for the manufacture of poilite asbestos cement building materials, both corrugated and tiling, together with plant for the manufacture of asbestos-cement pipes for water mains etc. In view of the heavy tariff on imported asbestos goods, the products should find ready sale.

U.S. Purchase of Cornish Clay Mines

The Papermakers' Importing Co., an American firm which has been long one of the chief purchasers of English china clays, has acquired the Anchor United China Clay Co., Ltd., and the Melingoose China Clay Co., two Cornish firms capable of producing 50,000 tons of china clay a year.

The Interessen-Gemeinschaft

The I.-G. Farbenindustrie has been licensed by the National Lead Company of America to use the company's patents relating to the manufacture of titanium pigments. The sales area will probably be confined to Central Europe.

German Potash Production and Sales

H.M. Consul-General at Cologne (Mr. W. N. Dunn) informs the Department of Overseas Trade that according to figures issued by the Reich Statistical Office and published in the *Deutsche Bergwerks Zeitung* of August 9, the production of potash salts amounted to 94 mill. dz. (1 dz. = 100 kg.), equivalent to 12.6 mill. dz. pure potash. Thus the potash output as compared with 1925 has decreased by 21.9%, but is still considerably higher than in 1924, and comparatively speaking falls little short of 1913. The rationalisation of the potash mining industry is seen from the fact that of the 228 potash works to which a participation figure has been allotted, only 66 participated in the output of 1926 on a monthly average, as against 85 in 1925 and 126 in 1923. Sales of potash salts have decreased from 43.26 mill. dz. (12.25 mill. dz. pure potash) in 1925 to 38.94 mill. dz. (11 mill. dz. pure potash), a decrease of 10%. Of the amounts sold in 1926, 26.35 mill. dz. (6.94 mill. dz. pure potash) was sold on the home market and 12.59 mill. dz. with 4 mill. dz. pure potash abroad. The decrease as compared with 1925 amounted to 11.5% as regards export sales, and 9.5% as regards inland sales.

Activated Charcoal

The source of the note on activated charcoal, which appeared in the issue of August 6, p. 772, was the "Chemical Trade Journal" of August 12, p. 161. We regret that the acknowledgment was inadvertently omitted.

REVIEWS

SPECTROSCOPY. By Prof. E. C. C. Baly, C.B.E., M.Sc., F.R.S. 3rd Edition. In 4 vols. Vol. 2. Pp. vi + 398. Text-books of Physical Chemistry, edited by Sir W. Ramsay and F. G. Donnan, C.B.E., Ph.D., F.R.S. London: Longmans, Green & Co., Ltd., 1927. Price 18s.

It is now three years since the first volume of the new edition of Baly's "Spectroscopy" was published. The advances in spectroscopy have necessitated an extension of the original plan of two volumes to four. Will the first volume be out of date by the time the fourth (or last) volume is published? In fact, like some other recent "text books" in physics, it is neither a text book nor yet a treatise or "handbuch." The price of a book like this is beyond the pocket of the average student. The detail of the exposition is too great in view of the ground the modern student of physics has to cover. For the research worker, on the other hand, such a book can never replace the original sources of his subject.

The present volume contains five chapters. Chapter 1 deals with interference methods, and contains an interesting account of the applications of interferometry to astronomy, such as the determination of the linear diameter of Betelgeuse. Chapter 2 is on methods of illumination. A detailed account is given of King's work on the excitation metallic spectra by the volatilisation of metals.

Chapter 3, on the nature of spectra, reveals the difficulty of being certain about the origin of spectra. It is asserted that "the Swan spectrum . . . is characteristic of carbon monoxide," while in a recent paper Johnson has shown that the emitter is HC-CH. Chapter 4, on fluorescence and phosphorescence, contains an excellent theory of these phenomena by Prof. Baly himself.

The last chapter, the photography of the spectrum, written in conjunction with Dr. Mees, is one of the best in the book, and contains much of value and interest to the practical spectroscopist. W. E. DOWNEY

DEFECTS IN GLASS. By C. J. PEDDLE, M.B.E., D.Sc. Pp. xiv + 205. London: Glass Publications, Ltd., 1927. Price 8s. 6d.

This book is primarily written for producers and workers of glass, but it is likely to be equally valuable to some users of that very interesting material. Most of the commoner and some of the rarer defects are considered in turn, but the book is much more than a mere technical description of defects and of means of preventing and curing them, as in it the author enters at length into the scientific aspects of the subject. He rightly urges that defects should be reported as soon as they occur, and that the origin of the defect must be found before any attempt at a remedy is made, though the latter recommendation is somewhat Utopian. A lengthy classification of defects is given, and the chief ones—lack of homogeneity, striae, cords, bubbles, seeds, stones, and devitrification—are considered in turn, a final chapter dealing with the question of durability.

The few chemists who have long been engaged in the scientific study of the causes of defects in glasses of various kinds and the best means of preventing them will

find little that is really new in this volume, but the much larger number of readers who have had little or no scientific training, but considerable practical experience in the production and use of glass, will find a large amount of valuable information. Amongst others that might be mentioned, is a statement to the effect that "when a portion of a pot or tank breaks away and enters the molten glass, it is not fireclay which is entering, but mullite, a material composed of minute needle-like crystals, which are highly refractory and very difficult to dissolve." This fact, whilst familiar to chemists who manage to keep up to date on the subject, throws a new light to others on the persistency with which minute "stones" remain in molten glass, and indicates the very modern outlook of the author, for this source of mullite was only discovered in 1924.

A very large portion of the volume is occupied by the subject of *devitrification*, in which term the author includes the separation of amorphous solids as well as the more usually recognised crystalline ones; by this means he includes opacity or opalescence under devitrification, and is able to simplify his treatment of the subject. This portion of the book is particularly well written and, notwithstanding the complexity of the subject, it is very clear. Incidentally, when the author states the case for glass being a mixture of compounds and not a single compound, he is not wholly on safe ground, for some of his arguments are equally as applicable to compounds of very low thermal conductivity as to mixtures, and very similar words might be used to show that pure quartz is a mixture!

Most of the illustrations are reproductions from photographs: some are very beautiful, and are invaluable in a careful study of devitrification.

Whilst much remains to be done before a complete account of the defects in glass and of the means of preventing and remedying them can be written, this volume is unquestionably the best introduction to the subject which has yet been published, and can be heartily commended to all who are interested in it.

ALFRED B. SEARLE

AN INTRODUCTION TO PHYSIOLOGICAL CHEMISTRY. By MEYER BODANSKY, Ph.D. Pp. vii + 440. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. Price 20s.

Dr. Bodansky's book, written to serve as a student's text-book of physiological chemistry, deserves considerable praise. It is throughout accurate in detail, and, what is equally important, it maintains throughout its whole course a wide outlook on the chemistry of life processes which cannot fail to broaden the student's mind and to make him appreciate that biochemistry is not merely the chemistry of urine and blood.

Of a large number of recent text-books of this type that have been published, this one strikes the reviewer as being outstanding. It deals particularly, as the accepted meaning of its title indicates, with the chemistry of the life processes of the higher animals, but the whole treatment of the subject is vitalised by the wide outlook to which reference has just been made. The book maintains the high standard of the publications of this firm.

J. C. D.

COMPANY NEWS

UNITED TURKEY RED CO., LTD.

An interim dividend has been declared on the ordinary shares of 3% actual, less tax.

WALKERS PARKER & CO., LTD.

It has been decided to close down the company's lead works at Bagillt, in the Halkyn district of North Wales, owing to slackness of trade and foreign competition. These works had yielded no profit since 1890. It was decided to close them some years ago when the Welsh mines were worked down to the water level, but during the war the Government endeavoured to unwater the lead mines in the Halkyn district, but without success. The company will retain the property, and the industry will be transferred to their Chester works, 20 miles away, thus affording considerable economy in working costs.

VEREINIGTE GLANZSTOFF FABRIKEN

The general meeting was held on August 27, when it was decided to increase the capital to 69,000,000 marks by the issue of 60,000 ordinary shares at 300 marks each, and 5,000 preference shares at 60 marks each. Of the new capital 8,400,000 marks are to be offered to the old shareholders at 120 marks per share, the remaining 9,600,000 marks capital to be disposed of to the best advantage of the company.

NUERA-ART SILK CO., LTD.

A statement has been issued by the chairman of this company to the effect that "the final option on the Lilienfeld patents for the manufacture of new artificial silks has been exercised by Messrs. Courtaulds and the Vereinigte Glanzstoff Fabriken A.-G.," and that the Nuera Company now enters upon its rights to manufacture the new silks. Every effort is to be made to start production on a commercial scale at the earliest possible moment, and it is anticipated that the new process will prove a commercial success and greatly enhance the prospects of the company. The patents in question relate to the manufacture of a silk of great tensile strength, and in March, 1926, after careful investigation of the processes, the board decided that a company the size of the Nuera would not be able, unaided, to exploit them to the full advantage. Accordingly, in August of last year steps were taken to interest other companies in the processes, and the company investigated them in co-operation with Courtaulds and the Glanzstoff enterprise.

INTERNATIONAL PAPER CO.

The gross revenue for the half-year ended June 30 last amounted to \$7,071,551 (against \$4,431,662 at June 30, 1926), the net revenue being \$2,407,253 (against \$1,277,216). Dividends on the preferred and common stocks absorbed \$2,231,134 (against \$1,349,109), and \$22,463,949 was carried forward (against \$21,854,114).

LEYLAND AND BIRMINGHAM RUBBER CO., LTD.

A final dividend of 2½% actual, less tax, has been declared, making 5% for the year.

ELLIOTT'S METAL CO., LTD.

A dividend has been recommended of 2s. per share on the ordinary shares, less tax.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 81 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.

Lead Hyposulphite.—9d. per lb.

Lithopone, 30%.—£22 10s. per ton.

Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride.—4d.—7d. per lb., carboys extra.

Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.

Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep.—6s.—6s. 3d. per lb.

Zinc Sulphide.—1s. per lb

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9—£9 5s. per ton. Grey, £15 per ton. Liquor, 9d per gal. 32° Tw.

Charcoal.—£8—£9 per ton according to grade and locality.

Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.

Red Liquor.—9d.—10d. 16° Tw. per gal.

Wood Creosote.—1s. 9d. per gal., unrefined.

Wood Naphtha.—Miscible, 4s.—4s. 1d. per gal., 60% O.P.

Solvent, 4s. 3d. per gal., 40% O.P.

Wood Tar.—£4 10s.—£5 per ton and upwards, according to grade.

Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 4½d.—2s. 8d. per gal.

Acid Cresylic, 99/100.—2s. 9d.—2s. 10d. per gal. 97/99.—2s. 1½d.—2s. 5d. per gal. Pale, 95%, 2s.—2s. 3d. per gal. Dark, 1s. 9d.—2s. 2d. per gal.

Anthracene Paste.—A quality, 2½d.—3d. per unit, 40%—3d. per unit; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal. Both according to gravity.

Benzole.—Crude 65's, 10d.—10½d. per gal., ex works in tank wagons; Standard motor, 1s. 3d.—1s. 3½d. per gal., ex works in tank wagons; Pure, 1s. 6d.—1s. 7d. per gal., ex works in tank wagons.

Toluole.—90%, 1s. 4d.—1s. 9d. per gal. Pure, 1s. 7d.—2s. per gal.

Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 2s. 5d. per gal.

Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 9d.—10d. per gal. Heavy, 8½d.—8¾d. per gal. Standard specification, 7½d.—7¾d. per gal. Salty, 7d. per gal., less 1½%.

Naphtha.—Crude, 7½d.—8d. per gal., according to quality. Solvent 90/160, Country, 10½d.—11d. per gal.; London, 1s. 2d.—1s. 4d. per gal. Solvent 95/160, 1s. 4d.—1s. 5d. per gal. Solvent 90/190, Country, 10d.—11d. per gal.; London, 1s.—1s. 4d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £7 10s. per ton. Whizzed or hot pressed, £8 10s.—£9 per ton.

Naphthalene.—Crystals.—£11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.

Pitch, medium soft.—90s.—95s. per ton, f.o.b. according to district.

Pyridine.—90/140.—5s. 9d.—7s. per gal. 90/180.—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.

Acid Amidonaphthol disulpho (1.8.2.4).—10s. 9d. per lb.

Acid H.—3s. per lb. 100% basis d/d.

Acid Naphthionic.—1s. 6d. per lb. 100% basis d/d.

Acid Neville and Winther.—4s. 9d. per lb. 100% basis d/d.

Acid Sulphanilic.—9d. per lb. 100% basis d/d.

Aniline Oil.—7½d. per lb., naked at works.

Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—4½d. per lb.
 m-Cresol 98/100%.—2s. 7½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d. 1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline.—1s. 8d. per lb. d/d.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4d. 2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt, according to quantity. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 3d.—1s. 3½d. per lb. Technical 11½d.—1s. per lb.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone.—6s. per lb.
 Benzozaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb. 12 W. Qts.—11½d. per lb.
 Borax B.P.—24s.—27s. per cwt. Powder 26s.—29s. per cwt, according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 2d.—2s. 3d. per lb. Potassium. 1s. 9½d.—1s. 10½d. per lb. Sodium.—2s.—2s. 1d. per lb. Granulated ½d. per lb. less. All spot.
 Calcium Lactate.—1s. 2d.—1s. 3d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate. 6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., bulk 2s.—2s. 3d. per gal.; Winchesters, 2s. 11d.—3s. 9d. per gal.; 20 vols., bulk 4s.—4s. 3d. per gal.; Winchesters, 5s.—6s. 6d. per gal.
 Hydroquinone.—2s. 11d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 22s. per cwt.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 9s.—12s. 9d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 6s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonol.—9s. 6d.—9s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—2s. 9d.—3s. per lb.
 Phenazone.—4s. 3d.—4s. 6d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 100s. per cwt., less 2½% for ton lots.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins (1000 oz. lots).
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

per cwt. according to quantity, carr. paid any station in Great Britain in ton lots.

Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignor's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 8½d.—1s. 9½d. per lb. Crystal, 1s. 9½d.—1s. 10½d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
 Sulphonol.—6s. 6d.—6s. 9d. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.
 Aubepine (ex Anethole).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzote.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 17s. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. 6d. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. 6d. per lb.—(ex Shui Oil) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrinol.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—18s. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.
 Camphor.—75s. per cwt. Cananga, Java, 26s. per lb. Cassia, 80/85%.—7s. 6d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure.—6s. per lb.
 Eucalyptus, 75/80%.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%, 20s. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 17s. 6d. per lb. Japanese, 8s. 3d. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 10s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Oct. 25th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on September 8th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Fesca, and Fesca & Sohn. Centrifugal separators etc. 21,453. Aug. 15. (Ger., 1.10.26.)

Grönning. Filter. 21,546. Aug. 16.
 Hunt and Wood. Evaporators. 21,435. Aug. 15.
 Johnson (I.-G. Farbenind.). Process of flotation. 21,918. Aug. 19. Driers. 21,985. Aug. 20. Apparatus for separating solid substances of different specific gravity. 21,987. Aug. 20.
 Nes. Manufacture of adsorbing-agents containing silica. 21,803. Aug. 18.
 Ross. Emulsifiers and mixers. 21,617. Aug. 16.
 Saunders. Furnace for drying kilns. 21,939. Aug. 20.
 Siemens A.-G. Purification of gas mixtures. 21,804. Aug. 18. (Austria, 19.8.26.)
 Sterzl. Disintegrating, mixing, etc. materials. 21,926. Aug. 19. (Ger., 20.8.26.)
 Turner. Drying-machines. 21,994. Aug. 20.
 Twiss, and Dunlop Rubber Co. Production of articles from aqueous dispersions. 21,531. Aug. 16.
 Wood. Machinery for grinding, mixing, etc. 21,854. Aug. 19.

I. Complete Specifications

4326 (1926). Marks (Industrial Dryer Corp.). Drying or conditioning. (275,681.)
 9422 (1926). Shell-Mex Ltd., and Lawson. Filters. (275,695.)
 12,691 and 17,508 (1926). Clark. Determining, indicating, and/or controlling moisture-content and quality of materials. (275,741.)
 14,183 (1926). Gröppel, Gröppel, Waschkau, and Scholvien. Settling apparatus for washing granular materials. (253,139.)
 15,598 (1926). Owen. Drying-apparatus. (275,760.)
 17,865 (1926). Elmore. Separation of materials by flotation. (275,778.)
 18,462 (1926). Sweetland. Filters. (275,779.)
 31,421 (1926). Morterud. Evaporation. (263,132.)
 162 (1927). Minter. Kilns. (275,858.)
 3685 (1927). Corlett. Centrifugal separators. (266,693.)
 14,347 (1927). Kehren. Furnaces. (273,671.)
 *19,152 (1927). Appareils et Evaporateurs Kestner. Removal of a substance solidified or condensed on cooling-drums. (275,952.)
 *20,407 (1927). Kohtsch. Separation of solid materials. (275,970.)
 *20,869 (1927). Harter. Apparatus for carrying out exothermic catalytic gas reactions. (275,983.)

II.—Applications

Dewar. Treatment of refractory oils etc. containing sulphur. 21,868. Aug. 19.
 Johnson (I.-G. Farbenind.). 21,918. See V. Purification of montan wax. 21,984. Aug. 20.
 Sanders. Lubricating-oils. 21,837. Aug. 19.
 Siemens A.-G. 21,804. See I.

II.—Complete Specifications

7053 (1926). I.-G. Farbenind. Production of liquid hydrocarbons and derivatives from coal, tar, and the like. (249,155.)
 12,293 (1926). Patart. Regeneration of contact masses for the catalytic hydrogenation of carbon oxides. (252,361.)
 17,865 (1926). Elmore. See I.
 32,189 (1926). Halden. Low-temperature carbonisation. (263,197.)
 32,223 (1926). Duchemin. Gas scrubber. (263,794.)
 5857 (1927). Inray (Allgem. Ges. f. Chem. Ind.). Continuous treatment of hydrocarbons. (275,884.)
 12,795 (1927). Still. Coke ovens. (275,914.)
 14,334 (1927). Chilowsky. Manufacturing gas from heavy oils. (271,899.)
 *7598 (1927). Rütgerswerke A.-G., and Kahl. Production of labile bitumen emulsions. (275,928.)
 *21,181 (1927). I.-G. Farbenind. Destructive hydrogenation of carbonaceous materials. (276,001.)

*21,203 (1927). Florentin, Kling, and Matignon. Obtaining light hydrocarbons from oxygenated organic compounds. (276,007.)

III.—Application

Carpmael (I.-G. Farbenind.). Manufacture of *o*- and *p*-xylene. 21,995. Aug. 20.

III.—Complete Specifications

7053 (1926). I.-G. Farbenind. See II.

15,039 (1926). I.-G. Farbenind. Cyclic hydrocarbons and derivatives thereof. (253,911.)

5857 (1927). Imray (Allgem. Ges. f. Chem. Ind.). See II.

IV. Applications

• Carpmael (I.-G. Farbenind.). Manufacture of green vat dyestuffs. 21,710. Aug. 17.

Geigy A. G. Manufacture of leuco-compounds of vat dyestuffs. 21,440. Aug. 15. (Ger., 16.8.26.)

Gubelmann, Stallmann, and Weiland. 1-Amino 2, 4-dichloroanthraquinone. 21,501. Aug. 15.

I.-G. Farbenind. Manufacture of azo-dyestuffs. 21,892. Aug. 19. (Ger., 19.8.26.)

Johnson (I.-G. Farbenind.). Manufacture of finely-divided azo colouring-matter etc. 21,790. Aug. 18.

Newport Co. Preparation of para-hydroxy-ortho-benzoylbenzoic acid. 21,496. Aug. 15. (U.S., 29.11.26.)

IV.—Complete Specifications

11,815 (1926). I.-G. Farbenind. Manufacture of vat-dyestuffs. (251,996.)

12,282 (1926). Carpmael (I.-G. Farbenind.). Manufacture of azine dyestuffs and intermediates. (275,724.)

12,284 (1926). I.-G. Farbenind. Manufacture of azo dyestuffs. (252,182.)

13,223 (1926). I.-G. Farbenind. Manufacture of vat dyestuffs. (260,910.)

15,039 (1926). I.-G. Farbenind. See III.

20,212 (1926). Newport Co. Preparing nitro-amino-benzoyl-*o*-benzoic acid and its derivatives. (265,545.)

29,163 (1926). I.-G. Farbenind. Manufacture of cyclohexylamines. (261,764.)

*6308 (1927). I.-G. Farbenind. Manufacture of benzanthrone derivatives. (275,927.)

*16,487 (1927). I.-G. Farbenind. Manufacture of coloured compounds. (275,943.)

*21,203 (1927). Florentin, Kling, and Matignon. See

*21,440 (1927). Geigy A.-G. Preparations of leuco-compounds of vat dyestuffs. (276,023.)

V.—Applications

British Celanese, Ltd., Ellis, and Olpin. Treatment of cellulose derivatives. 21,680. Aug. 17.

Carpmael (I.-G. Farbenind.). Degreasing raw wool. 21,996. Aug. 20.

Henkel et Cie Ges. Washing textile fabrics. 21,610. I. Aug. 16. (Ger., 17.8.26.) Detergent compositions. 21,612. Aug. 16. (Ger., 17.8.26.)

I.-G. Farbenind. Opening up materials containing cellulose. 21,442. Aug. 15. (Ger., 13.8.26.)

Leao. Extraction of cellulose from vegetable products. 21,491. Aug. 15.

V.—Complete Specification

*21,442 (1927). I.-G. Farbenind. Opening up materials containing cellulose. (276,025.)

VI.—Applications

Brazier, and Macintosh & Co. Rollers for dyeing, printing, etc. 21,740. Aug. 18.

British Celanese, Ltd., Ellis, and Olpin. Coloration of materials. 21,567. Aug. 16.

Carpmael (I.-G. Farbenind.). Dyeing acetate silk. 21,820. Aug. 18.

Heberlein & Co. Treatment of fabrics. 21,891. Aug. 19. (Ger., 19.8.26.)

VI.—Complete Specifications

13,403 (1926). British Alizarine Co., Ltd., Dawson, Soutar, and Wood. Dyeing of cellulose ester artificial silk (275,752.)

29,488 (1926). Heberlein & Co. Chemically varying vegetable and artificial fibre. (261,793.)

7124 (1927). King. Dressing of textile materials. (275,891.)

VII.—Applications

Azogino Soc. Anon., Tanzi, and Toniolo. Manufacture of non-hygroscopic double salt from calcium nitrate. 21,826. Aug. 18. (Italy, 19.8.26.)

Carpmael (I.-G. Farbenind.). Electrolysis of brine. 21,626. Aug. 16.

Husain and Partington. Process for production of pseudo-perphosphates. 21,962. Aug. 20.

Johnson (I.-G. Farbenind.). Manufacture of ammonia. 21,919. Aug. 19. Production of hydrogen peroxide. 21,986. Aug. 20.

Nes. 21,803. See I.

Petersen. Manufacture of sulphuric acid. 21,439. Aug. 15. (Ger., 28.8.26.)

Robson. Manufacture of sulphate of ammonia. 21,623. Aug. 16.

VII.—Complete Specifications

16,704 (1926). Deutsche Gold- u. Silber-Scheideanstalt. Stabilising hydrocyanic acid. (254,747.)

1885 (1927). Tardun. Manufacture of lead monoxide. (265,190.)

*16,761 (1927). I.-G. Farbenind. Production of anhydrous metal chlorides. (275,945.)

*21,046 (1927). Chem. Fabr. Grossweissandl, and Leidler. Preparing large salammone crystals. (275,991.)

*21,209 (1927). Grothe, and Metallhütte Magdeburg. Treating copper- and zinc-containing lyes. (276,008.)

*21,346 (1927). I. G. Farbenind. Recovery of copper from liquors by precipitation. (276,017.)

VIII.—Applications

British Hartford-Fairmont Synd., and Wardley. Furnaces for treating glassware etc. 21,604. Aug. 16.

Dunn. Pottery kiln etc. 21,746. Aug. 18.

VIII.—Complete Specifications.

25,000 (1926). Rhenania-Kunheim Verein Chem. Fabr. Manufacture of glass containing barium. (259,953.)

*21,343 (1927). United States Metals Refining Co. Magnesite refractories. (276,016.)

IX.—Applications.

Marks (Internat. Precipitation Co.). Manufacture of waterproof plastic Portland cement etc. 21,469. Aug. 15.

Minache. Building material. 21,989. Aug. 20.

Nuttall and Schellings. Building-materials. 21,397. Aug. 15.

IX.—Complete Specifications

19,390 (1926). Schoenhoefer. Producing a plastic material capable of setting and hardening. (275,788.)

9354 (1926). Chem. Fabr. Grunau, Landshoff & Meyer, and Kirchner. Accelerating setting of hydraulic binding-agents. (275,897.)

X.—Applications

Goldsmith and Jackson. Manufacture of metal powders 21,770. Aug. 18.

Hornsey. Treatment of iron ores or oxides. 21,830. Aug. 18.

Johnson (I.-G. Farbenind.). 21,918. See I.

Metals Production, Ltd., and Taplin. Heat treatment of oxidised copper ores. 21,922. Aug. 19.

Wagner. Treatment of oxidised ores etc. 21,494. Aug. 15.

X.—Complete Specifications

3866 (1926). Michel. Protection of magnesium and its alloys. (249,484.)

12,129 (1926). Gustafsson. Producing metals in electric furnaces. (252,162.)

13,227 (1926). General Plate Co. Alloys containing gold. (257,891.)

17,865 (1926). Elmore. *See* I.

19,004 (1926). Hatfield and Green. Treatment of stainless or rustless steels or irons. (275,781.)

19,716 (1926). Crist. Metallising ores and recovery of metals and by-products. (275,791.)

26,903 (1926). Sprenger Patentverwertung Jirotko, and Jirotko. Producing metal coatings on aluminum and aluminium alloys. (275,828.)

1055 (1927). Metallbank u. Metallurgische Ges. Purifying aluminium and its alloys. (265,563.)

4516 (1927). Polanyi and Bogdandy. Apparatus for determining the composition of copper and zinc alloys. (268,306.)

*20,920 (1927). I.-G. Farbenind. Magnesium alloys for pistons of internal-combustion engines. (275,985.)

*21,260 (1927). Schrobsdorff. Producing alloys of very refractory carbides. (276,011.)

*21,346 (1927). I.-G. Farbenind. *See* VII.

XI.—Applications

Asahi Garasu Kabushiki Kaisha, and Ohta. 21,636. *See* XIII.

Barralet, and Damard Lacquer Co. Manufacture of insulation materials. 21,665. Aug. 17.

Carpmael (I.-G. Farbenind.). 21,626. *See* VII.

Internat. General Electric Co., Inc. High-frequency induction furnaces. 21,884. Aug. 19. (Ger., 19,8,26.)

XI.—Complete Specifications

12,129 (1926). Gustafsson. *See* X.

19,266 (1926). Allan. Electrolytic apparatus. (275,785.)

27,620 (1926). Oldham & Son, Ltd., and Clarke. Galvanic batteries. (275,832.)

*19,726 (1927). Lahousse. Composition for electrical insulation or impregnation. (275,958.)

XII.—Application

Akt. Separator. Recovering oil from fatty solutions of proteins etc. in water. 21,809. Aug. 18. (Sweden, 8,9,26.)

XIII.—Applications

Asahi Garasu Kabushiki Kaisha, and Ohta. Producing insulating varnish. 21,636. Aug. 17.

Taylor. Anti-corrosive paint etc. 21,652. Aug. 17.

XIII.—Complete Specifications

12,289 (1926). Light. *See* XX.

24,063 (1926). Becker, and Siemens & Halske A.-G. Manufacture of drying varnishes. (275,813.)

1983 (1927). Hercules Powder Co. Manufacture of high-grade rosins. (275,862.)

*19,692 (1927). British Thomson-Houston Co. Coating materials. (275,955.)

*19,726 (1927). Lahousse. *See* XI.

*20,352 (1927). I.-G. Farbenind. Colouring lacquers. (275,969.)

*21,113 (1927). Soc. Chem. Ind. in Basle. *See* XX.

XIV.—Applications

Brazier, Hurlston, and Macintosh & Co. Manufacture of transparent etc. rubber. 21,843. Aug. 19.

Twiss, and Dunlop Rubber Co. 21,531. *See* I.

XV.—Complete Specification

*21,305 (1927). Geigy A.-G. Preparing mineral-acid-free synthetic tanning-agents. (276,014.)

XVI.—Application

I.-G. Farbenind. Fungicide. 21,597. Aug. 16. (Ger., 16,8,26.)

XVI.—Complete Specifications

20,058 (1926). Liljenroth. Producing a mixed manure containing phosphoric acid and nitrogen. (275,843.)

*21,597 (1927). I.-G. Farbenind. Fungicide. (276,033.)

XVII.—Applications

Henkel et Cie, Ges. Halogen-calcium starch preparations. 21,613. Aug. 16. (Ger., 17,8,26.)

Marks (Corn Products Refining Co.). Purifying sugar. 21,404. Aug. 15. Manufacture of dextrose. 21,465. Aug. 15.

Manufacture of crystalline dextrose. 21,903. Aug. 19. Manufacture of dextrin. 21,904. Aug. 19.

Nes. Purification of liquids containing sugar. 21,802. Aug. 18.

White (Ackers, Lonsdale & Co., and Lonsdale). Treatment of sacchariferous etc. material. 21,828. Aug. 18.

XIX.—Applications

Akt. Separator. 21,809. *See* XII.

Pharmagans Pharm. Institut L. W. Gans. Manufacture of phosphatides. 21,706. Aug. 17. (Ger., 16,2,27.)

XX.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of basic ethers of resorcinol. 21,819. Aug. 18.

Chem. Fabr. vorm. Schering, and Jordan. Manufacture of alkylisoalkylenephenols etc. 21,485. Aug. 15.

Henry, Sharp, and Wellcome Foundation. Preparation of therapeutic substances. 21,544. Aug. 16.

I.-G. Farbenind. Manufacture of anti-serum for treatment of scarlet fever. 21,441. Aug. 15. (Ger., 14,8,26.)

Imperial Chemical Industries, Ltd., and Mendoza. Manufacture of pyrazolones etc. 21,912. Aug. 19.

Pharmagans Pharm. Institut L. W. Gans. 21,706. *See* XIX.

XX.—Complete Specifications

12,289 (1926). Light. Production of aldehyde-amine condensation products. (275,725.)

*21,113 (1927). Soc. Chem. Ind. in Basle. Manufacture of condensation products from formaldehyde and thiourea, or a mixture of thiourea and urea. (275,995.)

*21,203 (1927). Florentin, Kling, and Matignon. *See* IV.

*21,221 (1927). Chem. Fabr. vorm. Schering. Manufacture of thymol, its isomers or homologues, and their hydrogenation products. (276,010.)

*21,300 (1927). I.-G. Farbenind. Manufacture of 1-amino-3-dialkylamino-2-propanols. (276,012.)

*21,441 (1927). I.-G. Farbenind. Manufacture of an anti-serum for prevention or treatment of scarlet fever. (276,024.)

XXI.—Applications

Hermer. Photographic fixing process. 21,630. Aug. 17.

I.-G. Farbenind. Production of photographic films. 21,598. Aug. 16. (Ger., 16,10,26.)

XXI.—Complete Specifications

16,357 (1926). Rieder. Sensitised coatings and processes for photo-etching. (275,763.)

*11,980 (1927). I.-G. Farbenind. Manufacture of photographic plates or films. (275,933.)

*21,360 (1927). Marconi's Wireless Telegraph Co., Ltd. Heat-sensitive recording-papers etc. (276,020.)

XXIII.—Complete Specification

9097 (1926). Sauer. Production of gases for combating vermin. (260,274.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—

Algeria: Coal, coke, briquettes, coal tar, lime, cement, fertilisers for vines and cereals (169). *Belgium*: Beeswax, paraffin wax, tallow (158). *British India*: Chemicals, drugs, medicines, perfumery, culinary essences (152); artificial silk yarn, paper (153); Portland cement, steel solid drawn tubes, cast-iron wheels (The Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E. 1). *Germany*: Heavy and fine chemicals except cresols and phenols (162). *Hungary*: Caustic soda (167). *New Zealand*: Copper tubes and sheets (156); compression testing machine (A.X. 5097). *South Africa*: Insulators (B.3736); steel rivets (B. 3740). *Turkey*: Porcelain insulators (B.X. 3734).

First-Aid Materials

The Chief Inspector of Factories gives notice that by Order dated June 27 the Home Secretary has prescribed that, as from October 1, all materials for dressings contained in the first-aid boxes or cupboards which are required to be provided in pursuance of Section 29 (1) of the Workmen's Compensation Act, 1923, or Regulation 4 (a) of the Docks Regulations, 1925, or Regulation 47 of the Building Regulations, 1926, shall be those designated in, and of a grade or quality not lower than, the standards prescribed by the British Pharmaceutical Codex, 1923.

News from Advertisements

The Appointments Board of the Imperial College of Science and Technology announces particulars of its service (p. vi).

An experienced shorthand typist is required as secretary to a chemist (p. vi).

The University of London, University College, announces particulars of the Ramsay Laboratory of Chemical Engineering (p. vi).

The City of Cardiff Education Committee announces particulars of its courses and open scholarships (p. vi).

An old-established chemical business is for sale (p. vi).

A chemical laboratory assistant is required by the Experimental Department of the Fine Cotton Spinners' and Doublers' Association (p. vi).

A highly-trained chemist requires a junior partnership in a chemical concern (p. vi).

There are 113 firms represented under various headings in our Buyers' Guide.

PUBLICATIONS RECEIVED

CALENDAR OF THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, LONDON, INCLUDING AS INTEGRAL PARTS: THE ROYAL COLLEGE OF SCIENCE, THE ROYAL SCHOOL OF MINES, AND THE CITY AND GUILDS (ENGINEERING) COLLEGE. Session 1927-28. London: Pp. 555. Eyre and Spottiswoode, Ltd., 1927. Price 2s.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF STANDARDS, Washington: Government Printing Office, 1927:—U.S. Government Master Specification No. 485 for Gaskets, Metal-encased. Circular No. 336. Pp. 3. Price 5 c.—U.S. Government Master Specification No. 486 for Packing, Hard Fibre Sheet. Circular No. 335. Pp. 2. Price 5 c.—Organisations co-operating with the National Bureau of Standards. Miscellaneous Publication No. 96. Pp. 11.—Directory of Commercial Testing and College Research Laboratories. Miscellaneous Publication No. 90. Pp. 39. Price 15 c.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF MINES, Washington: Government Printing Office, 1926:—Accidents in the Petroleum Industry of Oklahoma, 1915-1924. By H. C. Fowler. Technical Paper 392. Pp. iv+20. Price 10 c.; Composition of Materials from Various Elevations in an Iron Blast Furnace. By S. P. Kinney. Technical Paper 397. Pp. 22. Price 5 c.; Investigations of the Preparation and Use of Lignite, 1918-1925. By O. P. Hood and W. W. Odell. Pp. viii+204. Bulletin 255. Price 50 c.; Low-Temperature Carbonisation of Coal. By A. C. Fieldner. Pp. iv+46. Technical Paper 396. Price 15 c.; Manual of Testing Methods for Oil Shale and Shale Oil. By L. C. Karriek. Bulletin 249. Pp. v+70. Price 20 c.; Oilfield Emulsions. By D. B. Dow. Bulletin 250. Pp. vi+112. Price 25 c.; Safety Rules for Installing and Using Electrical Equipment in Coal Mines. Sponsored by U.S. Bureau of Mines and American Mining Congress. Technical Paper 402. Pp. v+21. Price 5 c.; Smoke-Abatement Investigation at Salt Lake City, Utah. By O. Monnett, G. St. J. Perrott, and H. W. Clark. Bulletin 254. Pp. v+98. Price 30 c.; Suggestions for the Design of Electrical Accessories for Permissible Mining Equipment. By L. C. Hsley and E. J. Gleim. Bulletin 258. Pp. 47. Price 15 c.; The Bowie-Gavin Process, its Application to the Cracking of Tars and Heavy Oils, etc. By C. P. Bowie. Technical Paper 370. Pp. iv+42. Price 15 c.; Utilisation of Manganiferous Iron Ores. By T. L. Joseph, P. H. Royster, and S. P. Kinney. Technical Paper 393. Pp. 28. Price 10 c.; Heavy Liquids for Mineralogical Analyses. By J. D. Sullivan. Technical Paper 381. Pp. 26. 1927. Price 10 c.; Typical Methods and Devices for Handling Oil-Contaminated Water from Ships and Industrial Plants. By F. W. Lane, A. D. Bauer, H. F. Fisher and P. N. Harding. Technical Paper 385. Pp. 66. Price 15 c.; Underground Limestone Mining. By J. R. Thoenen. Bulletin 262. Pp. vi+100. Price 30c.; Blasting to Lessen Boulders in Hard-Rock Stopes. By E. D. Gardner and S. P. Howell. Technical Paper 383. Pp. iv+23. Price 10 c.; Coal-Mine Fatalities in the United States: 1925. By W. W. Adams. Bulletin 275. Pp. vii+129. Price 20 c.; Dust Respirators, their construction and filtering efficiency. By S. H. Katz, G. W. Smith and E. G. Meiter. Technical Paper 394. Pp. iv+52. Price 15 c.; Iron-Ore (Hematite) Mining Practice in the Birmingham District, Ala. By W. R. Crane. Bulletin 239. Pp. vii+144.—Engine Service Tests of Internal-Combustion Engine Lubricating Oils made from California Crude Petroleum. By M. J. Gavin and G. Wade. Technical Paper 387. Price 15 c.—Accidents at Metallurgical Works in the United States during the Calendar Year 1925. By W. W. Adams. Technical Paper 412. Pp. 40. 1927. Price 10 c.—Cement in 1925. By B. W. Bagley. Mineral Resources of the United States, 1925= Part II: 24. 1927. Price 5 c.—Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1925. Mine Report by J. M. Hill. 1: 17. 1927. Price 10 c.—Explosibility of Coal Dust from Four Mines in Utah. By H. P. Greenwald. Technical Paper 386. Pp. v+20. 1927. Price 5 c.—Problems in the Firing of Refractories. By G. A. Bole, J. Blizard, W. E. Rice, E. P. Ogden, and R. A. Sherman. Bulletin 271. Pp. vii+197. 1927. Price 50 c.—Safeguarding Workmen at Oil Derricks. By H. C. Miller. Bulletin 272. Pp. vi+111. 1927. Price 40 c.—Sand and Gravel in 1925. By E. R. Phillips. Mineral Resources of the United States II: 25. 1927. Price 5 c.—Silica in 1925. By F. J. Katz. Mineral Resources of the United States II: 26. 1927. Price 5 c.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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EDITORIAL

Co-ordination Compounds

THE newspapers have, with considerable unanimity, complained that the presidential addresses and other papers read at the British Association are not intelligible to the ordinary reader, nor even to the trained and well-educated scientific reporter, and that the British Association, as a medium for making science known to the public, suffers in consequence. We think this is undoubtedly true, and that the complaint is well justified. The British Association was formerly important as a means of interesting the public in science and instructing it in some of those controversial topics which in former days attracted so much attention. It is, in spite of some efforts to maintain a certain degree of popularity, no longer such a means. There are reasons for this change, and it may be worth while to state some of them. Fifty or seventy years ago there were highly controversial sections of geology, zoology, botany, and chemistry, the main outlines of which could be understood by those who had only a rudimentary knowledge of these subjects. Many of these sections have been well investigated and explained; the points of doubt and argument now left involve a considerable acquaintance with the subject. In the middle of the last century an amateur could make useful contributions to most sciences except mathematics; no deep knowledge was necessary to appreciate the discoveries of Murchison, Sedgwick, Faraday, Mendel, Boyd Dawkins, Darwin, and Lubbock. All that elementary work, or almost all, has been done; a lengthy training in mineralogy and a well-equipped laboratory are necessary to the modern geologist; the biologist has become a specialist; the modern chemist must not only have an active brain, a good memory and nimble fingers, he must know the essential foundations of physical chemistry, thermodynamics, and an immense mass of organic and inorganic chemistry, much of which is highly technical and difficult. The new work in chemistry which is of fundamental importance, for instance, the conceptions of valency, co-ordination, ionisation and optical activity, can be

put in simple language and made intelligible to many people, but this is, as we know, a laborious business. You can hardly expect the busy man of science, of eminence sufficient to justify his choice as an exponent at the British Association, to spend the time necessary to paraphrase his discourse so as to make it suitable for general consumption; it is hard for the chemist to write so that he is intelligible to all chemists, harder still for him to write so that he is intelligible to the botanist and the engineer. The popular exposition of chemistry is, in our opinion, worth doing, and not very difficult to do, but it is a tedious business involving a great expenditure of time. It is not work for the professor who is capable of original research; his time is too precious for that. Neither the professor nor the student preparing for his examinations can afford the time for this work. If we consider such a subject as co-ordination compounds, we recognise that Dr. Sidgwick has made this plainer to us than any writer whom we recollect; that it is not entirely easy for us to follow is partly due to the complexity of the subject, and partly to the imperfection of our education. We have no right to expect Dr. Sidgwick to do more for us. In the old Daltonian or Cambrian epoch the combination of atoms was easy to understand, and it sufficed to explain all that was known. When Faraday introduced the ion to us, this was no difficulty and no complication. Organic chemistry introduced to us fresh examples of chemical combination, and gradually many types of chemical combination have become known which fit neither the old beliefs nor the old phraseology. Such combination as occurs in alum, in many hydrates, in alloys, solid and liquid solutions, colloids, co-ordination compounds, crystals and so on, is all capable of explanation in terms of nuclei and electrons, and of the electrical attractions between these; you may explain the cohesion of crystals of lithium chloride in terms of atoms or of ions, but you are bound, if you do so, to explain in what sense you use these terms. Our old phraseology is being strained to include new conceptions, and it is a slow business and

involves a good deal of study to learn exactly what meaning should be attached to covalency, polar bodies, ions and so forth, and to explain to the curious public the meaning of co-ordination without employing ambiguous or unintelligible terms. Let anyone try and explain the elements of crystal structure or aqueous solution in simple English, and the magnitude of the task becomes apparent. It is merely the magnitude which is troublesome; it is not a difficult business; anyone with enough brains to solve a cross-word puzzle could do it, but you get very little assistance from the average textbook. It takes a student at a university only a little time to learn the current views on these theoretical points from the professors; it is extremely difficult to learn them from the printed page. We are very grateful to Dr. Sidgwick for placing at the disposal of the chemical public so lucid and careful an account as he has done. Some day the whole gamut of chemical combination from the mere mechanical mixture of alum— if that is a mixture and not a compound, as to which we are uncertain—right down to hydrochloric acid, will be explained to us in simple terms; meanwhile, we are thankful for what we have got. We have a few crystals of copper sulphate on our table, and are ready to listen to anyone who will explain these to us without bringing in the terms "atom" or "ion," neither of which helps us very much. We do not care greatly whether the mortar belongs to this brick or that, or is shared between them, or lent by one to the other, but we should like to know how the pieces fit in to each other and how they stick together.

Human Physiology

Dr. C. G. Douglas, the President of the Physiology Section of the British Association, makes a plea for the further study of human physiology, and points out how much we have yet to learn of the natural causes which regulate the chemistry and the mechanism of the human body. An old writer tells us that ignorance of natural causes disposeth a man to credulity, and credulity, because men love to be hearkened unto in company, disposeth them to lying; so that ignorance itself without malice is able to make a man both to believe lies and tell them. The study of natural causes has thus a moral side as well as a profound effect on our health and well-being. We wish that some chemist would invent a new word for hydrogen ion concentration, for these three words, two of them Greek in origin and one Latin, require a couple of dozen letters and are in very frequent use. It seems that the h. io. con. is the property in the blood which regulates the respiration and circulation in the blood, and Dr. Douglas explains how the addition of acid or its excretion, and the addition of alkali or its excretion, alter the h. io. con. so that this is physiologically and qualitatively nearly equivalent to acidity. The respiratory centre of the brain is sensitive to the h. io. con., and when an excess of acid, usually carbonic acid, in the blood is caused, the brain promptly starts the lungs to work, jams its foot hard on the accelerator as it were, and at the same time increases the speed of the circulation of the oxygenated blood; further analogies will at once occur to everyone who has ever driven a motor-car. We judge from

Dr. Douglas's address that ordinary red blood is chemically a convenient liquid for the storage and release of either oxygen or carbonic acid, and we think it would not be difficult to write much of very little value on the occurrence of red blood in the animal kingdom, with cursory remarks on the exceptional cases of its occurrence in insects, and so on. The human combustion chamber is so elastic that it can enable the lungs to attain a maximum efficiency twenty times as great as the normal minimum. We hope in due course to have a full report of the discussion on hormones and their effect on digestion; meanwhile our curiosity has been excited by an account in *The Times* of the work of Miss Boas, at the Lister Institute, on the poisonous character of the dried white of egg, and how the evil may be averted by potato starch or arrowroot. Eggs, we have heard, may produce asthma, but whether eggs neutralised by potato starch are equally injurious in that respect we know not. *The Times* goes on to explain that physiologically bread should not be eaten without butter, nor porridge without milk. Fortunately, *The Times* has at last acquired a reputation for respectability; otherwise some people might have called it flippant to touch lightly on such cereal topics.

The Empire Mining Congress

The Empire Mining and Metallurgical Congress is held every three years, and this year was held in Montreal in the latter part of August. Great Britain, the senior partner in the Empire firm, was represented by the Rt. Hon. Sir Robert Horne, whose metallurgical activities in connexion with the base metals are very considerable, by Sir Thomas Holland, Sir Richard Redmayne, and others. It was very appropriate that the congress should be held in Canada, for Canada is highly mineralised, and is able to contribute enormous quantities of many metals for the consumption of the Empire. The Empire can supply its own gold, silver, tin, nickel, lead and zinc, and the main supply of the world's nickel comes from Canada, while most other metals are produced there in greater or less quantity. The congress, so we judge from a kind correspondent, was sumptuously entertained in Quebec, Montreal, Ottawa, and Toronto, and several valuable papers were read, including one on magnesia refractories, one on Portland cement, one on smelting titaniferous iron ores, and one on the utilisation of brown coal. The discussions included the consideration of coal and petroleum, and dealt with the mineral resources and methods of production of Canada, Australia, South Africa, and India, as well as other parts of the Empire. We hope at an early date to be able to publish an abstract of many of the more important papers. Such congresses are very pleasant, and they may also be very valuable; we do not now know to what extent nickel, cobalt, chromium, zinc, and certain other metals may become essential in particular industries a few years hence; titanium was once a mere curiosity, aluminium hardly much more. We shall be wise to place on record the production of our Empire mineral resources and the possibilities of further production; the time will come when the demand for metals will increase largely and the convenient sources of supply be much diminished.

CO-ORDINATION COMPOUNDS*

By N. V. SIDGWICK, O.B.E., Sc.D., F.R.S.

When the British Association last met in Leeds, 37 years ago, the attention of Section B was largely devoted to the discussion of ionisation, and at a joint meeting with Section A the new theory of Arrhenius was defended by van 't Hoff and Ostwald against the attacks of S. U. Pickering and Prof. H. E. Armstrong. That meeting may be taken as marking the recognition in this country of the distinction between ionised and non-ionised linkages. It seems appropriate, therefore, that I should devote this address to the discussion of a third species or sub-species of atomic linkage, that of co-ordination.

The theory of co-ordination is indeed by no means new: it is only a few years younger than that of electrolytic dissociation; but its interpretation, and especially the establishment of its relation to the older theory of structural chemistry, have only become possible through the advance made in our knowledge of atomic structure in the last few years: and there are still many points in which its bearing on questions of general chemistry is not yet fully realised.

Werner's theory of co-ordination, which was first put forward in 1891, originated in an attempt to explain the structure of certain compounds formed by apparently saturated molecules with one another. A large number of such compounds, often very stable, had been observed, but they were commonly disregarded by chemists, or were shelved under the convenient name of molecular compounds; and such attempts as had been made to formulate them on the lines of structural chemistry had been conspicuously unsuccessful. The most marked peculiarities of these compounds were three. In the first place their structure appeared to be quite independent of the ordinary rules of valency, according to which the numerical value of the valency of an atom element was primarily determined by the group in the periodic table to which it belonged, first rising and then falling by single units as we go from one group to the next. In these compounds the structure was rather determined by the tendency of four or six atoms or groups to arrange themselves round a central atom. Secondly, in these complexes, a univalent atom or group of atoms such as chlorine or NO_2 could be replaced by a whole apparently saturated molecule such as water or ammonia without affecting the stability of the complex. Thirdly, such replacement was always accompanied by a remarkable change in the ionisation of the molecule. Thus, platinum chloride PtCl_4 combines with six molecules of ammonia forming a compound $\text{Pt}(\text{NH}_3)_6\text{Cl}_4$, in which all four chlorine atoms are ionised. As the ammonia molecules are removed one by one, the chlorine atoms appear to take their places in the non-ionised part of the molecule, until we reach $\text{Pt}(\text{NH}_3)_2\text{Cl}_4$, which is not ionised at all, and is not a salt: every replacement diminishes the positive charge on the platinum complex by one. If more ammonia molecules are replaced by chlorine atoms, the ionisation occurs again, but now the complex has acquired a negative charge, so that we finally reach the well-known "double salt" K_2PtCl_6 .

To explain these phenomena, Werner proposed a theory of molecular structure founded on entirely new principles: that it was determined by the tendency of atoms, irrespective of the periodic groups to which they belonged, to attach to themselves a definite number (usually six, sometimes four, and less often other numbers) of other atoms or groups, which might either be univalent radicals or whole molecules capable of independent existence. These groups together with the central atom formed the "co-ordination complex" and the groups were said to occupy the "first sphere" of combination of the central atom; the molecule might also contain other atoms or groups occupying a "second sphere," which were less firmly attached, and did not count as part of the co-ordination complex. For example, in the hexammine of platinum chloride $[\text{Pt}(\text{NH}_3)_6]\text{Cl}_4$, the ammonia molecules were regarded as occupying the first sphere of the platinum and satisfying its co-ordination number 6, while the chlorine atoms occupied the second sphere. Experimentally the groups in the second sphere were distinguished by the fact that they were ionised in water, while those forming part of the co-ordination complex were not. Werner produced a great mass of evidence in support of these views; the chemical public in general did not, however, pay much attention to them until in 1911 Werner showed that certain compounds of chromium and other elements which, on his theory, should have asymmetric molecules could actually be resolved into their optically active forms. It then became evident that the theory must at least contain a large element of truth.

Thus, some fifteen years ago, Werner had been able to demonstrate that his theory accounted for the structure of a large number of (mainly inorganic) compounds, with which the ordinary structural theory was not able to deal. He himself applied the theory to organic compounds as well: he regarded it as a general theory of molecular constitution, and sought to show that the structural theory failed even in dealing with organic compounds. But this must be admitted to be the weakest part of his argument: he was not really able to prove that the structural theory was inadequate in the sphere of its greatest triumphs, that of organic chemistry.

An impartial critic writing at this time (say, in 1913) might have summed up the position thus: The theory of structural chemistry gives a satisfactory account of the molecular constitution of nearly all organic and a certain number of inorganic compounds, but it is unable to deal with a large number of substances of the latter class. The theory of co-ordination, which proceeds on wholly different lines, is able to explain the structure of those compounds with which the former theory breaks down: it can account for their composition, their properties, their isomerism, and even their stereoisomerism. There thus appear to be two different modes of chemical combination, each holding within its own sphere, but neither applicable to the whole of chemistry. This was obviously a most unsatisfactory position, and one which could only be temporary. It was clear that the true theory of molecular structure when it was discovered must be one which would apply to all compounds, both organic and inorganic, and that

* Presidential Address to Section B—Chemistry, of the British Association, delivered at Leeds on September 1.

the two rival theories, that of structural chemistry and that of co-ordination, must ultimately prove to be two partial aspects of the same general phenomenon.

The final solution of the problem was scarcely to be expected until a more definite idea had been reached of the physical mechanism of atomic linkage, and this could only be attained when more was known of the structure of the atom. The discovery of the electron as a universal constituent of all forms of matter had suggested that it was in this that the mechanism of valency was to be sought; but a further development of our knowledge of the electronic arrangement was necessary before it could be applied in detail to answer the questions asked by the chemist. This development was reached, in the years from 1911 onwards, mainly through the work of Rutherford, Bohr, and Moseley. Through their researches we learnt that the atom consists of a positive nucleus surrounded by groups of electrons, and that each successive element in the periodic table contains one more unit of positive charge on its nucleus than the one before it, and one more planetary electron: the atomic number being at once the ordinal number of the element in the periodic table, the number of units of positive charge on the nucleus, and the number of surrounding electrons. The conceptions of the nuclear atom and of atomic number may be said to give us the empirical formula of the atom. The next stage, the determination of the structural formula, of the way in which the surrounding atoms are arranged, although it is not yet complete, has been so far developed by means of the Bohr theory and its subsequent modifications, that we are now in a position to apply the physical results to the solution of the purely chemical problems of valency and molecular structure.

It is evident that the cause of chemical combination is the striving of atoms to attain more stable arrangements of their planetary electrons by some kind of redistribution. The inert gases, since they do not enter into chemical combination, must already possess an arrangement too stable to be capable of improvement; their atomic numbers therefore give us the sizes of a series of completed or stable groups, and it may be expected that when other atoms combine to form a molecule, they thereby attain these numbers of electrons, or something like them.

The application of these ideas in detail to the explanation of valency was primarily due to Kossel and G. N. Lewis, who published their views almost simultaneously, in 1916. Kossel dealt with ionised links, and showed that their structure could be explained by supposing that they were due to the migration of one or more electrons from an atom which had a few more than a stable (inert gas) number, to another which had a few less; hence the valency in ionised compounds was usually equal to the number of places by which an element was removed from an inert gas, and was positive if it came after the inert gas, and negative if it came before. The more difficult problem of the non-ionised link, such as we find in elementary chlorine or hydrogen, or in methane, was explained by Lewis by the assumption that it is possible for two atoms, each of which is a few electrons short of a stable number, to share electrons in such a way that each counts as part of the constitution of each

atom, thus forming a link which is not merely due to electrostatic attraction, and so cannot be ionised.

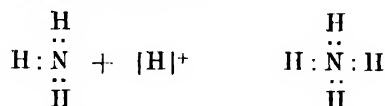
These views of the two fundamental kinds of linkage—ionised and non-ionised, polar and non-polar, or, as Langmuir has conveniently called them, electrovalent and covalent—that one is due to the transference and the other to the sharing of electrons between two atoms, has been confirmed by all subsequent discoveries, and may be taken to be generally accepted. The atomic models on which both Kossel and Lewis founded their theories have indeed been shown to be impossible. These authors supposed that the electrons surrounding the nucleus were at rest, and Lewis in particular assigned to them definite positions in his famous cube, which was subsequently developed in so much detail by Langmuir. We now know that any such static hypothesis is untenable; it involves the assumption of a variety of otherwise unknown forces, and it is incapable of explaining many of the properties of atoms, especially their spectra; whereas all these are accounted for by a dynamic model, in which the electrons move in orbits round the nucleus much as the planets move round the sun. But the conceptions of the transference and the sharing of electrons can equally well be applied to the dynamic model of Bohr.

So far the mechanism of valency at which we have arrived is that of structural chemistry rather than that of co-ordination. The numerical value of the valency of an atom appears equal to the excess or defect of its electrons as compared with the stable number of an inert gas. If it has, say, two electrons in excess, loosely attached and forming an imperfect group, it can lose them and become a divalent cation, or it can share them and so form two covalent links: if it has two electrons less than the stable number it can take up two from another atom or atoms and become a divalent anion, or it can share two electrons belonging to other atoms and become di-covalent; if the excess or defect is two, the valency, of whichever kind, is two also. The next element, with an excess or defect of one, will have a valency of one. We thus arrive at the relation between the valency of an element and its group in the periodic table which was originally pointed out by Mendeléeff. In fact the majority of the structural formulae of organic chemistry can be translated into electronic formulae by the simple process of writing two dots (for two shared electrons) in place of a line. It is important to notice the reason for the two dots—for Lewis's assumption that two shared electrons are necessary for every covalency. The most familiar property of valency, which has been recognised from the earliest times, is that if one atom combines with another it not only uses up one of its own units of combining power, but one of those of the other atom as well. Where the link is ionised, the reason of this is obvious: the electron which one atom loses must be taken up by the other. But the same must hold with covalency also. If the covalent link consisted of a single shared electron, this would not be true. If the atom A could form a covalent link with B merely by sharing one of its own electrons with B, this would use up one of the units of B, since it would increase B's electrons by one; but it would not affect the combining power of A. For example, hydrogen (1) is one

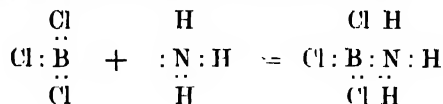
electron short of the stable helium number 2; carbon (6) is 4 short of the stable neon number 10. If in methane (CH_4) each hydrogen atom is attached to the carbon by a single shared electron, then if this electron is derived from the hydrogen it will satisfy the carbon, but will leave the hydrogen still one electron short; if it is derived from the carbon, it will leave the carbon four electrons short of the stable number. In either case the resulting molecule would be unsaturated, whereas it is in fact saturated. It was to meet this difficulty that Lewis assumed that the covalent link consisted of two shared electrons, one derived from each of the two linked atoms. On this hypothesis the carbon in methane shares one of its four valency electrons with each of the four hydrogen atoms, thus increasing the number of each hydrogen to two, and at the same time each hydrogen shares its own electron with the carbon, thus satisfying the carbon.

We have therefore got an electronic mechanism which will account for the two recognised forms of valency, the ionised and the non-ionised. If these are really the only two forms of linkage which can exist in a molecule, it must be possible to extend them so as to account for co-ordination. This is in fact surprisingly simple, and the solution was foreshadowed by Lewis in his paper of 1916. It is clear that the link which attaches one of the groups of a co-ordination complex to the central atom is of the non-polar type. It is an essential point in Werner's theory that such links are not ionised; this is how they are distinguished from the links to atoms in the "second sphere." Thus in the compound $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}_2$ the two chlorine atoms outside the bracket enclosing the co-ordination complex are ionised, while those inside are not. The same conclusion is supported by the fact that the arrangement of the groups in the co-ordination complex round the central atom can give rise to optical activity; for this, as we know from organic chemistry, is only possible with groups which are attached by covalent links, that is, by directed forces. We must therefore look for an explanation of co-ordination in the formation of covalencies, that is, of links formed of pairs of shared electrons. But they must arise in some way different from that which we have hitherto assumed, since their numerical relations are different; their number is not related to the periodic group of the central atom, and also they can be formed with atoms (such as the nitrogen in ammonia or the oxygen in water) which have already completed a stable number of electrons. Now in the normal covalency formation described above it was assumed that one of the two shared electrons of a link came from each of the two atoms concerned. It is obviously possible that both might be derived from one of them; and the recognition of this possibility is all that is required to provide an electronic mechanism for co-ordination. By means of this extension of the idea of covalency formation we can explain all the peculiarities of co-ordination compounds, of which, as we have seen, the most important are the power of further combination shown by apparently saturated molecules such as water and ammonia, the attainment of a valency limit (the co-ordination number) independent of the periodic group to which the atom belongs, and the peculiar change of

electrovalency which accompanies the replacement of a univalent radical such as chlorine by a whole molecule such as ammonia. We may consider these in turn. In nitrogen there are five valency electrons; by combination with three hydrogen atoms this number is increased to eight, giving a molecule of ammonia, in which the octet of the nitrogen is complete and the atom is so far saturated. But, though complete, the octet is not fully utilised: six of its members are shared with the three hydrogen atoms, but the other two are unshared, and so can form a fourth link if another atom can be found which will share them without sharing some of its own electrons with the nitrogen in return. This may happen in a variety of ways. A hydrogen ion, consisting of a single proton with no attendant electron, is capable of taking up two electrons, and, as we all know, if a hydrogen ion meets an ammonia molecule it combines with it to form an ammonium ion



The nitrogen has now shared all its eight valency electrons, two with each of the four hydrogen atoms; but since the ammonia molecule is electrically neutral, while the hydrogen ion is positively charged, the resulting NH_4^+ molecule is also positively charged. Again, boron has three valency electrons; it can share one of them with each of three chlorine atoms (thus completing the octets of the chlorines), and at the same time take a share in one of the electrons belonging to each of the chlorines. This gives boron trichloride BCl_3 , in which the boron has increased its valency group from three to six. The boron cannot combine with a fourth chlorine atom, because, although its own octet is not complete, it has no more unshared valency electrons to offer for a covalent link. But if it meets an ammonia molecule it can share the unshared pair of electrons of the nitrogen, and so form a co-ordinate link:—



In this way each of the two atoms assumes a covalency (or, if we prefer to call it so, a co-ordination number) of four.

The conditions for the formation of a co-ordinate link thus are that we should have one atom which has a pair of unshared valency electrons to offer, and another which has room for one or more pairs of electrons in its valency group. It is convenient to have a symbol and a nomenclature to express this process, and I have therefore suggested that, while the ordinary covalent link is represented by a line $\text{A}-\text{B}$, the co-ordinate link should be written as an arrow $\text{A} \rightarrow \text{B}$, pointing away from the atom which contributes the two electrons of the link; also we may call the atom which lends the electrons (A) the donor, and that which receives them (B) the acceptor.

We have now to apply these ideas to the compounds on which Werner based his theory. Any simple cation—that is, an atom stripped of its valency electrons—can

act as an acceptor. It can build up a valency group by sharing electrons belonging to other atoms, that is, by forming co-ordinate links. Thus the chromic ion $[\text{Cr}]^{+++}$ contains a stable core of twenty-one electrons, and has no valency group; the stability of this arrangement is proved by the stability of the chromic salts. This ion can then form a series of co-ordinate links with molecules of ammonia, by sharing the "lone pair" of electrons of the nitrogen atom. Since the stable size of the valency group for such an ion is 12, six molecules of ammonia will be taken up, and in this way the hexammine $[\text{Cr}(\text{NH}_3)_6]^{+++}$ is produced. We have thus accounted for the power which certain complete molecules possess of combining further through co-ordination.

The next point is to explain the peculiar change of electrovalency which accompanies the replacement of an ammonia molecule by, say, a chlorine atom. It is natural that if an ammonia molecule is removed, this should be replaced by another covalently linked atom, because that is required to maintain the valency group of 12. When the ammonia is removed it takes away with it the two shared electrons which it originally contributed; the chlorine atom which replaces it supplies one electron to be shared by the chromium, but the chromium is called upon to supply the other electron for the link. Thus the chromium is one electron short of its stable number, and must take up an electron from elsewhere to make up the deficiency. In other words the replacement of the ammonia by chlorine will reduce the positive charge on the ion by one unit, giving instead of $[\text{Cr}(\text{NH}_3)_6]^{+++}$ the ion $[\text{Cr}(\text{NH}_3)_5\text{Cl}]^{++}$, or the salt $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$. The same change will occur for every replacement of a whole molecule in the complex by a univalent radical. Thus the very peculiar change of electrovalency which Werner established is a necessary result of the electronic mechanism underlying the linkage. The third important characteristic of the co-ordination compounds is the co-ordination number itself. As we have seen, the most remarkable point about these compounds is that the relation observed in ordinary structural chemistry between the valency of an element and its group in the periodic table disappears. Instead of finding that the valency—the number of links which an atom can form—increases from one in the first group to four in the fourth, and then falls (in the simpler compounds at any rate) to one in the seventh, we find that the co-ordination number is independent of the periodic group, and is usually either six or four. But this again follows necessarily from the theory. So long as the valency is expressed by ionisation, or by normal covalencies to which each atom contributes one electron, it must be limited either by the number of electrons which the atom has to offer, or by the number for which it has room in its valency group; it will therefore be determined by the distance of the atom in question from the nearest inert gas, or, in other words, by the group in the periodic table to which it belongs. In its saturated compounds the atom will usually be left either with an imperfect valency group (like the boron in boron trichloride) or with one which is incompletely shared, like the nitrogen in ammonia. Where co-ordination occurs this limitation is removed;

the atom can give or take as many electrons as may be necessary, and in the fully co-ordinated atom it will have a fully shared valency group. Its maximum co-ordination valency, or co-ordination number, is, therefore, half the number of electrons in its maximum valency group.

In this way the conception of the co-ordinate link as being a covalency, that is, a link of two shared electrons, differing from the ordinary covalency only in this, that the two electrons both come from one of the linked atoms instead of one from each, provides the mechanism required to explain the existence and the properties of the co-ordination compounds of Werner. This conclusion removes the apparent contradiction between organic and inorganic compounds; it refers the structure of molecules of both classes to the same physical principles, and exhibits the original co-ordination theory of Werner and the older structural theory as two aspects of the same general process. It further removes two objections which might have been urged against the co-ordination theory as it was originally proposed. The first of these is that it seemed to assign a unique position to one or two of the atoms in a molecule, which were regarded as "co-ordination centres" in some way governing the structure of the whole. This is obviously an incorrect view of the molecule, in which every atom is in a sense as important as every other. We can now see that this is in fact the case, and that the nitrogen in an ammine, for example, is just as much a centre of co-ordination as the metal. The second point is that the distinction which Werner made between principal and subsidiary valencies, which was always unsatisfactory, now disappears. It originated in a desire to retain the valencies of the structural theory, while recognising the formation of more links than the structural theory would permit. It has long been clear that there was no ground for maintaining the existence of this distinction within the co-ordination complex. The electronic theory shows that the difference between a normal and a co-ordinate covalency is in their method of formation; when they have been formed both alike consist of two shared electrons.

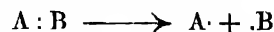
The further application of these ideas to those compounds with which Werner's name is most closely connected is an inquiry of great interest, but I do not propose to pursue it here. I would rather consider some more general questions. We have been led, in seeking an explanation of the structure of co-ordination compounds, to the conception of a third form of atomic linkage in addition to the recognised forms of electrovalencies and covalencies; or, as we should rather say, we have found that a covalency can arise in a second way. This new method is peculiar in that it allows of the combination of apparently saturated atoms or molecules with one another, and it is therefore the condition which makes the association of liquids possible. Links of this type are not confined to inorganic compounds, but are widely spread in organic chemistry, as Werner himself showed. Co-ordination is thus of great importance throughout the whole of chemistry. Now that we understand the physical mechanism which underlies it, we may hope to arrive at some idea of its characteristic properties, and it will be well

to consider what new light these throw on various problems of chemistry in general.

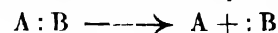
We have already seen that the formation of a co-ordinate link involves the presence of one atom which can act as a donor and another which can act as an acceptor. The donor must have a pair of unshared valency electrons. The acceptor must have fewer valency electrons than it is capable of holding. This raises the question of the maximum size of the valency group. If we maintain the original octet theory, that the valency group cannot exceed eight, and at the same time hold that every covalency involves two shared electrons, it follows that the maximum covalency cannot exceed four. The existence of stable compounds such as sulphur hexafluoride shows that this conclusion is false, and hence that one or other of the two assumptions must be abandoned. Some chemists maintain the octet limit, and explain the existence of atoms with a covalency greater than four by assuming the possibility of a covalent link formed of a single shared electron: they suppose, for example, that in sulphur hexafluoride the sulphur has eight shared electrons, and that two of the fluorine atoms are attached by two electrons each, and the other four by one each. This view seems to me to be untenable. There must be some relation between the mechanism of a link and its behaviour; if not it is of little use to discuss the mechanism. Links of single electrons undoubtedly occur in a limited number of compounds of hydrogen, such as $[\text{H}_2]^+$ and the hydrides of boron (B_2H_6 etc.); but, as we should expect, they are always very unstable. I cannot believe that a substance like sulphur hexafluoride, which is one of the most stable of known compounds, and can be heated to a red heat with sodium without decomposition, can contain four such links. I should therefore abandon the limit of eight for the valency group (as G. N. Lewis has now done), and adhere to the view that in all but a few unstable compounds every covalency involves two shared electrons. On these principles the maximum size of the valency group is twice the covalency or co-ordination maximum. An examination of the structures of known compounds gives strong reason to believe that there is a direct and simple relation between the maximum covalency (co-ordination number) of an atom and its position in the periodic table, and that this depends not on the periodic group, but on the period in which it occurs, so that the co-ordination classification runs horizontally, while the normal valency values run vertically. It would take too long to discuss the evidence for this statement, but I may give the conclusions. The maximum covalency of hydrogen is 2: that of elements in the first short period (lithium to fluorine) is 4: that of elements in the second short period (sodium to chlorine) and the first long period (potassium to bromine) is 6: and that of the later elements is 8. The maximum number of electrons in the valency group is, of course, twice as great, being 4, 8, 12, and 16, respectively. No physical reason for these facts can as yet be given, but a certain relation can be traced between the numbers and those of the grouplets of the Bohr theory as modified by Stoner and Main Smith.

The next question is the difference in properties which is

to be expected between the normal and co-ordinate covalencies. These are essentially of two kinds. In the first place the co-ordinate links are in general less stable. The stability of a link depends on the work required to break it, or, in other words, on the difference of energy content between the original molecule and the products of the rupture of the link. Hence, the more unstable these products are, the more difficult it is to break the link. The rupture of a normal covalency leads to the production of two univalent radicals



that is, of two highly unstable products. But a co-ordinate link can break by the return of the two shared electrons to the atom to which they originally belonged

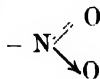


and one at least of the products is now a molecule capable of independent existence. Thus, the products of the rupture of a co-ordinate link are, as a rule, more stable than those formed by breaking a normal covalency, and the co-ordinate link is therefore less stable. This difference is particularly marked in rings containing co-ordinate links, those which Prof. Morgan has called chelate rings: these are far more sensitive to strain, owing to the weakness of the co-ordinate link, than the ordinary rings of organic chemistry; while the latter are known of every size from 3 to 18 members, chelate rings almost invariably contain either 6 or 5; a few 4-rings are known, and one or two 7- and 8-rings; but none with less than 4 or more than 8 members. This explanation of the difference in strength between normal and co-ordinate links is of considerable importance; the fact is beyond dispute, and if we are to maintain that the mechanism of both forms of linkage is the same, consisting in the sharing of two electrons, we must be able to give a reason for this difference in stability.

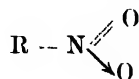
The second point of difference is that while the normal covalency involves no considerable disturbance of the electrostatic equilibrium in the molecule, this is not true of the co-ordinate link. In the normal link between two atoms, each atom shares one electron with the other atom. If the electrons were shared equally between the two, there would be no electrostatic disturbance at all. We do not know enough about the dynamics of the sharing of electrons to say how nearly this is true, but the properties of ordinary covalent compounds indicate that it is not far from the truth, and that the shared electron usually divides its time more or less equally between the two atoms which share it. But when a co-ordinate link is formed between two originally neutral atoms, one of them loses and the other gains a share in two electrons. Hence, the acceptor must receive a negative charge from the link and the donor a positive charge. This fact is expressed by some chemists, such

as Prof. Lowry, by writing the link $\overset{+}{\text{A}}-\overset{-}{\text{B}}$ instead of $\text{A} \rightarrow \text{B}$. A molecule containing such a link is therefore an electrical dipole. This electrostatic disturbance will have two chief results: it will increase the dielectric constant of the substance, and it will increase the attraction of the molecules for one another, and therefore diminish the volatility. That this does actually

occur we have plenty of evidence; I may give a few examples, selected from non-associated substances, in order to avoid the complications which association might produce. While the value of the dielectric constant for hydrocarbons is about 2—3, for ethers about 4, and for esters about 7 (all these being free from co-ordinate links), it is greatly increased by the introduction of a nitro-group

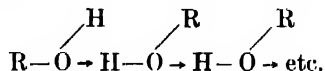


which contains this link, and is for nitromethane 39 and for nitrobenzene 36. The effect on the boiling point is seen by comparing the alkyl nitrites $\text{R}-\text{O}-\text{N}=\text{O}$ with the isomeric nitro-compounds



the latter boil from 50° to 100° higher than the former. Many other examples might be quoted.

These examples suggest the consideration of associated liquids. As long as we were at liberty to invent new kinds of subsidiary valencies, the existence of association caused no trouble. But now that we claim to have discovered the mechanism of atomic combination, we must identify the link between the molecules of an associated substance with one or other of the forms of link that we have recognised, and it is evident that the co-ordinate link is the form required. We ought, therefore, to be able to find in every associated substance a donor and an acceptor atom. Such atoms are always found to be present: in the most familiar class of associated compounds, those containing hydroxyl groups, the oxygen atom of this group, with its two pairs of unshared valency electrons, is the donor, and the hydrogen atom, being able as we have seen to increase its valency group from two to four, is the acceptor. We thus get the possibility of an indefinite degree of polymerisation:—



That the association does depend on the two atoms of the hydroxyl group is shown by the fact that if we replace either the oxygen by sulphur or the hydrogen by an alkyl group the association disappears: neither the mercaptans nor the ethers are associated. Associated substances possess the properties which we have seen to accompany the co-ordinate link, the high dielectric constant and the low volatility. The latter property is commonly taken to be sufficiently explained by the rise of molecular weight which the association produces, but unless this is much greater than we have any reason to suppose, it will not account for the whole effect. For example, the ethers boil about 60° lower than the corresponding thio-ethers; hydrogen sulphide boils at -61°, and so unimolecular H_2O should boil about -120°. If the real formula of water is H_4O_3 (and it is very improbable that its average polymerisation is even as great as this at 100°), its true molecular weight is not 18, but 54. This will account for a rise in the boiling

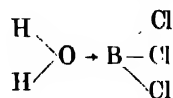
point, but not for so large a rise as is actually found. Hydrogen selenide (mol. wt. 81.2) boils at -42°, and butane (mol. wt. 58) at +1°. Evidently the polymerised molecules themselves are much less volatile than corresponds to their molecular weights, as we should expect from the presence of the co-ordinate link. The high values of the dielectric constant (water, formamide, and hydrogen peroxide about 80, methyl alcohol 35, ethyl alcohol 27) are further evidence of co-ordination. This reference to the dielectric constant raises a point which is worth mentioning, although I cannot discuss it in detail here. In some modern developments of the theory of organic reactions great stress is laid on the dipole moment of such groups as hydroxyl. The values of these moments are calculated from the dielectric constants of the hydroxylic compounds, and are assumed to apply to the single unassociated molecules. Now, since we have seen that the association itself must increase the dielectric constant owing to the co-ordination of the molecules with one another, it is by no means certain that values so obtained hold good for the unpolymerised hydroxyl group. It is, of course, quite possible that the same conditions which make the hydroxyl group so ready to polymerise also give it a high dipole moment even in the simple molecule; but the rise in the dielectric constant which the association itself must produce is a factor which must be taken into account, especially as it is one which will vary with the temperature.

This view that association is due to co-ordination throws light on the behaviour of a group of substances whose position was hitherto rather puzzling. There are many substances, such as sulphur dioxide, ethers, and amines, which behave in many ways like associated liquids, and yet when they are directly tested are found not to be associated; they are volatile, and give simple values of the molecular weight in the pure state and in non-associated solvents. It has long been a problem how such substances should be classified. It is now clear that they contain only one of the two elements necessary to co-ordination: they have donor atoms (oxygen or nitrogen), but no acceptor atoms (the acceptor properties of hydrogen attached to nitrogen are for some reason very weak). They are thus incapable of polymerisation, and in the presence of non-associated liquids they behave as normal non-associated substances. But in the presence of a substance capable of association, and so containing acceptor as well as donor atoms, they behave as associated substances.

These considerations emphasise a very important and far-reaching characteristic of the co-ordinate link, its one-sided nature. The two atoms taking part in it perform quite different functions; and in determining the structure of a co-ordination compound it is essential to show which of the two co-ordinated atoms is the donor and which the acceptor. This distinguishes the electronic view of co-ordination from the subsidiary valency theory of Werner and his school; there was no apparent reason why two atoms which could form subsidiary valencies with a third atom should not also form them with one another. We can see now that such a linkage is impossible; there must be the necessary opposition in character between the two atoms before

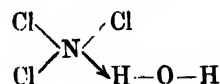
co-ordination can take place. It is true that Werner himself was saved by his almost uncanny insight into molecular structure from falling into this error, but there was nothing in his theory to save him from it, and not all his followers had as true an intuition as he had himself. The recognition of this distinction, to which the electronic interpretation directly leads, is a definite advance.

Among the more important developments of the theory of co-ordination which must be expected in the near future, its systematic application to organic chemistry must take a high place, for it is by the study of organic compounds that we really can examine in minute detail the influence of structure on properties. The very existence of organic chemistry—the fact that the compounds of carbon form a group at least as numerous and important as all other chemical compounds together—can only be fully explained by reference to the theory of co-ordination. Werner pointed out long ago that the unique position of carbon was due to the fact that its valency and its co-ordination number were identical. This we should now express by saying that as it has four valency electrons it can obtain a fully shared octet by normal covalency formation and without the production of co-ordinate links. But this is not all. Since carbon is in the first short period of the table, this octet is incapable of further expansion. Hence the ordinary saturated quadrivalent carbon atom is incapable of acting either as an acceptor or as a donor, and for this reason it is peculiarly well protected from the attack of other atoms. This is undoubtedly the chief cause of the remarkable sluggishness ("trägeit," as Victor Meyer called it) so characteristic of carbon, a disinclination to react which gives comparative stability to a large number of thermodynamically unstable compounds. That this explanation is sound may be seen by comparing the behaviour of the halides of carbon with that of the halides of neighbouring elements. Most non-metallic halides are readily hydrolysed by water, and we may assume that the hydrolysis is preceded by a combination (through the formation of co-ordinate links) of the water with the halide. In boron trichloride, for example, the incomplete octet of the boron completes itself by sharing a pair of electrons from the oxygen of the water, forming the compound



analogous to the ammonia compound discussed above. A hydrogen and a chlorine atom then separate as hydrochloric acid, leaving a hydroxyl group attached to the boron, and by the repetition of this process the hydrolysis to boric acid is completed. The same reaction occurs with silicon tetrachloride, because, although the silicon has already a complete octet, it can expand this to a group of 12, since it is in the second period. With nitrogen the position is not quite the same. In the trichloride NCl_3 the octet of the nitrogen is complete, and it is incapable of expansion; but it is not fully shared, and contains a lone pair of electrons. Hence, though it cannot be an acceptor, it can be a donor. It

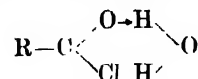
forms a co-ordinate link not with the oxygen, but with the hydrogen of the water, giving



The chlorine then reacts with the hydroxyl, forming hypochlorous acid, while the hydrogen remains attached to the nitrogen, the ultimate product being ammonia. The truth of this hypothesis of intermediate co-ordination with the water is strongly supported by the fact that it explains the unusual production of hypochlorous acid from chlorine attached to trivalent nitrogen.

But carbon tetrachloride cannot react in either of these ways. It has a complete octet, and cannot increase it, and the octet is fully shared, so that it cannot act as a donor. It therefore does not react at all. The remarkable inactivity of carbon tetrachloride has long been regarded as an unexplained anomaly, but we can now see that it is a necessary consequence of the theory of co-ordination. If we want to find a similarly inactive halide of an element in a later period, where a valency group of 12 is possible, we must obviously choose one in which this group of 12 is fully shared and also is incapable of further expansion. Examples of this are the hexafluorides of sulphur and selenium, whose inactivity is as remarkable as that of their carbon analogue. Tellurium hexafluoride on the other hand is hydrolysed by water, since its valency group of 12 can expand to 16, and the tellurium can therefore (like silicon in the tetrahalide) act as an acceptor.

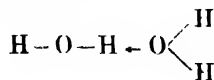
Now the carbon atoms in an ordinary saturated organic compound all resemble that in the tetrahalide in having fully shared valency groups of the maximum size. They are therefore incapable of the most obvious form of reactivity, which begins by co-ordination with a reagent molecule: if they are to react at all, it must be through some other atom in the molecule. It is a significant fact that one of the most elementary rules of organic chemistry is that a carbon atom united only to other carbon atoms or to hydrogen or the halogens is very slow to react, but that the introduction of a single oxygen atom into the molecule facilitates reaction. The comparison of the paraffins with the ethers or alcohols, of the ethers with the esters and the esters with the acid anhydrides, or of the alkyl halides with the acyl halides, illustrates the effect which an oxygen atom may have on the stability of a molecule. It seems natural to relate this effect to the strong donor properties which oxygen exhibits, and to suppose, for example, that the rapid hydrolysis of an acyl halide is due to the formation through the oxygen of a compound



in which the hydrogen of the water is brought into close proximity with the chlorine, while the relative inactivity of an alkyl halide is the result of its inability to form such a compound.

I make these suggestions (which might easily be extended) because it seems to me that in the intensive modern study of the influence of structure on the

reactivity of organic compounds this side of the question has been too much neglected. Great attention has been devoted to the consideration of the effect of other atoms in the molecule on the strength of a particular linkage. A new mechanism and a new terminology—or perhaps more than one—have been invented to account for the results. This mechanism is described in terms of physical concepts, and although it appears to me that the properties which are assigned to these concepts need considerable modification before they can be accepted by the physicist, there is no doubt that this mechanism enables its inventors to correlate a large number of important generalisations, so that some real truth must underlie it, although we may at present be in some doubt as to what that truth exactly is. But I think these chemists have tended to rely too much on supposed modifications of the linkages within the molecule, and have not sufficiently considered the possibility of the formation of co-ordination compounds with the reagents employed, such as those which I have suggested above. The effect of one atom in a molecule in hastening the replacement of another may not be due merely to a weakening of the attachment of the latter, but may be caused by the formation of a co-ordinate link through the former, or this may promote co-ordination through some other atom in the molecule. We know now that even in purely “organic” compounds—quite apart from those organo-metallic compounds which the old-fashioned organic chemist regarded with so much distaste—co-ordination is of frequent occurrence. In the particular form of the production of chelate rings, that is, in the form of co-ordination between two atoms of the same molecule, it has been shown to occur in β -diketones and β -ketoesters, in many ortho-substituted phenols, and in α -keto-oximes, and to be responsible for much of the chemical as well as the physical peculiarities of these substances; and in the more general form of association or “molecular compound” formation its occurrence is widespread. Formerly the production of such compounds was ascribed to some inferior and rather contemptible form of valency, possibly to a force acting not between atoms at all, but between whole molecules, and so the influence of their formation on what were regarded as the reactions of genuine valencies was naturally taken little into account. But we now realise that they owe their existence to the production of co-ordinate links, and that the co-ordinate link is in essence the same as a normal covalency. The co-ordinated hydrogen, for example, as in



is attached to each of the two oxygen atoms by means of two shared electrons. The link on one side is just as genuine as that on the other, although, owing to the difference in the states of the two oxygen atoms, one of them may separate more easily. It therefore seems probable that the formation of such a link may often be a preliminary stage to the complete transference of the hydrogen from one point of attachment to another, and that the possibility of its formation may be a necessary condition of reaction. We have further to recognise

another way in which reaction may be promoted by co-ordination, which is illustrated by the example I gave of the hydrolysis of an acid chloride. The formation of a co-ordination compound between two molecules may bring two atoms into proximity with one another, and so favour their reaction. In developing this possibility we have to consider the stereochemical relations. The study of chelate rings has shown us what forms of ring are most stable; owing to the weakness of the co-ordinate link which they contain such rings afford, as I have already pointed out, a more delicate test of strain than the ordinary rings of organic chemistry. Thus we find that a chelate ring of six atoms, including double links, is formed with peculiar ease. From this we may conclude that when a chain of atoms is formed by co-ordination which includes one or two double links, the sixth atom of this chain will be able to approach the first very closely, and so may be expected to react with it. In these and other ways the consideration of possible intermediate co-ordination products may provide the clue to many organic reactions.

If this line of thought is to be pursued, there is a preliminary question which requires investigation. We have seen that two conditions are essential to the formation of a co-ordinate link, the presence of an atom with an unshared pair of valency electrons (the donor), and of another (the acceptor) which can add two electrons to its valency group. But these conditions, though necessary, are not sufficient. They are both fulfilled in most organic molecules other than those of hydrocarbons. The normal hydrogen atom has only two electrons, and it can hold four: every halogen atom, every oxygen atom, every trivalent nitrogen atom has an unshared pair of valency electrons; and yet halides, ethers, and amines are not as a rule associated. For co-ordination to take place it is necessary not only that such atoms should be present, but also that they should be so linked that they are able to exercise their donor or acceptor properties. Hydrogen, for example, is a powerful acceptor when it is joined to oxygen or fluorine: it is a weak acceptor when it is joined to nitrogen; it is practically not an acceptor at all when it is combined with carbon or one of the heavier halogens. We cannot at present explain these differences in behaviour, but it is quite easy to show that they exist. In the same way the donor properties of oxygen are very largely influenced by its state of combination. If the influence of co-ordination on reactivity in organic compounds is to be studied in detail, the first necessity is a knowledge of the factors which promote co-ordination itself, and this can only be attained by a careful examination of the facts from this point of view; a thorough investigation of the influence of substitution on the tendency of molecules of a particular type to associate with themselves, or to form addition compounds with other substances, would no doubt throw much light on the question. It would be particularly interesting to know what is the effect on activity, both in donors and in acceptors, of the peculiar tendencies to reaction which the modern organic chemist represents by positive and negative signs.

I have tried in these remarks to emphasise the fact

that the modern electronic interpretation of the theory of co-ordination has a value far outside the range of those compounds which the theory was originally devised to explain. There is too great a tendency even now to regard the question of co-ordination as one which is of interest only in connection with a highly special group of substances which the ordinary chemist rarely meets, whereas in truth the study of this question has given us a wider and a truer conception of the nature of the processes by which molecules are built up. The determination of the factors which influence chemical reaction is perhaps the most important of the fundamental problems of chemistry, and it is essential that the factor of co-ordination, with the new possibilities of reaction-mechanism which it opens up, should be recognised and investigated.

CANADIAN INDUSTRIAL NOTES

The salt production of Canada for 1926 was 262,547 tons, an increase of 12 per cent., and the value of output \$1,480,149. The average price, for all grades, showed a decline from \$6.04 in 1925 per ton to \$5.63 in 1926. The imports of salt amounted to 188,401 tons, valued at \$1,036,594.

The Canadian Explosives, Ltd., which is closely affiliated with Nobel's Industries, Ltd., Great Britain, and a holding company for the following six operating concerns Canadian Explosives, Ltd., Canadian Giant Company, Ltd., Dominion Cartridge Company, Ltd., Canadian Fabrikoid, Ltd., Flint Paint and Varnish, Ltd., and Arlington Company of Canada, has changed its corporate title to Canadian Industries, Ltd. Holders of Canadian Explosives common stock will receive six shares of the new company's stock for one share of the old, giving the company an issued common capital 649,950 of no par value shares. There will also be outstanding \$4,650,000 of preferred stock similar to that of the old company.

The Standard Chemical Co., Ltd., of Canada, engaged in the manufacture of acetates, methyl alcohol, acetone, charcoal, etc., has submitted to the shareholders the details of a proposed capital reorganisation. The authorised capital of the company is \$5,000,000, divided into 37,500 shares of 7% cumulative preference stock of total par value of \$3,750,000, of which \$3,602,700 is outstanding; 12,500 shares of common stock of total par value of \$1,250,000, all issued. The arrears of dividends on preference shares cover a period of thirteen years. The reorganisation proposal is to have only one class of stock, of no par value, and each holder of the present preference shares will receive one of the new, and each holder of ten shares of the present common will receive one share of the new issue. Within the past few years the company has closed and dismantled works at Sault Ste Marie, Thornbury, Cookshire, Weedon and Donald because of inability economically to operate them, partly due to exhaustion of wood supply and market conditions of the products. Considerable stock in the company is held in Britain.

The Canadian Salt Co., Ltd., is replacing its old Grainer plant, at Sandwich, Ontario. A new and completely modern plant will be erected at a cost of about \$150,000.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICE

CHEMICAL SOCIETY'S LIBRARY

The library of the Chemical Society is closed each evening at 5 o'clock until September 10.

CALENDAR OF FORTHCOMING EVENTS

Sept. 12 to 14.—INTERNATIONAL SOCIETY OF LEATHER TRADERS' CHEMISTS. Bi-Annual Conference in London. (See CHEM AND IND., August 26, p. 768.)

Sept. 13.—SOCIETY OF CHEMICAL INDUSTRY. Official Visit to the Shipping, Engineering and Machinery Exhibition at Olympia, London, W.

Sept. 14.—INSTITUTION OF SANITARY ENGINEERS. Visit to the Shipping, Engineering and Machinery Exhibition at Olympia.

Sept. 20, 21, and 22. IRON AND STEEL INSTITUTE. *Glasgow Meeting.* Royal Technical College, Glasgow, commencing each day at 10 a.m. (See CHEM. AND IND., Sept. 2, p. 786.)

Sept. 23 to 26.—ASSOCIATION OF SPECIAL LIBRARIES AND INFORMATION BUREAUX. Fourth Conference, Trinity College, Cambridge. Amongst the papers to be read are the following:—"The necessity for uniformity in the cataloguing of periodicals," discussion to be introduced by Dr. W. Bonser, Mr. J. F. Pownall, and Miss H. A. Ball. "Recent developments in connexion with the science library, South Kensington," by Col. Sir H. G. Lyons. Brief statements will be given on the work of the International Institute of Intellectual Co-operation (Paris), the International Institute of Bibliography (Brussels), the World List of Scientific Periodicals, etc. "Rationalisation in industry," by Major L. Urwick. "Forecasting of industrial and trade tendencies; the function of statistics in modern industrial organisation," by (a) H. Quigley and (b) W. Wallace. "Trade information and statistics in Great Britain as compared with other countries," by A. E. Overton. Papers dealing with patent classification, and the methods of searching patent specifications in Great Britain, Germany, and the United States, will be given. "Information bureaux and liaison with national and local libraries," by A. F. Ridley. "Special library from the administrative standpoint, with special reference to methods of indexing and filing," by P. K. Turner. "Information bureau in relation to the consultant," by Dr. J. C. Withers. Discussion on "New methods of photographic reproduction as applied to printed and MS. material." A panel of expert translators; discussion to be introduced by Dr. R. S. Hutton. "Standards of book selection in science and technology," by Sir Richard Gregory, followed by a discussion. (See CHEM. AND IND., Sept. 2, p. 788.)

Sept. 26 and 27.—CERAMIC SOCIETY. *Refractory Materials Section Meeting.* Town Hall, Bournemouth, commencing at 10 a.m. each day. The following papers will be read:—"A consideration of steel works refractories," by A. T. Green. "Note on silica bricks made without added bond," by W. J. Rees and W. Hugill. "Some experiments in the drying of clays," by R. S. Troop. "Crushing strength of unfired fire-clay bodies," by W. C. Hancock. "Determination of iron silicates," by A. E. J. Vickers. "Refractory material used as mortar for laying up refractories," by Prof. D. A. Moulton. "Characterisation of clay," by Dr. A. F. Joseph. Discussion to be opened by S. R. Hind. "Effects of temperature on the mechanical properties of silica products," by A. J. Dale.

Oct. 5.—INSTITUTION OF SANITARY ENGINEERS. Opening Sessional Meeting.

Oct. 7.—SOCIETY OF CHEMICAL INDUSTRY. *Manchester Section.* Chairman's Address, by C. J. T. Cronshaw.

THE INSTITUTE OF METALS

Dr. L. Aitchison, of Birmingham, gave the opening lecture of the annual meeting of the Institute of Metals at Derby on September 6, with the president, Sir John Dewrance, K.B.E., in the Chair. Dr. Aitchison said that the reasons for the employment of the non-ferrous metals in our various systems of transport are very similar to those that govern their utilisation in all other branches of engineering. The non-ferrous metals and alloys are only needed when they can offer certain chemical or physical properties that are required by the engineer, and that are not possessed by iron and steel. In general, the properties that lead to the greatest employment of the non-ferrous metals and alloys are:—(1) A high resistance to corrosion; (2) high values of thermal or electrical conductivity; and (3) a low value of specific gravity. In addition, the properties of ease of machining, ease of cold working, and simplicity of casting contribute to the wider usefulness of the materials.

The use of non-ferrous metals on account of high electrical or high thermal conductivity is particularly illustrated by the purposes to which copper is put. This metal enters very extensively into the construction of electrical plant, whilst its thermal conductivity is made use of in boiler tubes and the like.

A high resistance to corrosion is a conspicuous feature of nickel and its alloys. These metals are not very extensively used in connexion with transport, but an example is found in cupro-nickel condenser tubes. Many examples of good resistance to corrosion are found in the alloys of copper. Typical illustrations of the use of this metal and its alloys on this account occur in condenser tubes and turbine blading, as well as in gun metal and phosphor bronze castings, which are extensively employed in ship construction.

The use of metals having a much lower specific gravity than iron and steel, and having at the same time mechanical properties comparable with those of the ferrous metals, is of great importance in transport systems. The alloys actually employed are those based upon aluminium and magnesium. The alloys of aluminium at the present time are, of course, much more extensively employed than the alloys of magnesium, and the aluminium materials find their way into a great many parts, both in the cast and in the wrought condition. A variety of aluminium casting alloys can be employed, and are more or less interchangeable, but most of the wrought parts are made in duralumin.

An important branch of modern transport is that comprised by aeroplanes, seaplanes, flying boats, and airships, and in all these branches of transport lightness is a property which is prized very greatly. The employment of the non-ferrous metals in these different forms of aeronautical structure, as well as in the engines that are employed to drive them, afford very interesting examples of the value to the engineer of the low specific gravity of the light aluminium alloys—these being one third of those of the irons and steels.

Another field into which non-ferrous metals enter very largely is that of anti-friction materials. These are of various kinds, having tin, or lead, or copper as their basis. They are able to act in a way that no steel or iron is able to rival.

Dr. Marie L. V. Gayler discussed the effect of under-cooling on the macro- and micro-structure of some silicon-aluminium and copper-aluminium alloys. It has been found impossible to under-cool "modified" silicon-aluminium alloys systematically, and it has been shown that the curves of solubility represented by the "modified" diagram correspond closely to the supersolubility curves of the "normal" alloys.

Dr. A. G. C. Gwyer and H. W. L. Phillips dealt with the constitution of binary alloys of aluminium with silicon and with iron. The eutectiferous nature of the aluminium-silicon system has been confirmed, and special attention paid to the solubility of silicon in solid aluminium. The position of the Al-FeAl₃ eutectic has been redetermined, and the structure of the alloys lying towards the middle of the constitutional diagram has been, it is thought, elucidated. The paper also dealt with the constitution of certain of the ternary alloys of aluminium, silicon, and iron, under both equilibrium and metastable conditions. The latter are of considerable practical importance, because they are met with not only in commercial alloys, but also in commercially pure aluminium.

Mr. A. R. Raper gave a paper on "The equilibrium diagram of copper-tin alloys containing from 10 to 25 atomic per cent. of tin." This investigation on the copper-tin alloys forms a continuation of the work done by Stockdale on this system. The alloys were examined both by thermal and micrographic analysis, and the results obtained confirm in many respects the classical work of Roberts, Austen and Heycock and Neville. The α - β boundary shows a sudden change in direction at 580°, which, together with other micrographic evidence, favours Stockdale's view of a polymorphic change of the β constituent. The eutectoid point has been found to be at Sn 16.15 (or 73.15% Cu by weight), the temperature of the inversion being 520°. The "transformation" curve has been determined carefully by thermal analysis, and the results are entirely in agreement with those of Roberts-Austen and Stansfield. In particular, the slight horizontal indicated by them at about 610° has been confirmed. As determined by the present author, it exists from Sn 22.5 to Sn 25 at a temperature of 638°. The inclusion of this new horizontal in the diagram makes the interpretation of this region easier, and evidence for a new eutectoid at Sn 23 has been obtained.

Discussing the "Effect of work and annealing on the lead-tin eutectic," Mr. F. Hargreaves found a marked softening action of work at air temperature on the lead-tin eutectic. With 78% reduction in thickness, the Brinell hardness is reduced from about 14 in the chill-cast condition to 4.2 when tested immediately after hammering. This value is actually lower than that of either constituent in the pure state.

"The reaction between solid magnesium and liquid tin" was described by Dr. W. Hume-Rothery. The reaction was studied between 250° C. and 350° C. in order to see whether reactions of the type, primary solid X + liquid = secondary solid Y, can proceed when the solid phase concerned do not form solid solutions. When a rod of magnesium is stood in a limited quantity of molten

tin, the magnesium dissolves until the liquid reaches the equilibrium composition at the particular temperature concerned. Since, however, true equilibrium requires the compound Mg_2Sn (probably Mg_4Sn_3) as the phase in equilibrium with the liquid, a further reaction of the type, solid magnesium + liquid = solid magnesium stannide, tends to take place, and the above point can be tested, since no solid solutions are formed. The experiments show that when sufficient magnesium has dissolved to give the liquid the equilibrium composition, all further direct reaction is stopped by a thin film of magnesium stannide which shows no appreciable thickening even after three weeks at the above temperatures. On the other hand, a few large crystals of magnesium stannide are sometimes formed by a slow reaction. This is probably the ordinary phenomenon of crystal growth due to surface energy effects, since the thin surface film has a high surface energy and so tends to form a more compact mass. But any solution at one point exposes more magnesium to the action of the liquid, and so the reaction gradually proceeds. The experiments are of interest in connexion with the fundamental principles underlying soldering and other reactions between solid and liquid metals.

A paper by W. T. Cook and W. R. D. Jones dealt with the forging of copper-magnesium alloys. The properties of the alloys in the forged and heat-treated conditions were examined. The ductility of these alloys depends primarily on the forging temperature. If this temperature be low the elongation and the reduction of area are impaired seriously, and the values are not restored by subsequent heat-treatment. The mechanical properties of copper-magnesium alloys containing up to 11% copper are not improved by simple heat-treatment, which causes a general decrease in test values. The addition of copper to magnesium up to about 2% is beneficial. Beyond this amount the increase in tenacity is small, whilst there is a regular decrease in ductility and a proportional increase in specific gravity. There is no advantage in adding more than this amount of copper to magnesium either for castings or for forgings. To obtain the best results the forging temperature must be controlled, and care must be taken to guard against any possibility of cold-shut when casting ingots for forging.

In a paper on "Grain growth in compressed metal powder," Dr. C. J. Smithells, W. R. Pitkin, and J. W. Avery described an investigation of the changes which take place in certain properties of bars of pressed tungsten powder when the temperature is gradually raised. These changes are attributed to grain growth, which is shown to begin at a temperature determined by the particle size of the powder and the pressure used in forming the bar. Using powders whose mean particle size varied from 0.6 to 3.5 μ , and pressures between 8 and 32 tons/in.², the temperature at which grain growth could first be detected varied from 1100° K. to 1500° K. These conditions cover those usually employed in the technical preparation of ductile tungsten. The results are in conflict with those of Sauerwald, who was unable to detect grain growth below 2800° K., but are consistent with the established facts of grain growth in worked metals.

In a paper on "The constitution and physical properties of some of the alloys of copper, zinc, and cadmium," C. H. M. Jenkins dealt with the constitution of the copper-zinc-cadmium alloys, and discussed the physical properties of the two most commonly used brasses containing small proportions of cadmium. The study shows a complex constitution in the range of the ternary system where the copper content exceeds 45% and the cadmium content is less than 10%. The solid solubility of cadmium in α brass diminishes with increasing proportions of zinc from a maximum value of 2.7%. Cadmium present beyond the proportion retained in solid solution is found to occur as the binary constituent, Cu_2Cd . The alloys whose constituents are α brass and more than a trace of Cu_2Cd commence to melt at comparatively low temperatures between 549° and 614° C. Traces of free Cu_2Cd on heating dissolve in the α phase without melting, owing to the slightly increased solubility at higher temperatures. A peritectic reaction, in which the β phase of the Cu-Zn system reacts with liquid to form the α phase and Cu_2Cd , occurs in this system at 614° C., considerably affecting the properties of the alloys. This reaction is primarily due to the result of the two peritectic reactions found in the binary copper-zinc and copper cadmium alloys, at 906° and 549° C. respectively. The effect of cadmium on β brass is noticeable in a different manner. This phase shows a greatly increased solid solubility for cadmium with increase of temperature, reaching a maximum value at 8%. At low temperatures the γ constituent seems to have a greater power than the β phase of retaining cadmium in solid solution. The effect of cadmium on the physical properties of 70 : 30 and 60 : 40 brass has been studied by the use of cadmium-bearing zinc containing proportions of cadmium decidedly in excess of those likely to be encountered in retort zinc. The results show that the greater proportion of the cadmium content of the zinc is retained in the brass, and is not lost by oxidation or volatilisation during melting. The presence of less than 0.2% of cadmium seems to prevent the hot-rolling of 70 : 30 brass and cadmium, and of more than 0.5% to increase to a slight extent the liability to unsoundness in cast material. The general results indicate that the use of cadmium-bearing zinc does not produce any marked alteration in the physical properties of the brass. Additions of cadmium up to 1% by weight cause an improvement in the tensile strength, generally accompanied by a reduction in elongation. The effect is most noticeable in the cast 70 : 30 brass, and is less pronounced in worked material.

Some experiments were described by H. Sutton and A. J. Sidery, in which samples of aluminium and aluminium alloys were treated by various protective processes, including anodic oxidation, zinc-, cadmium-, and nickel-plating. The resistance of aluminium, duralumin, and of certain other aluminium alloys to corrosion by sea-water is considerably increased by anodic oxidation and the subsequent application of a grease, such as lanoline. Electro-deposited coatings of zinc, 0.0005 in. thick, afforded better protection to aluminium than did coatings of cadmium of similar thickness, but the two types of deposit appeared to give an approximately equal degree of protection when applied to alloys of



The Golden Wedding of Professor and Mrs. Armstrong: A Family Group

aluminium. Unsatisfactory results were obtained from nickel deposits of normal thickness.

The nature of the film produced by anodic oxidation of aluminium was discussed by H. Sutton and J. W. W. Willstrop, who described a method of isolating the film from anodically treated aluminium. The metallic aluminium is volatilized in dry hydrogen chloride. The films isolated from treated commercial aluminium sheet are usually of a grey colour, due to traces of carbon left behind when the aluminium sublimes as chloride. The presence of elementary silicon in films produced on commercial aluminium is also shown. Films varying in thickness from 0.033μ to 2μ have been obtained, the thickness of the film produced by the usual standard treatment being about 1μ . From the volume of gas evolved by treated aluminium when heated *in vacuo* to 1200°C ., the film is shown to consist of oxide and not of hydroxide.

In a paper on "Age-hardening tests with elektron alloys," Dr. K. L. Meissner discussed the capability of age-hardening of six different elektron alloys, made up by the I. G. Farbenindustrie A.-G. at Bitterfeld (Germany), with respect to ageing at room temperature and at elevated temperatures up to 200°C ., with different ageing periods of from 8 to 40 hrs.

Dr. W. Humm-Rothery and S. W. Rowell described an investigation of the equilibrium diagram of the system magnesium-cadmium by thermal and microscopic methods. The system contains a solid solution based on cadmium and denoted α , a definite inter-

metallic compound MgCd_2 , and a solid solution in magnesium denoted β . The solid solution α extends from 0 to about 24 atomic per cent. magnesium at most temperatures. The compound MgCd_2 does not form any solid solutions, whilst the β solid solution extends from about 40 to 100 atomic per cent. magnesium. The solidus and liquidus are shown not to meet at the composition 50 atomic per cent. as reported by the earlier workers. The β solid solution undergoes a transformation at temperatures about 200° to 250°C ., but the maximum temperature of this change is at 54 atomic per cent., and not at 50 atomic per cent., as previously reported. This change is unaccompanied by any alteration in microstructure, and it has not been possible to obtain any two-phase alloys in this region either by slow cooling or by quenching. It is suggested that the change is of the same nature as that of the β brasses. Prolonged annealing is necessary to attain equilibrium in the solid alloys in the neighbourhood of the compound MgCd_2 and the principal differences between the present and the earlier work are due to the fact that the former investigators did not anneal their alloys for a sufficient time.

In a "Note on cathodic disintegration as a method of etching specimens for metallography," Dr. Cyril S. Smith showed that the well-known phenomenon of cathodic sputtering can be used to develop the structure of metal specimens for microscopic examination. Silver-copper alloys are particularly suitable for etching by this process, which causes staining of the copper-rich constituent as well as removal of the silver.

CORRESPONDENCE

A NOTE ON THE FORMATION OF ELEMENTS

SIR,—The rarity of the rare gases has been commented upon before as being in itself a phenomenon which was remarkable (*e.g.*, Aston, *Nature*, November 29, 1924). An explanation of it, as well as of several other independent phenomena, can be offered on the hypothesis that the evolution of the elements from the primordial protons and electrons takes place by the following steps:—

(a) An initial combination to form rare gas nuclei ;

(b) The synthesis of the nuclei of the remaining elements from the rare gas nuclei, the protons, and the electrons combining amongst themselves.

The Table I illustrates the results to be expected from this hypothesis, any element marked in it being obtained by the combination of the isotopes of the rare gases given in the first row vertically above it and the column in its line to the extreme left. The isotope values are marked in figures, and are those given by Aston (*Phil. Mag.*, 49, p. 1198). The isotopes 18, 34, and 38 have been included to complete the analogies between the formations of the halogens, though it is not indispensable to do so. The formation of an isotope by two or more independent combinations of the same rare gases is shown by the corresponding number in brackets near the isotope number (*e.g.*, Sn¹¹⁸⁽⁴⁾ denotes its formation from the following combinations:—A³⁴ + Kr⁸⁴, A⁴⁰ + Kr⁷⁸, A³⁸ + Kr⁸⁰, A³⁶ + Kr⁸²). The table shows the elements formed by the combination of two

positive nuclei only, and hence expected to be commonest excepting sometimes when the synthesis is of lightest nuclei (*e.g.*, Si, O, etc.).

The following consequences of such an arrangement are to be expected:—

(1) The parent nuclei—those of the rare gases are rare.

(2) Elements resulting from synthesis of nuclei of increasing mass have increasing rarity and instability.

(3) Isotopes of similarly formed elements show similar mass spectra, *e.g.*, the remarkable similarity between the mass spectra of Sn and Cd, and Se and Kr, observed by Aston (*Phil. Mag.*, 49, 1196), even though the pairs have not all the isotopes in common.

(4) The stellar spectra indicate, as we proceed from the hot type stars to the cooler M-type, the emergence in succession of the elements H, He, Si, O, N ; Ca, Mg ; Fe, alkalis and alkaline earths ; other metals.

(5) In the stage of formation of the earlier nuclei these will preponderate in the composition of the body. As further stages are attained, newer elements are formed, and thus the latter diminish in proportion. An example is the preponderance of Si and O over Fe, Ca, etc. in the composition of the B and A types of stars ; and then the gradual ascendancy gained by the latter over the former as we proceed to succeeding types, as in the sun. Proceeding still further, we find in the earth this ascendancy greatly reduced (*cf.* Miss C. E. Moore and H. N. Russell, *Astr. Journ.*, 43, 1, p. 12). This finds an explanation in the considerations put forward below.

TABLE I

	H 1	He 4	Ne (18), 20, 22	A (34), 36, (38), 40	Kr 78, 80, 82, 83, 84, 86	Xe 124, 126, 128, 129, 130, 131, 132, 134, 136	Radon 222
H	—	—	F 19 Na 23	Cl 35, 37 K 39, 41	Br 79, 81 Rb 85, 87	I 127 Cs 133 (Te 130)	—
He	—	—	Mg 24, 26	Ca 40, 44 (A, 38, 40)	Sr 86, 88 (Kr 86, 84, 82) Zr 90	Ba 138 (Xe 128, 130, 132, 134, 136) Cs 133 Ce 140	Ra etc.
Ne	—	—	Ca 40(2), 44 A 36, 38, 40(2)	Fe 54(2), 56(3) Ni 58(3), 60(2) Co Cr 52	(Rb, Rh, Pd) (At. wts., 90—126, At. Nos., 46 and less)	Rare earths ; At. wts., 142—158 At. Nos., 64 and less	Unstable nuclei
A	—	—	—	Zn 68, 70 Se 74(2), 76(2), 78, 80 Kr 78, 80 (Ge 74(2) (As)	Sn 116(2), 118(4), 119, 120(4), 122(3), 121, 124(2) Cd 112, 114(2), 116(3) Sb 123 Te 124 Xe 124	Rare earths ; At. wts., 158—176 At. Nos., 72 and less	..
Kr	—	—	—	—	Rare earths ; At. wts., 156—176 At. Nos., 72 and less	Radio-active elements	..
Xe	—	—	—	—	—	Unstable nuclei	..
Radon	—	—	—	—	—	—	..

To show the elements formed by the combination of two positive nuclei and a number of electrons, an electron reducing the atomic number by unity. The small figures denote atomic weight of isotopes.

(6) Any stage of formation would represent an equilibrium process, as many atomic nuclei being formed as are disintegrating at any instant. The condition for synthesis would be governed by the physical conditions, such as temperature, pressure, etc. of the surroundings only; while disintegration can take place due to these same conditions as well as the internal forces brought into existence within the nucleus. Heavier nuclei would be more complex and hence more unstable; therefore, these are more liable to disruption through the latter cause. A case in point is that of radioactivity. The presence of the radioactive elements in the stars is extremely doubtful, while in the earth they are believed to be concentrated in the upper crust only. This would show a late start and an early inhibition of their formation after the separation of the earth from the sun. The present-day radioactivity is a phenomenon showing the disintegration of heavy nuclei due to instability only, while the process of formation has already ceased.

M. F. SOONAWALA

Physics Department,
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SPECTRUM ANALYSIS

SIR,—Difficulties of reproduction have caused Fig. 3 in my article on "Spectrum analysis in metallurgy" (CHEMISTRY AND INDUSTRY, August 19, p. 745) to be meaningless, and so I write to say that I shall be glad to send to anyone interested, a contact print from the original negative on receipt of stamped envelope.

The word "spectra" in line 1 should be "spectral."

Yours faithfully,

The Laboratory,
Batchelor, Robinson & Co., Ltd.,
Llanelli

J. R. GREEN

PERSONAL AND OTHER ITEMS

Sir Alfred and Lady Mond have returned to London from Aix-les-Bains and Evian-les-Bains.

Sir Frank Baines, who has retired from the position of Director of Works at the Office of Works, has been appointed consultant to Imperial Chemical Industries, Ltd., on all architectural and constructional matters.

Mr. A. Maude has been appointed general manager of James Woolley, Sons & Co., Ltd., Manchester.

Mr. F. Penman has been appointed assistant research chemist to the Victorian Department of Agriculture.

The annual congress of the International Union of Pure and Applied Chemistry opened in Warsaw on September 3.

The Lister centenary exhibition at the Wellcome Historical Medical Museum, 54A, Wigmore Street, will be closed on October 1.

The late Mr. P. Mernagh, a member of the staff of Public Analyst of the London County Council, left £3143.

The late Mr. F. Bentley, of Birkenhead, paint manufacturer, left £91,616.

The late Mr. M. Cox, late director of Mather & Platt, Ltd., left £44,096.

The death is announced of Mr. S. A. Russell, a director of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., of Silvertown, chairman of the India Rubber Manufacturers' Association, and a member of the board of management of the British Rubber and Tyre Manufacturers' Research Association.

Safeguarding of Key Industries—Appointment of Referee and Panel

Under the provisions of Section 1, Sub-section (5), of the Safeguarding of Industries Act, 1921, and of Section 10, Sub-section (4), of the Finance Act, 1926, complaints as to the improper inclusion of articles in, or their exclusion from, the lists of articles chargeable with duty under Part I of the Safeguarding of Industries Act, as amended by the Finance Act, 1926, have to be referred for decision to a tribunal consisting of the Referee appointed by the Lord Chancellor and of two persons selected by the Lord Chancellor from a panel of persons of special scientific attainments appointed by the President of the Board of Trade. (Cf. p. 821).

The Lord Chancellor has appointed Mr. A. A. Hudson, K.C., to be the Referee, and the President of the Board of Trade has appointed the following gentlemen to be the panel of persons of special scientific attainments:—Mr. A. Chaston Chapman, F.R.S., Prof. F. G. Donnan, C.B.E., F.R.S., Dr. J. H. Jeans, F.R.S., Prof. F. A. Lindemann, F.R.S., Prof. S. Smiles, O.B.E., F.R.S., and Prof. J. F. Thorpe, C.B.E., F.R.S.

Isopropyl Alcohol Regulations, 1927

Regulations have been made by the Commissioners of Customs and Excise requiring, in virtue of Section 16 of the Finance Act, 1927, that all who import, manufacture, sell or use isopropyl alcohol shall furnish certain information, and that manufacturing premises shall be registered.

Orange Juice as an Antiscorbutic

By Order in Council, the use of concentrated orange juice is authorised as an antiscorbutic on board merchant ships. The juice must contain not less than 70% of total soluble solids by weight; it must be free from alcoholic fermentation, and contain no mould growths. Cane sugar up to 20% by weight of the finished product may be added, but the juice should not contain any added colouring matter, chemical preservatives, or metallic impurities.

Exports of Synthetic Nitrates

According to the *Financial Times*, the production of nitrates by the Synthetic Ammonia & Nitrates Company, whose works are at Billingham, have increased so much that the British exports now almost equal and will soon outstrip those from Germany.

The Thermal Efficiency of Electrical Generation

Discussing the thermal efficiency of electric generating stations, Mr. H. Quigley ("World Power," July, 1927) states that the average fuel consumption per electric unit generated in British generating stations has diminished from 3.11 lb. to 2.40 lb. Taking the average of 25 of the largest and most efficient stations in Great Britain (representing 25% of the national output of electricity), the average consumption per unit has fallen since 1922 from 2.05 lb. to 1.80 lb. In 1925–26 the Barton (Manchester) station achieved a record by

and practices will be shown. The chemical bodies are co-operating closely to make the Exposition a success, and there will be a special course of lectures for students conducted by Prof. W. T. Read.

Some New Substantive Polyazo Dyes

E. F. Hitch and F. H. Smith, in a paper read at the Detroit meeting of the American Chemical Society, describe a number of new direct cotton dyes containing four or more azo groups. Some of the dyes, which contain eight azo groups, have remarkable affinity for vegetable fibres, and possess good solubility. All these dyes contain two or more para-amino residues, and are prepared by coupling two molecular equivalents of a tetrazo body, such as tetrazo-benzidine, to a component capable of double coupling, such as H-acid, then combining this new tetrazo compound with two molecular equivalents of an end-component. If one of these end-components is capable of double coupling, the dye can be combined with diazo or tetrazo bodies to form dyes having one or more additional azo groups.

German Nitrogen Industry

The Hibernia concern is contemplating the erection of two new plants in Westphalia to utilise the Mont Ceniz process for the manufacture of synthetic ammonia. The output, believed to be about 4 tons a day, would thus be brought eventually to the equivalent of 15,000 metric tons of fixed nitrogen annually.

German Artificial Silk Industry

Speaking at the general meeting of the Vereinigte Glanzstoff Fabriken A.-G., held on August 27 (cf. CHEM. & IND., Sept. 2, p. 790), the chairman discussed the expansion of the artificial silk industry, and said that the new factory near Cologne was constructed in conjunction with Messrs. Courtauld's, and that the Vereinigte Glanzstoff Fabriken and the Dutch Enka Co. had jointly taken over the Giesches Erben artificial silk factories, which were now being extended. A new silk factory had also been erected in co-operation with the I.-G. Farbenindustrie, and the Bemberg concern, allied to the Vereinigte Glanzstoff Fabriken, was considerably widening its activities. All these plans had involved considerable outlay. Perhaps the most important event in the recent history of the company was that a firm footing had been obtained in the American market through the increased interest of the Vereinigte Glanzstoff Fabriken in the American Bemberg co-operation. The board of the Vereinigte Glanzstoff Fabriken was convinced that the development of the artificial silk industry had not reached its full tide, and that a period of further expansion lay ahead.

The Bemberg Artificial Silk Co. has decided to increase its capital by 12,000,000 marks (£600,000) to 28,000,000 marks (£1,400,000). The money will be used to repay an American loan (for extension of the factory), and to carry out further extensions. The dividend paid by the company will be larger than last year, when 8% was paid.

Erratum

On line 6 of p. 786, col. ii, of the issue of September 2, for "South Shields" read "North Shields."

REVIEWS

THE ELEMENTS OF CHEMISTRY. By W. FOSTER, A.M., Ph.D. Second printing, corrected. Pp. xviii+576. New York: D. Van Nostrand Co., 1926. Price \$2.

Intended for students having no previous knowledge of chemistry, this book may be recommended as presenting, in an adequate and attractive manner, a well-knit account of fact, theory, and application. It is freely illustrated, many of the figures and photographs, depicting the application of the science to the arts of peace and of war, being particularly interesting. It is justly claimed that the language is simple and direct, and it is emphasised that "science is a method, and not a collection of facts." The 47 chapters are provided with summaries and exercises; a number of problems are also included, together with references for collateral reading.

A. A. E.

MODERN SOAP AND GLYCERINE MANUFACTURE. By E. T. WEBB. Pp. 224. London: Davis Bros., 1927. Price 25s.

This book is the antithesis of most of the modern books published on soap manufacture, in that no attempt is made to describe all the processes and plant which have been used or proposed for the manufacture of soap from time to time, and which have now fallen completely out of use. The author confines himself strictly to the essentially practical side of modern soap manufacture and with success, at any rate as regards the actual soap boiling method for the manufacture of modern types of household soaps.

A very full and detailed description of the preparation of an ordinary boiled soap is the outstanding feature of the soap section. The author is inclined to dogmatise somewhat in places, as, for instance, his insistence on the absence of salt in the finishing operation, although this is by no means necessary, as the majority of commercial soaps can be and are finished quite as successfully with brine as without it.

A point of interest to be noted is an attempt to classify the various commercial oils according to their soap-making properties by means of an empirical factor derived from the numerical difference between the saponification value and the iodine number of the various fats and oils ("I.N.S." value), together with a figure which the author has termed the "soap solubility ratio," and which is obtained from the so-called "I.N.S." number. The figures so obtained are of interest in that they do indicate to some extent the type of soap likely to be obtained from mixtures of fats which are required to possess certain general properties when made into soap.

The preparation of "run" and "glued up" soaps is dealt with in outline only, as is also the preparation of toilet soaps, dry soap powders, cold process soaps, and half-boiled soaps. There is an interesting chapter on quantity relations in soap manufacture and other necessary details of interest, such as the influence of radiation losses in connexion with the time of settling of the finished soap. In general, the practical data contained in the book are accurate and reliable.

A considerable section of the whole book (about one third) is devoted to the question of glycerin recovery, and full consideration has been given to the question of evaporation and distillation. The section on distillation is very full and complete, especially as regards the Rumbke system, with which the author is evidently well acquainted. He also devotes considerable space to the Wood still, and gives a fuller description of its working than is found in most text books. This system of distillation is extremely efficient in practice, and the author's opinion that it seems to be the system of the future is certainly borne out as far as practical experience is concerned.

The book as a whole is a useful addition to the literature dealing with the practical side of soap manufacture, and as such should prove of particular interest where an insight into modern working practice is desired.

F. G. REYNOLDS

1. WÄRMETECHNISCHE GRUNDLAGEN DER INDUSTRIEÖFEN. By Prof. H. v. JÜTTNER. Vol. I. Der Industrieöfen in einzeldarstellungen, edited by L. Litinsky. Pp. viii + 260. Leipzig: Otto Spamer, 1927. Price, paper, 20 r.m., bound, 23 r.m.
2. WÄRMEWIRTSCHAFT IN DER KERAMISCHEN INDUSTRIE. By Dr. W. STEGER. Part V. Wärmelehre und Wärmewirtschaft in einzeldarstellungen, edited by Prof. H. Pfützner, with the assistance of Profs. A. Naegel and W. Pauer. Pp. x + 147. Dresden and Leipzig: Th. Steinkopff, 1927. Price, paper, 8 m., bound, 9.50 m.

Both these works are units of series appearing in Germany and dealing with fuel economy. They are indicative of the general tendency there to promote economy of fuel and energy as a means to improve the competitive position of manufacturers. In Spamer's series it is proposed to devote each volume to a type of furnace, whilst in Steinkopff's series each volume is concerned with a particular industry, and much can be said for each method of classification.

(1) v. Jüttner's book, being introductory to its series, deals with heat and fuels in general. It is an uncommon type of fuel book, starting off with the physical theory of heat in which is included the laws of thermodynamics and the quantum theory as applied to specific heats. Heat transmission follows, then combustion, the production of heat balances, and lastly a survey of fuels in general. The term "general survey" seems to be an apt one. The author is known as a maker of books rather than experiments, and seems to devote undue space to tabulating and graphing a variety of quantities divorced from reality. The composition is given of gases in equilibrium with carbon under a wide range of temperatures and pressures, all expressed to the third decimal place and based on data of doubtful validity. Much of the matter is compiled uncritically, while the free spelling of names shakes confidence in the author's care. Thus we find "Boudoir" for "Boudouard," "Gontal" instead of "Goutal," and we read of the "Wet Carburizing Co. of Dufried," which we interpret as a concern which, under a somewhat similar name, formerly operated a process in Dumsfries. The book has

a certain use for an expert, but it would be dangerous to quote it as authoritative.

(2) The other book by Steger is the fifth of its series, and has its own special interest because, in the ceramic industries, fuel consumption and costs represent so large a part of the expenses of production, and yet the literature giving a scientific treatment of the subject is scanty. The book is not a mere descriptive account of furnaces. The author rightly begins by discussing the peculiar chemical and physical phenomena of these industrial processes without which no rational discussion of their fuel problem can be made. For the quantitative treatment of drying he uses a Mollier diagram of the properties of steam. The main section deals with the firing process, and while types of furnaces are described, space is mainly and rightly devoted to the thermal analysis of the process and to the scope of methods for improving the thermal efficiency. The use of lignites in increasing quantity commands attention. Measuring instruments are described, but much of the matter here is not special to ceramics and, at times, is so brief as to be superficial and hardly worth inclusion. The chapter on heat balances is valuable, and especially the collation from literature of a number of results published for typical furnaces. In view of their use where conditions have allowed, it would have been interesting if the author could have given some data on electrically-heated furnaces. There is still something of the character of arts and crafts about the ceramic industries which compels the scientific man to walk delicately when seeking to modify existing practice. In pursuing thrift in the use of heat the scientific man is on firmer ground, and to him this book should make a special appeal.

H. J. HODSMAN

DISPERSOIDOLOGICAL INVESTIGATIONS. By Prof. P. P. VON WEIMARN and Collaborators. Reports of the Imperial Industrial Research Institute. XI. Vol. 7. No. 8. Pp. 22. March, 1926. XII-XVI. Vol. 7. No. 17. Pp. 51. December, 1926. Osaka: Japan: Imperial Industrial Research Institute, Department of Commerce.

In these reports the author continues his investigations on the dispersion of silk and of cellulose by solutions of very soluble salts, more particularly the chlorides, iodides, and thiocyanates of the alkaline earth metals. The general nature of this action is illustrated by the close similarity of the effect on substances as dissimilar as fibroin and cellulose. The dispersions of silk, on dehydration by suitable salts or by alcohol, yield very interesting elastic masses resembling rubber or animal tendon.

As the action of the salts used in the process of dispersion and in other colloidal phenomena has very generally been ascribed to the anion, it is of great interest to note a new result obtained by v. Weimarn: that highly soluble *non-electrolytes*, like the polyphenols, also disperse silk and other proteins, as well as cellulose. This is a point for much further study.

These reports, like previous ones, are lavishly illustrated with admirable collotype reproductions of photomicrographs and ultramicrographs.

EMIL HATSCHEK

COMPANY NEWS

INTERNATIONAL HOLDINGS AND INVESTMENT CO.

The annual report for the year ended June 30 last states that the directors propose to sell the assets of this company to a Canadian company—the International Holding and Investment Company—registered in Quebec, by which it is hoped to broaden the market for the shares and relieve the company from paying English income tax on the revenue that is derived from Continental sources. The company's interest in the assets to be transferred to the Canadian company will be exactly equivalent to the present interests of the shareholders in them, so that in the event of liquidation each shareholder should receive the same equity in the Canadian company as he now holds in the English company. The company, which recently changed its name from the Cellulose Holdings and Investment Company to its present title, was formed to finance British Celanese, Ltd., and is entitled to an annual royalty of 3% on the Celanese Company's sales to a value of £3,000,000 and 1% on sales value in excess of £3,000,000 for 25 years after £90,000 has been paid in any year. During the year the company sold £425,000, part of its holding of £700,000 7% debenture stock in British Celanese, and has also sold its holding of preference shares in that company, with the exception of 1500 shares. On the other hand the company has acquired £150,000 6½% income debentures in British Celanese. The company has recently acquired interests in the Fabrique de Soie Artificielle de Tubize, the Société Française de Tubize, the Société Internationale d'Energie Hydro-Électrique (Sidro), and certain other undertakings. The paid-up capital of the company has increased from £53,025 in 1926 to £268,051, and the capital reserve from £138,252 to £1,258,250. The net profit after meeting all charges and debenture stockholders' participation in profits, amounted to £55,547, compared with £30,949 for 1926. A dividend of 9d. per share was declared on the ordinary shares, against 7d. for the previous year.

As a result of negotiations it is announced that the company has agreed to waive its right to appoint three directors to British Celanese, Ltd. In consideration of this British Celanese will raise no objection to the royalty payable to the Holdings Company being sold and transferred to the Canadian company.

BRITISH GLUES AND CHEMICALS, LTD.

The accounts for the year to May 31, 1927, show a loss of £12,761, after allowing £32,216 for depreciation, compared with a loss of £22,919 for 1926, after allowing £29,123 for depreciation. No dividend will be paid on the preference shares, on which the payment is in arrear since April, 1922.

BINNEY & SMITH AND ASHBY, LTD.

The amalgamation is announced of the carbon, lamp and vegetable black interests of the two old-established companies, Messrs. Binney & Smith Company and Messrs. Morris Ashby, Ltd., who will trade under the name of Binney & Smith and Ashby, Ltd., with registered offices at 17, Laurence Pountney Lane, London, E.C.4. The former is the pioneer of the carbon black business in America, whilst the latter was the first importer of this product into the United Kingdom for

commercial use nearly 60 years ago. It is intended to hold stocks of the well-known grades of carbon, lamp and vegetable black sold by these companies at all the principal distributing points of the United Kingdom, insuring users of prompt service.

BUELL COMBUSTION CO., LTD.

The incorporation is announced (for information only) of the above company with an authorised capital of £250,000 and an issued capital of £173,507. The company was incorporated in May, 1927, to acquire from Bolton & Partners, Ltd., and the Buell Pulverised Coal Syndicate, Ltd. the Buell pulverised coal systems, the goodwill and business in connexion with such systems, and the benefit of all pending contracts, including a licence granted to Babcock & Wilcox, Ltd., for use of the systems with water-tube boilers.

HORACE CORY AND CO., LTD.

The profit made by this company of colour manufacturers for 1926, after placing £1000 to reserve, was £10,491, plus £3419 brought forward, compared with a profit of £13,269, after placing £3000 to reserve, for 1925. A further dividend has been recommended of 5%, making 9%, against 10%, carrying forward £2160.

J. STONE AND CO., LTD.

The net profit for 1926 was £180,011, plus £67,075 brought in, compared with £161,058 for 1925. The dividend on the preference shares absorbed £39,000, and the directors recommend placing £45,133 to reserve, paying a dividend of 10% and a bonus of 1s. per share on the ordinary shares, £72,892 being carried forward.

HARBEN'S (VISCOSE SILK MANUFACTURERS), LTD.

At an extraordinary general meeting held on May 13, presided over by Sir Charles Mandelberg (chairman), the creation was approved of 200,000 new 8% first cumulative participating preference shares of £1, for 140,000 of which the Branston Artificial Silk Co. would subscribe at par. The balance of 60,000 shares would be held in reserve for acquiring further auxiliary plant and other purposes. In consideration for the taking up of the 140,000 preference shares, Harben's would put the Branston Company's works on a producing basis. This would enable Harben's to take steps immediately to extend its plant in order to increase its output to 18 tons per week. Since the beginning of the present year they had been producing and selling 9 tons per week at regular market prices. Orders were being received in excess of the capacity of the existing plant. The technical and research departments were fully alive to market requirements, and immediate steps were taken to meet demands for new effects or special yarns, and a thoroughly progressive policy was being adopted. The company was in a strong financial position, and if the profits continued at their present level, it would be able to pay a preference dividend by the end of the present year.

EASTMAN KODAK OF NEW JERSEY

A regular dividend has been announced of \$1.25 per share on the common stock, together with an extra dividend of \$0.75 per share.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£8 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1½d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.

Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9—£9 5s. per ton. Good demand. Grey, £14 10s.—£15 per ton. Liquor, 9d per gal.
 Charcoal.—£8—£9 per ton according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals.—8d.—9d. per lb. Crude 60's, 2s. 5d.—2s. 7d. per gal.
 Acid Cresylic, 99/100.—2s. 9d.—2s. 10d. per gal. 97/99.—2s. 4d.—2s. 6d. per gal. Pale 95%, 2s. 2d.—2s. 3d. per gal. Dark, 90%, 1s. 9d.—1s. 10d.; 95%, 2s.—2s. 2d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9½d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons, Pure, 1s. 5d.—1s. 6d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 4d.—1s. 5d. per gal. Pure, 1s. 6d.—1s. 7d. per gal.
 Xylol.—1s. 3d.—1s. 4d. per gal. Pure, 2s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d. per gal. Heavy, 9d. per gal. Standard specification, 7½d.—7½d. per gal. ex works. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 8½d.—9½d. per gal. Solvent 95/160, 1s. 4d.—1s. 5d. per gal. Solvent 90/190, 8½d.—9½d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals.—£11 10s.—£12 per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—90s.—92s. 6d. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 9d.—6s. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilio.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.
o-Cresol 29/31° C.—5½d. per lb.
m-Cresol 98/100%.—2s. 7½d. per lb.
p-Cresol 32/34° C.—2s. 8½d. per lb.
Dichloraniline.—2s. 3d. per lb.
Dimethylaniline.—1s. 11d. per lb.
Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
Dinitrochlorbenzene.—£84 per ton d/d.
Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
Diphenylamine.—2s. 10d. per lb. d/d.
α-Naphthol.—2s. per lb. d/d.
β-Naphthol.—11d.—1s. per lb. d/d.
α-Naphthylamine.—1s. 3d. per lb. d/d.
β-Naphthylamine.—3s. per lb. d/d.
p-Nitraniline.—1s. 8d. per lb.
m-Nitraniline.—3s. per lb. d/d.
o-Nitraniline.—5s. 9d. per lb.
Nitrobenzene.—6d. per lb., naked at works.
Nitronaphthalene.—1s. 3d. per lb. d/d.
R. Salt.—2s. 2d. per lb. 100% basis d/d.
Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
o-Toluidine.—7½d. per lb., naked at works.
p-Toluidine.—2s. 2d. per lb., ex works, naked.
m-Xylidine Acetate.—2s. 6d. per lb. 100%.
N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.
Acid, Benzoic B.P.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
Acid, Boric B.P.—Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.
Acid, Camphoric.—19s.—21s. per lb.
Acid, Citric.—1s. 7d.—1s. 8d. per lb. Less 5%.
Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
Acid, Salicylic.—B.P. pulv. 1s. 3d.—1s. 4d. per lb. Technical 11½d.—1s. per lb. Good demand.
Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
Amidol.—9s. per lb. d/d.
Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
Amidopyrin.—8s. 6d. per lb.
Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
Atropine Sulphate.—11s. per oz. for English make.
Barbitone.—6s. per lb.
Benzonaphthol.—3s. 3d. per lb.
Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
Borax B.P.—Crystall 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.
Bromides.—Ammonium.—2s. 2d.—2s. 3d. per lb. Potassium. 1s. 9½d.—1s. 10½d. per lb. Sodium.—2s.—2s. 1d. per lb. Granulated ½d. per lb. less. All spot.

Calcium Lactate.—1s. 2½d.—1s. 3½d. per lb.
Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
Chloral Hydrate.—3s. 6d. per lb., duty paid.
Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
Creosote Carbonate. 6s. per lb.
Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
Formaldehyde.—£39 per ton. Ex wharf in barrels.
Guaiacol Carbonate.—5s. per lb.
Hexamine.—2s. 4d.—2s. 6d. per lb.
Homatropine Hydrobromide.—30s. per oz.
Hydrastine Hydrochlor.—English make offered, 120s. per oz.
Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols. 2s. 3d. per gal. In carboys: Winchesters, 2s. 11d.—3s. 9d. per gal.; 20 vols., 4s. 3d. per gal.; Winchesters, 5s.—6s. 6d. per gal. Special prices for larger quantities.
Hydroquinone.—2s. 11d. per lb.
Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots, Potassium 4s. 1d. per lb. Sodium 4s. per lb.
Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
Iron Perchloride.—4d. per lb., 22s. per cwt.
Magnesium Carbonate.—Light Commercial £31 per ton net.
Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
Menthol.—A.B.R. recryst., B.P., 18s. 6d. per lb. net. Synthetic detached crystals, 9s.—10s. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 5d.—7s. 7d. per lb., Levig. 6s. 11d.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 8d.—5s. 10d. per lb., Powder, 5s. 1d.—5s. 3d. per lb.; White precip., Lump, 5s. 10d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 3d.—6s. 5d. per lb.; Yellow Oxide, 6s. 9d.—6s. 11d. per lb.; Persulph B.P.C., 6s.—6s. 2d. per lb.; Sulph. nig., 5s. 9d.—5s. 11d. per lb. Special prices for larger quantities.
Methyl Salicylate.—1s. 9d. per lb.
Methyl Sulphonol.—9s. 6d.—9s. 9d. per lb.
Metol.—11s. per lb. British make.
Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
Paraldehyde.—1s. 4d. per lb.
Phenacetin.—2s. 9d.—3s. per lb.
Phenazone.—4s. 3d.—4s. 6d. per lb.
Phenolphthalein.—6s.—6s. 3d. per lb.
Potass. Bitartrate.—99/100% (Cream of Tartar) 98s per cwt., less 2½%.
Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
Potass. Permanganate.—6d. per lb. spot.
Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins (1000 oz. lots).
Resorcin.—3s. 9d.—4s. per lb. spot.
Saccharin.—55s. per lb., and lower in quantity.
Salol.—2s. 4d. per lb.
Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hypsulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.
Sod. Nitroprusside.—16s. per lb.
Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
Sod. Salicylate.—Powder, 1s. 8½d.—1s. 9½d. per lb. Crystal, 1s. 9½d.—1s. 10½d. per lb.
Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton f.o.b., according to quantity, 1-cwt. kegs included.
Sulphonal.—6s. 6d.—6s. 9d. per lb.
Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—15s. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.
Aubepine (ex Anethole).—10s. 6d. per lb.
Amyl Acetate.—2s. per lb. **Amyl Butyrate**.—5s. 3d. per lb.
Amyl Salicylate.—3s. per lb.
Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. **Benzyl Alcohol free from Chlorine**.—2s. per lb.
Benzaldehyde free from Chlorine.—2s. 6d. per lb. **Benzyl Benzoate**.—2s. 6d. per lb.
Cinnamic Aldehyde.—Natural, 17s. per lb.
Coumarin.—10s. per lb.
Citronellol.—13s. 9d. per lb.
Citral.—8s. 3d. per lb.
Ethyl Cinnamate.—6s. 6d. per lb.
Ethyl Phthalate.—2s. 9d. per lb.
Eugenol.—8s. 6d. per lb. **Geraniol (Palmarosa)**.—18s. 6d. per lb. **Geraniol**.—6s. 6d.—10s. per lb. **Heliotropine**.—4s. 9d. per lb. **Iso Eugenol**.—13s. 6d. per lb. **Linalol (ex Bois de Rose)** 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb. **Linalyl Acetate (ex Bois de Rose)** 18s. 6d. per lb.—(ex Shui Oil) 14s. 6d. per lb.
Methyl Anthranilate.—8s. 6d. per lb.
Methyl Benzoate.—4s. per lb.
Musk Ketone.—35s. per lb.
Musk Xylol.—8s. per lb.
Nerolin.—4s. 6d. per lb.
Phenyl Ethyl Acetate.—12s. per lb.
Phenyl Ethyl Alcohol.—10s. 6d. per lb.
Rhodinol.—32s. 6d. per lb. **Safrol**.—1s. 6d. per lb. **Terpineol**.—1s. 8d. per lb. **Vanillin**.—17s.—17s. 6d. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. **Anise**.—3s. per lb. **Bergamot**.—28s. per lb. **Bourbon Geranium**.—14s. 6d. per lb.
Camphor.—75s. per cwt. **Cananga, Java**, 26s. per lb. **Cassia, 80/85%**.—7s. 6d. per lb. **Cinnamon, Leaf**.—6d. per oz. **Citronella**.—Java 85/90%, 1s. 11d. per lb., Ceylon, Pure, 1s. 9d. per lb. **Clove, pure**.—6s. per lb.
Eucalyptus, 75/80%.—2s. 3d. per lb. **Lavender**.—Mont Blanc 38/40%, 20s. per lb. **Lemon**.—8s. per lb. **Lemon-grass**.—4s. 6d. per lb. **Orange, Sweet**.—11s. 3d. per lb. **Otto of Rose**.—Anatolian, 30s. per oz., Bulgarian, 75s. per oz. **Palma Rosa**.—10s. 6d. per lb. **Peppermint**.—Wayne County, 17s. 6d. per lb. **Japanese**, 8s. 3d. per lb. **Petitgrain**.—7s. 9d. per lb. **Sandalwood**.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Nov. 1st. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Sept. 15th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Blair, Desborough, Reynolds, Smith, and Thomson. Mixing liquids. 22,483—4. Aug. 26.

Comyn. Filters or separators. 22,321. Aug. 25.
 Ellinghouse. Emulsifying etc. apparatus. 22,510. Aug. 26.
 Fender, and Prodorite, Ltd. Acid-proof vessels. 22,061. Aug. 22.
 Hillier. Evaporators. 22,047. Aug. 22.
 Maccallum, and Smith & Blyth, Ltd. Grinding-mills. 22,459. Aug. 26.
 Soc. Ital. Pirelli. Degasifying liquids. 22,333. Aug. 25. (Italy, 31.8.26.)
 Verein. Schweizerische Rheinsalinen. Salt or evaporating pans. 22,403. (Switz., 15.9.26.)
 Wade (Riley Stoker Corp.). Pulverising apparatus. 22,503. Aug. 26.

I.—Complete Specifications

27,268 (1926). Cooper and Mason. Mixing or pugging mill. (276,196.)
 5015 (1927). Vernay. Filtering apparatus. (266,719.)
 9628 (1927). British Separators, Ltd., and Cahill. Centrifugal separating-apparatus. (276,268.)
 21,206 (1927). Frankl. Separation of gaseous mixtures. (276,292.)
 *10,497 (1927). Singer. Distilling liquids, particularly liquid hydrocarbons. (276,302.)
 *21,804 (1927). Siemens A. G. Purification of gas mixtures. (276,347.)

II.—Applications

Adam, Potter, and Gas Light & Coke Co. 22,542. See III.
 A.-G. f. Kohlensäure Ind., and Auerbach. Refining mineral oils etc. 22,181—2. Aug. 23. (Ger., 25.9.26 and 12.2.27.)
 Asiatic Petroleum Co., Ltd., and Joyce. Treating heavy petroleum oils etc. 22,561. Aug. 27.
 Aurig and Brühlmayr. Treatment of gases for removal of hydric sulphide etc. 22,273. Aug. 24.
 Coley. Low-temperature carbonisation of coal. 22,313. Aug. 25.
 Cutler. Dehydration of gas. 22,576. Aug. 27.
 Davidson. Retorts for treatment of oil shale etc. 22,297. Aug. 25.
 Hellthaler, and Riebeck'sche Montanwerke. Bleaching montana wax. 22,464. Aug. 26.
 Johnson (I.-G. Farbenind.). Production of mixtures of hydrogen and carbon monoxide. 22,275. Aug. 24. Production of ethylene. 22,596. Aug. 27.

II.—Complete Specifications

12,660 (1926). Gibson. Producing enriched illuminating or power gas. (276,065.)
 25,720 (1926). Dvorkovitz. Manufacture of hard coke. (276,181.)
 32,556 (1926). Still. Coke- and gas-producing furnaces. (263,817.)
 1657 (1927). Heppner. Increasing safety of porous and absorbent materials used for storing explosive. (261,846.)
 6811 (1927). Seelig. Cracking of oils. (268,323.)
 *10,497 (1927). Singer. See I.

III.—Application

Adam, Potter, and Gas Light & Coke Co. Distillation of oils etc. 22,542. Aug. 27.

III.—Complete Specification

32,978 (1926). Combustion Utilities Corp. Purification of tar acid-bearing oils. (276,216.)

IV.—Applications

Blair, Desborough, Reynolds, Smith, and Thomson. Manufacture of nitrated compounds. 22,485. Aug. 26.
 Carpmal (I.-G. Farbenind.). Manufacture of condensation products of benzanthrone-series. 22,381. Aug. 25.
 I.-G. Farbenind. Manufacture of arylazo-diarylamines. 22,087. Aug. 22. (Ger., 21.8.26.)
 Manufacture of dye-stuffs. 22,462. Aug. 26. (Ger., 21.10.26.) Manufacture

of monobenzoyldiaminoanthraquinones. 22,515. Aug. 26. (Ger., 30.8.26.)

Johnson (I.-G. Farbenind.). Manufacture of vat dyestuffs. 22,049. Aug. 22. Production of hydroxyalkylamines. 22,278. Aug. 24.

IV.—Complete Specifications

18,862 (1926). Carpmach (I.-G. Farbenind.). Manufacturing products of conversion of pericyannaphthalene-sulphonic acids. (276,126.)

21,947 (1926). British Dyestuffs Corp., and Wyler. See XX.

7061 (1927). Johnson (I.-G. Farbenind.). See XX.

*21,892 (1927). I.-G. Farbenind. Manufacture of azo-dyestuffs. (276,353.)

*22,087 (1927). I.-G. Farbenind. Manufacture of arylazo-dialkylamines. (276,372.)

V.—Applications

Fabrick van Chem. Producten. Manufacture of cellulose esters. 22,171. Aug. 23. (Fr., 24.3.27.)

Hands, and Spicers, Ltd. Production of cellulose ester etc. compositions. 22,586. Aug. 27.

Hardman. Treatment of cotton etc. 22,137. Aug. 25. (U.S., 20.10.26.)

I.-G. Farbenind. Manufacture of viscose silk. 22,362. Aug. 25. (Ger., 25.8.26.) Opening-up materials containing cellulose. 22,461. (Ger., 13.10.26.)

Johnson (I.-G. Farbenind.). Treatment of animal, vegetable, etc. materials. 22,276. Aug. 24.

Runkel. Recovery of cellulose from plants. 22,291. Aug. 14.

V.—Complete Specifications

18,337 (1926). Ellis (Kohnstamm & Co.). Degreasing textile materials. (276,121.)

6711 (1927). App. et Evaporateurs Kestner. Recovery of caustic soda from residual lyes after manufacture of artificial silk. (267,536.)

*21,610 (1927). Henkel & Cie. Reducing deterioration of colours of textile fabrics during washing. (276,337.)

*21,611 (1927). Henkel & Cie. Washing textile fabrics. (276,338.)

*21,612 (1927). Henkel & Cie. Detergent compositions. (276,339.)

VI.—Complete Specifications

14,275 (1926). Ellis (Chemical Works, formerly Sandoz). Dyeing of effect threads. (276,100.)

*21,613 (1927). Henkel & Cie. Halogen calcium-starch preparations. (276,340.)

*21,891 (1927). Heberlein & Co. Treatment of fabrics. (276,352.)

VII.—Applications

App. et Evaporateurs Kestner. Production of nitrate of lime. 22,466. Aug. 26. (Fr., 16.10.26.)

Clark, Newall, and Washington Chem. Co. Manufacture of magnesium carbonate. 22,383. Aug. 25.

Coley. Manufacture of zinc oxide. 22,314. Aug. 25. Gewerkschaft der Steinkohlenzeche Mont-Cenis. Purifying hydrogen. 22,180 and 22,488. Aug. 26 and 26. (Ger., 26.8.26 and 30.8.26.)

Johnson (I.-G. Farbenind.). 22,275. See II.

Sharp (Soc. Gén. Métallurgique de Hoboken). Manufacture of sulphuric acid. 22,159. Aug. 23.

Verein. Schweizerische Rheinsalinen. 22,403. See I.

VII.—Complete Specifications

12,661 (1926). Martin. See X.

16,064 (1926). Koehler. See X.

18,143 (1926). Jackson (Mathieson Alkali Works). Production of chromium compounds. (276,120.)

21,859 (1926). Kiscock. Producing molybdates. (276,155.)

29,164 (1926). Johnson (Duisberger Kupferhütte). See X.

6711 (1927). App. et Evaporateurs Kestner. See V.

*29,959 (1926). Liljenroth. Oxidising ammonia. (276,295.)

*15,515 (1927). I.-G. Farbenind. Storing dibasic calcium hypochlorite. (276,307.)

*18,850 (1927). Deutsche Gold- u. Silber-Scheideanstalt. Production of alkali hydride. (276,313.)

*21,826 (1927). Azogeno Soc. Anon., Toniolo and Tanzi. Manufacture of a non-hygroscopic or slightly hygroscopic double salt from calcium nitrate. (276,350.)

VIII.—Applications

Fender, and Prodorite, Ltd. 22,061. See I.

Hurlbut and Pryor. Glass-annealing leers etc. 22,455. Aug. 26.

IX.—Complete Specification

12,661 (1926). Martin. See X.

X.—Applications

Ashcroft. Metallurgy of ores. 22,478. Aug. 26.

British Thomson-Houston Co., Ltd. Carburising metals. 22,343. Aug. 25. (U.S., 26.8.26.)

Cole. Proofing metals against rust. 22,053. Aug. 22.

Coles. Disintegration of ores etc. 22,001. Aug. 22.

Coley. Reduction of ores, oxides, etc. 22,154—5. Aug. 23.

Separation of metals etc. 22,156. Aug. 23.

Dovel. Blast furnaces. 22,386. Aug. 25.

Ellis. Electroplating. 22,259. Aug. 24.

Elmore, Elmore, and Malan. Utilisation of cupriferous ores etc. 22,167. Aug. 23.

France. Apparatus for classification of ores etc. 22,186. Aug. 23. (Belg., 18.1.26.)

Washing minerals. 22,471. Aug. 26. (Belg., 4.12.26.)

Johnson (I.-G. Farbenind.). Recovery of metals etc. soluble in ammoniacal liquors. 22,279. Aug. 24.

Leaching metals etc. soluble in ammonia. 22,280. Aug. 24.

Metalbank u. Metallurgische Ges. Production of aluminum alloys. 22,496. Aug. 26. (Ger., 18.9.26.)

Smith. Reducing ores etc. 22,433. Aug. 26. (U.S., 4.4.27.)

X.—Complete Specifications

12,144 (1926). Hadfield. Manganese steel. (276,048.)

12,661 (1926). Martin. Manufacture of lime, gypsum, cements, etc., calcination of ores etc. (276,066.)

12,707 (1926). Hanemann. Manufacture of grey cast iron. (262,043.)

12,828 (1926). Frankl. Producing synthetic pig iron. (252,708.)

12,934 (1926). Bosse, Richter, Lauch, Siegelberg, and Koch. Metallising process. (252,710.)

16,064 (1926). Koehler. Forming metal phosphides. (276,112.)

26,051 (1926). Browne. Making sound silicon iron. (276,190.)

29,164 (1926). Johnson (Duisburger Kupferhütte). Recovery of copper, zinc, and other metals from solutions containing chlorides and sulphates. (276,200.)

5449 (1927). Cammell, Laird, & Co., Ltd., Allan, and Hague. Alloy steels. (276,249.)

*19,654 (1927). Krupp A.-G. Steel alloys. (276,317.)

XI.—Applications

Ellis. 22,259. See X.

Marks (Insulux Corp.). Insulating-compositions. 22,288. Aug. 24.

Soc. Ital. Pirelli. Impregnating insulating materials 22,330. Aug. 25. (Italy, 31.8.26.)

XI.—Complete Specifications

5184 (1926). Bleack. Primary batteries. (248,011.)

21,884 (1927). Internat. General Electric Co. High-frequency induction furnaces. (276,351.)

XII.—Complete Specification

23,140 (1926). Metallbank u. Metallurgische Ges. Treating crude oils and fats. (275,536.)

XIII.—Application

Imperial Chemical Industries, Ltd., and Jenkins. 22,481—2. See XXII.

XIV.—Applications

Galbraith and Mills. Manufacture of rubber. 22,027. Aug. 22.

Jackson (General Rubber Co.). Treating rubber latex. 22,347. Aug. 25.

Johnson (I.-G. Farbenind.). Production of raw rubber from rubber latex. 22,595. Aug. 27.

XIV.—Complete Specification

7700 (1927). Chem. Fabr. Kalk., and Oehme. Vulcanisation of rubber. (272,860.)

XVI.—Applications

Johnson (I.-G. Farbenind.). Manufacture of fertilisers. 22,277. Aug. 24.

Kensington. Manufacture of fertilisers. 22,385. Aug. 25.

XVI.—Complete Specification

*1419 (1927). Adelantado. Manufacture of phosphate fertilisers. (276,297.)

XVIII.—Applications

Claassen. Manufacture of baking-yeast. 22,504. Aug. 26. (Ger., 19.11.26.)

Johnson (I.-G. Farbenind.). Cultivating micro-organisms. 22,597. Aug. 27.

XIX.—Applications

Baker (Trehurne). Treating flour. 22,493. Aug. 26.

Claassen. 22,504. See XVIII.

N. V. Huygen & Wessel's Ingenieursbureau. Sterilising liquids. 22,346. Aug. 25. (Holland, 14.5.27.)

XIX.—Complete Specifications

19,428 (1926). Matzka. Preservation of eggs etc. (276,132.)

6290 (1927). Matzka. Preserving fruit juices and other liquids. (276,254.)

10,292 (1927). Woo. Manufacture of edible substances. (269,576.)

XX.—Applications

Albert. Manufacture of arsenobenzenes. 22,463. Aug. 26.

Blair, Desborough, Reynolds, Smith, and Thomson. 22,483—5. See IV.

Burstall and Morgan. Manufacture of metallic compounds of ethylenethiourea. 22,324. Aug. 25.

I.-G. Farbenind. Manufacture of condensation products of urea. 22,594. Aug. 27.

Soc. Chem. Ind. in Basle. Manufacture of gold-nucleic acid compounds. 22,360. Aug. 25. (Switz., 25.8.26.)

XX.—Complete Specifications

16,451 (1926). Binz, and R  th. Production of organic arseno compounds. (255,839.)

17,752 (1926). Binz, and R  th. Production of organic arseno compounds. (255,861.)

21,947 (1926). British Dyestuffs Corp., and Wyler. Manufacture of quinoline derivatives. (276,156.)

7061 (1927). Johnson (I.-G. Farbenind.). Manufacture of aldehydes. (267,925.)

XXI.—Application

Simon. X-ray photography. 22,361. Aug. 25. (Ger., 25.8.26.)

XXI.—Complete Specification

20,115 (1926). I.-G. Farbenind. Manufacture of photographic silver halide emulsions. (258,237.)

XXII.—Applications

Blair, Desborough, Reynolds, Smith, and Thomson. 22,483—4. See IV.

Imperial Chemical Industries, Ltd., and Jenkins. Solvents for nitrocellulose. 22,482. Aug. 26. Nitrocellulose solutions. 22,481. Aug. 26.

XXIII.—Application

Adams-Hydraulics, Ltd., Argent, and Hopwood. Treatment of sewage etc. 22,345. Aug. 25.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Sewage pumping plant (A.X. 5117). *Austria*: Artificial horn, metal, artificial resin, casein and non-inflammable celluloid (178). *British India*: Paper, cresol (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Chile*: Chemists' supplies, rubber goods, glass syphons, raw materials for soap and face powder manufacturers, raw materials for tanners excepting sodium sulphide and anilines (192). *Czechoslovakia*: Tin, lead, antimony (A.X. 5122). *Egypt*: Turbo alternators, boilers (B.X. 3748). *Germany*: Chromium, manganese, tungsten, bismuth, iron and titanium ores (184); raw products for fertilisers (bones, crushed bones, sinews, etc.) (185). *New Zealand*: Insulating material for cold storage, water meters (177); copper welded steel wire (A.X. 5111). *South America*: Stationery (191). *Spain*: Mercury containers (Board of Management of the Almaden and Arrayanes Quicksilver Mines, Madrid). *South Africa*: Insulators (B. 3749).

Safeguarding of Key Industries Act

The Board of Trade have received a complaint, under Section 1, Sub-section (5), of the Safeguarding of Industries Act, 1921, that spectacles, eyeglasses and monacles have been improperly excluded from the lists of articles chargeable with duty under Part I of that Act as amended by Section 10 of the Finance Act, 1926. The complaint will be referred for arbitration to a tribunal consisting of the Referee, Mr. A. A. Hudson, K.C., and of Dr. J. H. Jeans, F.R.S., and Prof. F. A. Lindemann, F.R.S., who have been selected by the Lord Chancellor for the purpose of this arbitration from the panel constituted under Section 10, Sub-section (4), of the Finance Act, 1926. (Cf. p. 812.) Any communications regarding this complaint should be addressed without delay to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1.

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during August, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 600, of which 505 were from

merchants or importers. To these should be added 16 cases outstanding on July 31, making a total for the month of 616. These were dealt with as follows :—(Granted—540 (of which 521 were dealt with within 7 days of receipt); referred to British makers of similar products—47 (of which 37 were dealt with within 7 days of receipt); referred to Reparation Supplies available—5 (all dealt with within 2 days of receipt); outstanding on August 31, 1927—24. Of the total of 616 applications received, 563, or 91%, were dealt with within 7 days of receipt.

• British Industries Fair

The record of the British Industries Fair for the boom year of 1921 is regarded by the Department of Overseas trade as already broken. According to figures published this week, the space taken for the London section of next February's Fair is now 9,000 sq. ft. more than it was at the White City this year, and, with several months still to run, the combined space booked at London and Birmingham is already only a few thousand feet short of the record. "The astonishing success of the fair," said an official of the Department of Overseas Trade in an interview, "is a solid tribute to the cumulative effect of wide newspaper advertising at home and overseas, and to the patriotic lead which editors everywhere have given the public. The practical business results of last year's fair have led at least 80% of the exhibitors to come in again, and to bring in their wake not only firms which had exhibited in the past and dropped out, but a large number of others quite new to the fair. At this comparatively early date the majority of sections are all bigger than last year. Certain of them, indeed, have now but little space left, and the question whether the increased space available for the next three years will be adequate is already exercising the minds of the Department. The graph of buyers is ascending. Last year the fair was visited by a record number of them, and there is a reasonable certainty of an increase next year. This fact that the fair, as it becomes more and more representative of British industries, attracts year by year more overseas buyers is clearly an invaluable stimulus to overseas trade."

News from Advertisements

A chemist-executive is available for work in connexion with cellulose acetate, allied products and acetate silk (p. vi).

An 18-in. diameter centrifuge is for sale (p. vi).

A highly-trained chemist requires a junior partnership in a chemical concern (p. vi).

Page vii is devoted to a display of advertisements by various Polytechnic Associations.

There are 114 firms represented under various headings in our Buyers' Guide.

Casein Exports of Argentina

During 1926 Argentina exported 19,459 metric tons of casein, valued at an average price of 530 - 550 Argentine paper pesos per ton, an increase of 10% in quantity and 15% in price compared with 1925. Nearly half the export is taken by the United States, and the remainder by Europe.

Scientific Instruments

The Cambridge Scientific Instrument Co., Ltd., is showing a very representative collection of scientific instruments at the Shipping, Engineering and Machinery Exhibition at Olympia (from Sept. 8 to 24). A noteworthy feature of the exhibit is the arrangement of typical groups of instruments mounted on panels as they would be in actual use. Thus, one panel comprises two totally-enclosed indicators arranged for connexion to electrical distance thermometers measuring oil, water, and air temperatures in a turbine and condenser plant, as well as a pressure recorder and a compound gauge. Six illuminated dial CO₂ indicators working in conjunction with a CO₂ recorder are shown in operation: these instruments possess many novel features of considerable interest. A robust dissolved-oxygen recorder, a new apparatus for boiler-house use, is on view, as well as a variety of the well-known Cambridge instruments for measuring and regulating temperature, draught, and pressure gauges, and other instruments for engineering and electrical measurements.

PUBLICATIONS RECEIVED

FIFTH ANNUAL REPORT OF THE SAFETY IN MINES RESEARCH BOARD, INCLUDING A REPORT OF MATTERS DEALT WITH BY THE HEALTH ADVISORY COMMITTEE, 1926. Mines Department. Pp. 55. H.M. Stationery Office, 1927. Price 9d.

PHOSPHORIC ACID, PHOSPHATES, AND PHOSPHATIC FERTILISERS. By Wm. H. Waggaman, assisted by H. W. Easterwood. American Chemical Society Monograph Series. Pp. 370. New York: The Chemical Catalog Co., Inc., 1927. Price \$7.50.

FERTILISERS AND SOIL IMPROVERS. By W. Gardner. Pp. vii + 184. London: Crosby Lockwood & Son, 1927. Price 7s. 6d.

FIRE RESISTANT CONSTRUCTION. BUILDING RESEARCH SPECIAL REPORT No. 8. By R. E. Stradling, M.C., D.Sc., Ph.D., A.M.Inst.C.E., and F. L. Brady, M.Sc., A.I.C. Pp. vi + 57. Department of Scientific and Industrial Research, H.M. Stationery Office, 1927. Price 1s. 6d.

REPORT ON THE WORK OF THE LIGHTING DEPARTMENT OF THE CORPORATION OF THE CITY OF GLASGOW FOR THE YEAR FROM JUNE 1, 1926, TILL MAY 31, 1927. Pp. 11. Glasgow: Inspector of Lighting, 20, Trongate. 1927.

REPORT ON THE COMPETITION OF INDUSTRIAL DESIGNS, 1927. Royal Society of Arts, John Street, Adelphi, London, W.C.2. Pp. 30. London: F. J. Parsons, Ltd.

PUBLICATIONS OF THE CANADA DEPARTMENT OF MINES. MINES BRANCH. Ottawa: F. A. Acland, 1927:—Preliminary Report on the Limestones of Quebec and Ontario By M. F. Goudge. No. 682. Pp. v + 75. Price 25 c. Use of Alberta Bituminous Sands for Surfacing of Highways. By S. C. Ellis. No. 684. Pp. 37. Price 20 c.

METHODS OF THE CHEMISTS OF THE UNITED STATES STEEL CORPORATION FOR THE SAMPLING AND ANALYSIS OF GASES. Third edition. Pp. xiv + 187. Pittsburgh, Pa.: The Carnegie Steel Company, 1927. Price \$2.00.

DIE LEHRE VOM TROCKNEN IN GRAPHISCHER DARSTELLUNG. By K. Reyscher. Second revised edition. Pp. 74. Berlin: Julius Springer, 1927. Price 4.50 r.m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW
SERIES

LONDON, SEPTEMBER 16, 1927.

No. 37

EDITORIAL

Cellulose

WE wish that we were better acquainted with the cellulose industry, its statistics, growth and future. We judge from *The Times* and other newspapers that its future may be difficult. The amount of wood, of paper, of artificial silk, and of explosives derived from cellulose, that man requires, increases year by year; not only does each man, woman and child want more, but the total number of men, women and children is increasing rapidly. Col. Pollitt told us in Edinburgh that at the present rate of increase the whole agricultural area of the world will, a hundred years hence, be inadequate to feed the human race. There are many possibilities in the next century; the present rate of increase may not persist; if we remember Darwin's books aright, the animal kingdom has always been limited by the immediate prospect of starvation; the cabbage butterfly, the earwig, the herring and the cod would speedily fill the whole world if there were only enough food for them: man only, proud, presumptuous man, has so far not filled up his quota, though he very speedily will. We are not greatly concerned about the food supply of man a hundred years hence. As old Merrythought said, "I never came into my dining room, but, at eleven and six o'clock, I found excellent meat and drink o' the table; my clothes were never worn out, but next morning a tailor brought me a new suit: and without question it will be so ever." On the other hand, long before the end of the century, it seems that there may be a great shortage of cellulose. Mr. Raitt, the cellulose expert to the Government of India, tells us that the paper industry and the cellulose industries require now forty million tons of raw wood a year, and will, twenty years hence, require sixty million tons, and that there is no probability of this quantity being available twenty years hence; he tells us that there are immense areas of bamboo forest in India which are a source of cellulose for the paper industry, and that a valuable

bamboo pulp suitable for paper can be made at a cost of about 15 per cent. less than that of wood pulp. If paper goes up rapidly in price, there would be many features to mitigate our disappointment: smaller newspapers, fewer journals, fewer books, fewer circulars, less litter left in streets, railways and the countryside. We can hardly hope for so desirable a result; the probability is that whole masses of vegetable matter, now wasted, will serve as the raw material for treatment by the chemist and the chemical engineer of the future. Time was when the papyrus was necessary to the man of letters; a few pieces of papyrus now divert the tourist in Syracuse, and it has ceased to be of any value; fifty years ago the paper-maker relied on rags; he now relies on wood pulp and esparto grass, and from the esparto grass residues he can make a sort of ebonite or bakelite more durable than paper; we understand that in Italy the esparto grass and its residues are being converted into artificial silk, the conversion of esparto grass into suitable cellulose being effected by chlorine obtained by the electrolysis of common salt. We suppose that esparto grass will have its day, that coniferous wood will have its day, that bamboo may very likely have its day, and possibly other supplies will be tried and found useful, and after some vicissitudes will be replaced by materials now unworthy of consideration. Of two things we are fairly confident; the chemist of the future will, five and twenty years hence, be as full of resource as he is to-day, and that is saying a good deal; we have read, even in this JOURNAL, statements implying that here and there may be found chemists with but little interest in business; we do not remember any statement made which denies their power of organising a piece of technical research and carrying it out with a skill which is really marvellous: this is the first thing of which we are confident; the second is that the chemist, five and twenty years hence, will still read his CHEMISTRY AND INDUSTRY, and that, whether it is printed on cellulose or on some new synthetic

or metamorphosed material, it will be printed in some permanent manner. Our daily news we can have by wireless, that will save twenty thousand tons a year; our parcels can be wrapped up in lead foil, it is desirable to increase the demand for lead; since the hospitals took to collecting lead foil and getting it re-smelted the price of lead has dropped from £30 to £22 a ton; artificial silk stockings will become dearer than natural silk; still the scientific journals, the weekly chemical ones at any rate, will be circulated and kept for reference. We are not sure who first compared the editor, cudgelling his brain for something to say, to the spider producing a thread by spinning its own entrails, but the mention of natural silk naturally brings this saying to the mind, and as one thought leads on to another, it may be suggested that a fresh topic should now be chosen for a fresh effort.

Mathematics in Chemistry

That department of chemistry, and it is an important one, which is an exact science, is necessarily involved with mathematics, and there are very many portions of physical and theoretical chemistry which require a knowledge of algebra, trigonometry, and the differential calculus, and a few in which the integral calculus is necessary. All these varieties of higher mathematics were invented to do with ease what could be done without them only with the greatest difficulty; the elementary stages are easy to learn and, with the exception of the integral calculus, easy to use. The paper we publish this week by Mr. S. K. Tweedy gives an example of an easy way of solving, with an accuracy equal to the errors of experiment, equations of a type common in chemistry, but very difficult to solve by the usual geometrical or algebraical methods. A similar method enables the calculation of logarithms to be easily performed, so easily that at seaside places where there is nothing to do we have often whiled away an odd half-hour by calculating the logarithms of half a dozen numbers to five or six places of decimals. The time was wasted, of course, but so it would have been had we read the latest cricket or racing news. Plotting data on a curve is the commonest method for the chemist to record his experiments, and the deduction of laws from these curves is very easy if one has had enough practice to avoid the obvious pitfalls. The plotting of data is also of the greatest value in industrial chemistry, and in almost every branch of industry; we know nothing to compare with it for recording daily or weekly makes, deliveries, sales, expenses, and so on. A chart of this character can show at a glance how many tons were made last week or since the first of February, how many pages of a journal were printed last week or since the first of January, what they cost for printing or in total, how much profit the manufacturer has made, assuming certain rough figures for overhead charges and so on. Those chemists who desire posts of responsibility in industry might do much worse than spend an hour a week in recording the facts of importance to them and a few hours every summer holiday over Taylor's theorem and the simple mathematical devices of that singular chemist, philosopher, and astronomer, Isaac Newton.]

THE SOLUTION OF MATHEMATICAL EQUATIONS IN CHEMICAL PROBLEMS

By S. K. TWEEDY, B.Sc.

A general method of solving equations of any type should form part of the mental equipment of every chemist. Mathematical equations are continually occurring in technical and research problems, and in the experience of the writer these are solved either by guesswork, graphical methods, or else by simplification into a form amenable to treatment by the elementary methods. Graphical methods are very often applicable, but graph-paper is not always at hand. The object of the present note is to call the attention of chemists to a simple, general, analytical method of solving equations attributed to Newton, and usually named after him.

The theory of the method is very simple. Suppose the equation is $f(x) = 0$, the true solution being x . A solution is estimated; let this be a , and suppose that a differs from x by a small quantity h . Then $a + h = x$. Expanding by Taylor's theorem we have:

$$0 = f(x) = f(a + h) = f(a) + hf'(a) + \frac{h^2}{2!} f''(a) + \dots + \frac{h^n}{n!} f^{(n)}(a) + \dots$$

where $f'(a)$ represents the value of the first differential coefficient of $f(x)$ with respect to x when $x = a$. If h is small enough so that all terms involving it to the second and higher powers may be neglected, then $0 = f(a) + hf'(a)$ or $h = -f(a)/f'(a)$, a quantity which can readily be calculated. Owing to the fact that some of the terms in the expansion have been neglected, the value of h found will be such that $a + h$ is not quite equal to x , the true solution, but it will be nearer than a . The process is continued, therefore, with the found $a + h$ as the estimated solution, and so on, until the correction quantity to be added to the previous approximation is negligibly small. As a rule this stage is reached fairly rapidly, depending on the nearness of the estimated to the correct solution. It is advisable, therefore, to exert a little care in estimating the primary solution. The final result is not affected by an arithmetical error at any stage of the approximation: the time taken to reach the result is increased, however.

Two examples are appended illustrating the applicability of the process, the first one being given in detail. The writer has worked out numerous examples with the aid of the method, and has found that practically the only differential coefficients required in order to apply the process to those equations which arise in chemistry are the following:

$$\frac{dy}{dx} = nkx^{n-1} \quad \log_e x \quad e^x \quad k^x \quad - \quad \frac{1}{x} \quad e^x \quad k^x \log_e k \quad (= 2.303k^x \log_{10} k)$$

where n and k are constants and e is the exponential function. The simple nature of these derivatives tends to render the method simple in application.

Examples.—(1) Let us calculate the temperature at which the red modification of litharge will dissociate in air (cf. Glasstone, *J. Chem. Soc.*, 1921, 119, 1914; Stahl, *Metallurgie*, 1907, 4, 682). The reaction $2\text{PbO} = 2\text{Pb} + \text{O}_2$ is accompanied by the absorption of 100,600 cal. According to Nernst's approximation formula for gaseous equilibria (cf. Partington, "Chemical Thermodynamics,"

p. 226) $\log_{10} K_p = -Q/4.576T + 1.75\sum n \log_{10} T + \sum nC$, where K_p represents the equilibrium constant of the reaction (expressed in partial pressures), Q is the heat absorbed in the reaction, $\sum n$ represents the excess of gaseous molecules on the right-hand side of the chemical equation over those on the left-hand side, and $\sum nC$ represents the algebraic sum of the chemical constants for the gaseous molecules present. In the reaction under consideration $Q = 100,600$ cal., and $\sum n = 1 - 0 = 1$, the oxygen molecule being the only gaseous molecule involved. The chemical constant of oxygen is 2.8, so that $\sum nC = 2.8$, and since $K_p = p_o$ (solids not appearing in the expression for the mass-action constant) we have $\log_{10} p_o = -100,600/4.576T + 1.75\log_{10} T + 2.8$. Since lithium will dissociate in air when its oxygen dissociation pressure equals the partial pressure of oxygen in air ($= 0.21$ atm.) $\log_{10} p_o$ has to be replaced by $\log_{10} 0.21 = -0.678$, and the equation becomes $21980/T + 1.75\log_{10} T + 3.478 = 0$, which has to be solved for T . One method of obtaining the solution is to plot the curves $21980/T = y - 1.75\log_{10} T + 3.478$, the value of T corresponding to the point of intersection giving the required solution. The analytical solution of the equation, according to Newton's method, is carried out as follows.

First estimate a solution. Put $T = 1000$; $f(T) = 13.25$. Put $T = 2000$; $f(T) = -1.74$. Put $T = 3000$; $f(T) = 2.23$. The required solution therefore is between 2000° and 3000°, and is nearer the former. Assume $T = 2250$ for the first approximation.

$$f(T) = 21980/T + 1.75\log_{10} T + 3.478$$

$$f'(T) = 21980/T^2 + 1.75/2.303T$$

$$(i) f(2250) = -9.768 + 5.865 + 3.478 = -0.425$$

$$f'(2250) = 0.00434 + 0.00034 = 0.00468$$

$$f(2250)/f'(2250) = -0.425/0.00468 = -90.8$$

Second approximation $= 2250 - (-91) = 2341$.

$$(ii) f(2341) = -9.388 + 5.895 + 3.478 = -0.015$$

$$f'(2341) = 0.00401 + 0.000325 = 0.004335$$

$$f(2341)/f'(2341) = -0.015/0.004335 = -3.5$$

Third approximation $= 2341 - (-3.5) = 2344.5$.

$$(iii) f(2344.5) = -9.376 + 5.897 + 3.478 = -0.001$$

$$f'(2344.5) = 0.00400 + 0.00032 = 0.00432$$

$$f(2344.5)/f'(2344.5) = -0.001/0.00432 = -0.23$$

Fourth approximation $= 2344.5 - (-0.23) = 2344.73$. The required temperature, therefore, is 2345°K. It is quite obvious that by continuing the successive approximations the solution of the original equation may be obtained to any required degree of accuracy.

(2) As a second illustration let us calculate the molecular volume of carbon dioxide at 60° ($= 333^\circ\text{K.}$) and 25 atm. with the aid of van der Waals' equation. The constants are $a = 3.1 \times 10^6$ atm. \times (c.c.)² and $b = 2.8$ c.c./mol. Expressing v in c.c. and p in atm. (48 in c.c. \times atm.) the equation to be solved is $[25 + (3.1 \times 10^6)/v^2](v - 42.8) - 82.07 \times 333$ or $25v^3 - 2.39v^2 + 3.1 \times 10^6 v - 132.68 \times 10^6 = 0$. A simple calculation on the assumption that carbon dioxide is a perfect gas shows that v is approximately 1100 c.c.m. The successive approximations are:

$$(i) f(1100) = 2189.53 \times 10^6; f'(1100) = 31.37 \times 10^6;$$

$$\text{ratio} = 70.$$

$$(ii) f(1030) = 250 \times 10^6; f'(1030) = 24 \times 10^6; \text{ratio} = 10.4.$$

$$(iii) f(1020) = 13.2 \times 10^6; f'(1020) = 23 \times 10^6; \text{ratio} = 0.6.$$

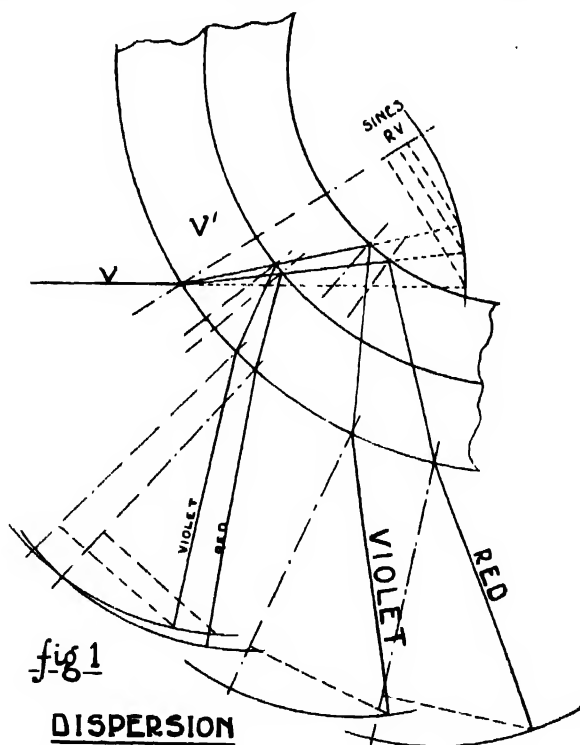
Hence the required volume is $1020 - 0.6 = 1019.4$ c.c.m. If this is the correct solution, then $f(1019.4)$ should be zero; actually it is 7.4×10^5 . If the approximation is carried a stage further the result 1019.37 is obtained, and $f(1019.37) = -1.43 \times 10^6$, so that the exact solution of the original equation lies between 1019.4 and 1019.37 c.c.m. By carrying the approximation process far enough the exact solution can be reached. In the present example the accuracy of van der Waals' equation does not warrant the calculation of v to more than the nearest c.c.

East London College,
University of London

RAINBOW "SPECTRA"

By ROBERT SAXON, B.Sc.

A converging beam of light is obtained by focussing a vertical illuminated slit upon a vertical test-tube filled with water. It is found that the usual spectra, as described in text-books, are obtained in addition to another caused by "vagabond" rays wandering round

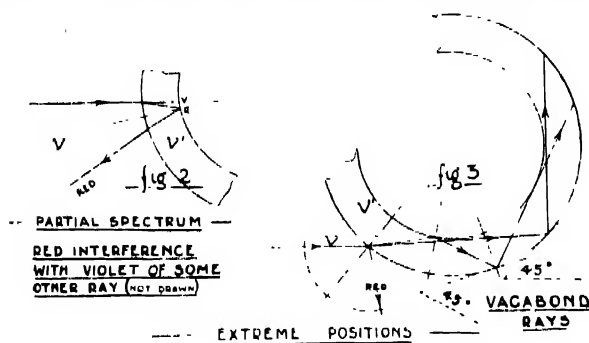


the tube in the glass itself, in zig-zag courses sent from surface to surface like a tramp. Another series of spectra can be obtained by reflected light from the tube when the beam impinges upon the tube in positions between the centre facing the source, and the "glancing" position, where the ray partly enters the glass and as vagabond rays fill the glass with glow, reflecting part of the spectrum.

The "Rainbow" spectrum made by the dispersing water shows absorption bands with coloured salts, and by altering the point of impinging, the length of track and amount of dispersion can be altered at will. Owing to reflection of the beam internally from concave surfaces the spectrum is not narrowed at the red end, as it is with the ordinary prism. The interference of the extreme bands shown in Figs. 2 and 3 (in which the dispersion is grossly exaggerated for purposes of reproduction) is negligible with thin tubes.

The difficulty in these experiments is to obtain tubes of circular uniform bore and thickness, but those supplied to the author by one of the oldest glass-blowing houses in Europe give good results. Air streaks, too, give interference, but when the blower wishes he can avoid these. Better results still will be obtained by forming a tube round a circular mandrel fixed inside a circular hole. The tubes used here are of $\frac{5}{8}$ -in. diameter, flint glass blown as thin as possible—varying from 0.3 to 0.5 mm. Experiments with thicker tubing, such as barometer and combustion tubing, give brilliant spectra, but the bore and thickness are not sufficiently uniform to give pure colours.

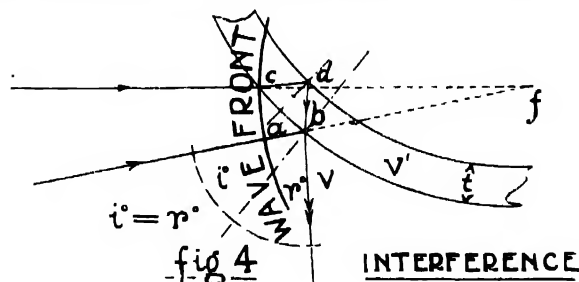
Coloured liquids give reflection spectra as shown in Fig. 1. The denser the colour of the liquid and the



brighter the colour in the spectrum in which absorption does not take place: for example, with potassium permanganate red, yellow, early green, and violet are brilliant, but blue and late green are weak. The violet is much longer and more evident than with a prism. In Fig. 1 it will be seen how increasing thickness lengthens out the spectrum according to the law of squares, and that the violet has less opportunity of total reflection than it would have with a prism, just as with the constant deviation block. When the beam impinges too near the axis of the lenses, that is, the middle of the tube facing the source, there is dazzle and reflection interference in this violet. Where mercury is used (after thoroughly drying and cleaning) in the clean warm tube these dispersion colours are very brilliant and produce dazzle whiteness when they interfere with the desired spectrum. Dark liquids (even Indian ink) give the desired spectrum (Fig. 4) without this interference. As such is not the case with flat surfaces it is evident that the cylinder has greater reflexive oscillatory power on a ray than a flat surface. The attendant rays on either side of any one ray under consideration may have a swing-over dynamic effect on that ray, and one is more normal to the surface than the other, except

when the beam hits the cylinder to pass through its axis. The one more nearly normal must have some decisive effect upon the ray which is not balanced on the other side.

Fig. 4 shows the desired means of producing spectra. A converging beam with imaginary focus and centre of



spherical wave fronts at f . The reflected ray from a interferes with that following path cd and the difference in phase represented by

$$(cd + db)/v' - ab/v$$

where v is the velocity in air, and v' that in glass of the rays, can be arranged or determined by the magnitude of c and t (thickness) along with the convergent angle.

Any part of the spectrum can be studied without the others, and photographic plates suited to these parts used. When the convergent angle covers as little as possible of the tube the light is monochromatic, and polarised.

CHEMISTRY AT THE BRITISH ASSOCIATION MEETING

Very few of those attending the meeting and immediately interested in the work of Section B will agree with the Special Correspondent of *The Times*, who gave it as his opinion that "There is a general impression of an arduous, overcrowded, and somewhat flat meeting. The proceedings in Section B were mildly arduous, they were not overcrowded, and the term "somewhat flat" could not be attached either to the intellectual standard of the proceedings or to the generous Yorkshire hospitality which the chemists received.

Dr. N. V. Sidgwick, F.R.S., whom we congratulate on having received the honorary D.Sc. degree of the University of Leeds, did not formally read his Presidential Address, but opened a discussion on Thursday, September 1, on the subject of his address, "Co-ordination compounds." Dr. Sidgwick's stimulating power of co-ordinating chemical facts and showing how these can be explained by our present knowledge of the structure of the atom is well known. His Presidential Address has already been printed in this JOURNAL (CHEM. & IND., September 9, p. 799), and we venture to believe that it will be regarded as a classical contribution to the subject. It was clear from the discussion, in which Professor G. T. Morgan, F.R.S., Professor C. K. Ingold, F.R.S., Dr. S. Sugden and Dr. F. G. Mann, all well-known workers in this field, took part, that although complete harmony among prevailing views has not been arrived at, we can even now appreciate the far-reaching importance to all branches of chemistry of the work on co-ordination compounds.

On the same afternoon Mr. A. T. King read a paper on "The chemical aspect of wool research," and an opportunity of seeing something of the work at the British Research Association for the Woollen and Worsted Industries was given.

On Friday, September 2, the chemists and physicists held a joint discussion on "The structure and formation of colloidal particles." Sir William Bragg, F.R.S., indicated with his characteristic clearness the information which the use of X-ray analysis had already given as to the constitution of colloid particles. Prof. Freundlich's contribution followed that of Sir William Bragg most happily, and Prof. Freundlich was welcomed not only as one of the foremost workers in this field, but as a friend: he received a great ovation. The work going on in the University of Leeds was described by Prof. R. Whytlaw Gray and Dr. F. L. Usher, and we had a communication from Sir James Walker's Laboratory by Mr. B. N. Desai and another from the Physics Laboratory at Leeds from Mr. J. Ewles.

It would take too long to describe adequately here the discussion on "The chemistry of hormones," on Monday, September 5. Prof. G. Barger, F.R.S., gave an excellent survey of the whole field, and described the useful rôle which the chemist has played and can play in the investigation of these "stirrers up" of physiological processes. Whether one considers the cases of adrenalin or thyroxin, whose chemical constitution is, in each case, now known beyond doubt, or the more difficult cases of insulin, secretin, the ovarian or the testicular hormones, the work of the chemist follows that of the clinician and the physiologist. Prof. H. S. Raper discussed the possible explanation of the activity of adrenalin: a wonderful chemical lecture by an eminent physiologist. Prof. J. C. Drummond emphasised the necessity of appreciation by chemists of the practical difficulties of working on such substances as the hormones and vitamins which possess such enormously high physiological activities: he described in detail work in progress at University College by Dr. A. S. Parkes on the ovarian hormone which has recently been shown to contain two substances one of which is active or dominant during oestrus and the other active during pregnancy. Prof. E. C. Dodds directed attention also to the ovarian hormone. When prepared by alcoholic extraction it appears to be an oil the distillation of which in high vacuum is extremely difficult.

Prof. J. Mellanby's interesting account of secretin indicated that there is some hope that the chemical nature of secretin will be revealed before very long in spite of the difficulties attached to the work. Drs. Seligwick, Simonsen, Henry, and Channon all took part in the discussion, and although Mr. F. H. Carr unfortunately could not be present (owing to a family bereavement), he sent a communication regarding the purification of insulin by crystallisation, on the lines of Prof. Abel, whereby an insulin possessing an activity of $3/2$ times that of insulin purified by ordinary methods has been obtained in small-scale experiments.

On Tuesday, September 6, five papers were communicated. Prof. H. M. Dawson dealt with "New developments in the study of acid catalysis," Prof. John Read with "Researches on menthones, menthols, and menthyl-

amines," Mr. W. A. Wightman with "Multiplanar rings and some consequences of strainless motion," Dr. W. Wardlaw with "Co-ordination compounds of molybdenum," and Dr. J. A. V. Butler with "The effect of an electric field on the adsorption of ions at the interface of mercury and neutral solutions of electrolytes."

The sectional excursions to the works of Messrs. Wood Bros. Glass Co., Barnsley (Thursday), to Messrs. The Yorkshire Coking and Chemical Co., Ltd., and Messrs. Hickson and Partners, Ltd., Castleford (Friday), to Messrs. L. B. Holliday and Co., Huddersfield (Monday), and to Messrs. Joseph Watson and Sons, Ltd., Leeds (Tuesday), were extremely well attended. The parties were most hospitably entertained, and no trouble was spared in making the visitors acquainted with the work.

For Section B, the Leeds Meeting of 1927 will be memorable, and its success very largely depended on the efforts of Mr. H. S. Patterson, the efficient, energetic and genial Local Secretary.

MOLER PRODUCTS, LTD.

A large party was present at the opening, last week, of the first unit of the plant which Moler Products, Ltd.,

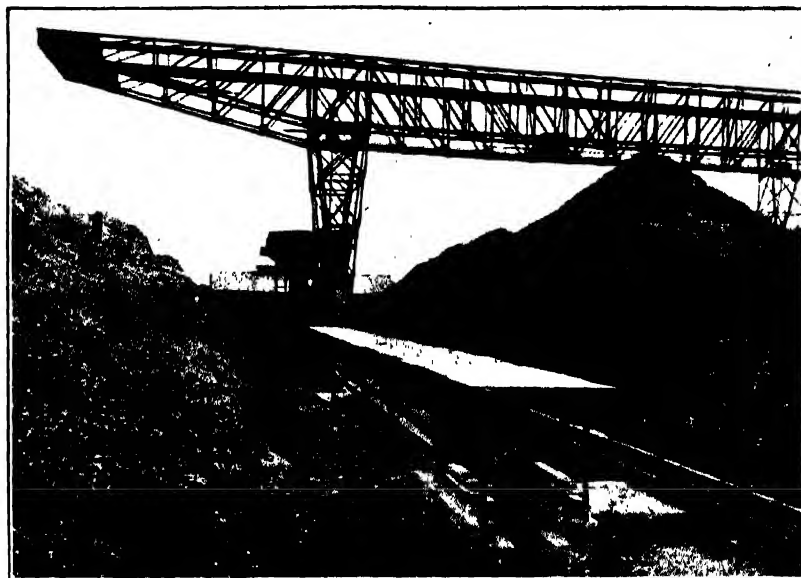


Behind is the cutter for the slabs as extruded from another machine under pressure. The cut slabs pass on to a rack that assumes a perpendicular position for conveyance on light rails to the kilns

has erected at Hythe, near Colchester, for the manufacture of constructional and insulating materials from diatomaceous earth. The factory is situated on the banks of the Colne, and represents, together with the

source of supply of the raw material in Denmark, a British investment of some £400,000. The lay-out of

slabs. They are stated to have efficient sound, heat and cold insulating properties; they are about one-third



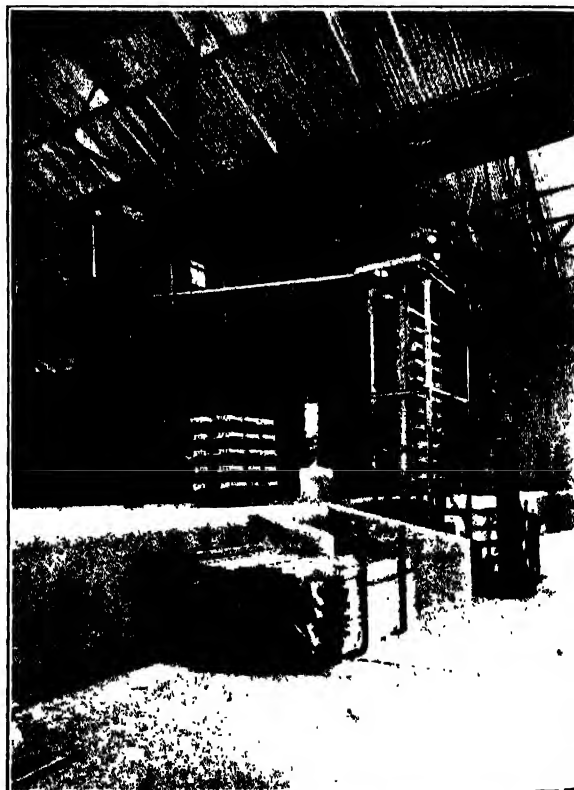
A 2000 ton dump of Fosalsil with the telpher and belt conveyor

the works appears to have been admirably conceived, the latest types of plant and labour-saving devices have been installed, and ample provision is made for expansion.

After the official opening, the guests first inspected the storage dump at the wharf, where 5000 tons of the diatomaceous earth is stored. From the dump a belt conveyor, capable of handling 100 tons per hour, carries the earth to the separating plant in which stones and other undesirable material is removed. From here some of the material passes through processes which convert it into a cement for coating steam pipes etc., whilst some is conveyed on a belt to hoppers, each capable of storing 45 tons. From the hoppers the material is delivered to mixers, in which it is converted into a plastic mass with the aid of water, and is then passed to brick-making machines, which force it through a die under heavy pressure. The extruded slabs, now shaped, passes over a cutting table, which measures and cuts off the length of brick required irrespective of the speed of the delivery. The shaped bricks are loaded automatically on to conveyors and passed to the drying chambers. From the drying chambers the bricks are transferred to the kilns, where they are fired at a temperature of 880°C ., control being by means of cones as well as by distant recording Cambridge pyrometers. The kilns are situated on a raised platform provided each side with railway sidings, so that the bricks, when cooled off, can be loaded directly into trucks with a minimum of trouble. The boiler plant, the gas-producer, and the electricity plant are all of the best of their kind. Waste-heat recovery is practised in the most approved fashion.

The materials thus manufactured from diatomaceous earth, are marketed by J. H. Sankey & Son, Ltd., of Canning "Town, under the trade name of "Fosalsil (Moler)," and are supplied in the form of solid or hollow partition blocks, or as porous solid insulating bricks and

lighter than ordinary clay products, and in the form of hollow partition blocks have a crushing strength of



Elevator for pressed partition slabs and bricks to the floor level of the kilns

about one half ton per square inch. A test carried out under working conditions in a gas works showed that the temperature of an uninsulated 14-in. wall of retort setting of ordinary firebricks was $195^{\circ}\text{C}.$, but when insulated with "Fosalsil" Moler porous insulating brick the temperature was reduced to $70^{\circ}\text{C}.$, and when insulated with Moler solid-insulating brick to $92^{\circ}\text{C}.$ Figures were supplied showing the efficiency of Moler cement used as a covering for steam pipes, boilers, etc.

Speaking at a luncheon which followed the visit, the chairman of the Board, Mr. J. A. Agnew, said that at present the plant was mainly producing building materials, but the Board felt that the company could soon play a very important part in the production of insulating products, mainly for power and gas plants.

THE SHIPPING, ENGINEERING AND MACHINERY EXHIBITION

The twenty-first Shipping, Engineering and Machinery Exhibition now being held in Olympia contains such a wide variety of exhibits that it will well repay a visit. Unless the visitor is specially interested in one particular branch of engineering, several visits could profitably be made before he could become familiar with all the exhibits which are worthy of attention. Some idea of the variety of the exhibits may be obtained from the following brief summary. Several stands are devoted solely to metals and materials used by the engineer, whilst another group shows developments in machine tools, and a third group exhibits various scientific appliances for measuring steam and water, automatically recording carbon dioxide in flue gases, measuring and controlling temperatures, and the treatment of feed water for boilers. Quite a number of stands also show pumping machinery, and illustrate the handling of solid materials. The separation of foreign matter from liquids, such as oils, either by filtration or by centrifuging can be studied. Furnaces, electric and coal-fired, are also on show. On the optical side one can examine pyrometers, range-finders, binoculars, photomicrographic apparatus, section-cutting apparatus, and so on. The gradual application of the internal-combustion engine for marine work is in evidence on several stands, whilst others show types of these engines suitable for land purposes. Another interesting feature is the number of stands taken by shipping companies, which illustrate the facilities they offer for transport. Power-transmission is also brought to the notice of the visitor, for numerous stands exhibit reduction gears, whilst others show belts, belt fasteners, and materials for treating belts to prevent slipping. Oxy-acetylene welding and cutting in air and water, and spray painting are also among the many interesting exhibits. The methods adopted by the organisers of the Exhibition seem to be on the right lines, since arrangements have been made for over 40 different scientific bodies to pay official visits to the Exhibition, thereby bringing their members into contact with the latest engineering developments. The Society of Chemical Industry paid its official visit on September 13, when the President, Mr. F. H. Carr, C.B.E., the Council, and the members were the guests of the organisers.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICE

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, is now ready. The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

CALENDAR OF FORTHCOMING EVENTS

Sept. 20, 21, and 22.—IRON AND STEEL INSTITUTE. *Glasgow Meeting.* Royal Technical College, Glasgow, commencing each day at 10 a.m. (See CHEM. AND IND., Sept. 2, p. 786.)

Sept. 22.—INSTITUTION OF THE RUBBER INDUSTRY. *Manchester and District Section.* Geographical Society, St. Mary's Parsonage, Manchester. Annual General Meeting, to be followed by a discussion which Mr. H. C. Young will open on his paper "Production methods in a rubber factory."

Sept. 23 to 26.—ASSOCIATION OF SPECIAL LIBRARIES AND INFORMATION BUREAUX. Fourth Conference, Trinity College, Cambridge. Amongst the papers to be read are the following:—"The necessity for uniformity in the cataloguing of periodicals," discussion to be introduced by Dr. W. Bonser, Mr. J. F. Pownall, and Miss H. A. Ball. "Recent developments in connexion with the science library, South Kensington," by Col. Sir H. G. Lyons. Brief statements will be given on the work of the International Institute of Intellectual Co-operation (Paris), the International Institute of Bibliography (Brussels), the World List of Scientific Periodicals, etc. "Rationalisation in industry," by Major L. Urwick. "Forecasting of industrial and trade tendencies; the function of statistics in modern industrial organisation," by (a) H. Quigley and (b) W. Wallace. "Trade information and statistics in Great Britain as compared with other countries," by A. E. Overton. Papers dealing with patent classification, and the methods of searching patent specifications in Great Britain, Germany, and the United States, will be given. "Information bureaux and liaison with national and local libraries," by A. F. Ridley. "Special library from the administrative standpoint, with special reference to methods of indexing and filing," by P. K. Turner. "Information bureau in relation to the consultant," by Dr. J. C. Withers. Discussion on "New methods of photographic reproduction as applied to printed and MS. material." "A panel of expert translators"; discussion to be introduced by Dr. R. S. Hutton. "Standards of book selection in science and technology," by Sir Richard Gregory, followed by a discussion. (See CHEM. AND IND., Sept. 2, p. 788.)

Sept. 26 and 27.—CERAMIC SOCIETY. *Refractory Materials Section Meeting.* Town Hall, Bournemouth, commencing at 10 a.m. each day. The following papers will be read:—"A consideration of steel works refractories," by A. T. Green. "Note on silica bricks made without added bond," by W. J. Rees and W. Hugill. "Some experiments in the drying of clays," by R. S. Troop. "Crushing strength of unfired fire-clay bodies," by W. C. Hancock. "Determination of iron silicates," by A. E. J. Vickers. "Refractory material used as mortar for laying up refractories," by Prof. D. A. Moulton. "Characterisation of clay," by Dr. A. F. Joseph. Discussion to be opened by S. R. Hind. "Effects of temperature on the mechanical properties of silica products," by A. J. Dale.

INTERNATIONAL SOCIETY OF LEATHER TRADES' CHEMISTS

In connexion with the Conference in London during the week commencing September 12 of the International Society of Leather Trades' Chemists, a luncheon was given on September 12 at the Connaught Rooms by the United Tanners' Federation of Great Britain and Ireland and the Federation of Curriers, Light Leather Tanners and Dressers. Mr. A. P. Preston, President of the United Tanners Federation, was in the chair.

Proposing the toast of "The International Society of Leather Trades' Chemists," the chairman said the Society was formed 30 years ago, and one of the founders was the late Professor Procter, whose recent death was so much regretted. Professor Procter was a pioneer of chemistry in the leather trade. Remarkable progress had been made in the leather trade during the 30 years the Society had been in existence. Chemical control was almost unknown in those early days, but to-day there was hardly a tannery in the country that was not controlled by chemists, and the Society could take a full share of the credit for this advance.

Professor D. McCandlish (President of the International Society of Leather Trades' Chemists 1926-7) said the Society at times had been subjected to a good deal of criticism which on occasion was not well directed. Leather chemists had tough hides, and were not hurt by honest constructive criticism, but a good deal of criticism had centred around the question of hide powder, and some of it was neither well directed nor deserved. Leather chemists appreciated that there was a good deal of irritation in the tanning and extract trades over the hide powder problem. This had been taken under the wing of the Society, in a quite altruistic manner it had taken on the question of the production of hide powder supplies, thinking it was going to do something which would be appreciated by the trades concerned, but the Society had been roasted and toasted over the matter for years. Nevertheless, the Society had made honest efforts to clear up the position and to serve the trade. It had no funds for paying research workers; indeed, it had a deficit of £150 last year, but it had a number of earnest volunteer workers who had been doing valuable work, and he believed it could be said that these volunteer workers had shown the way to a solution of the hide powder problem, and that in the not too distant future hide powder worries would be a thing of the past.

Dr. A. Gansser (Past President of the International Society of Leather Trades' Chemists) proposed "The Leather Trades' Federations," and put in a plea for collaboration and co-operation between all branches—the leather chemists, the tanners, and the extract people.

Mr. Harry Holder (President of the Federation of Curriers, Light Leather Tanners and Dressers) who responded, subscribed to that plea, and expressed the hope that leather chemists would be able to do something to make the leather trade somewhat more profitable than it had been in the past.

The final toast was "Allied Societies" proposed by M. U. J. Thuau (Hon. General Secretary, the International Society of Leather Trades' Chemists). He said the Conference marked a stepping stone in the path of

progress of research leather chemists, and one of the greatest achievements of the Conference was the acknowledgment of a new international method of tanning which could be applied in every country of the world. He coupled the toast with the name of the President of the Society of Chemical Industry, Mr. F. H. Carr, C.B.E.

Mr. Carr, in his response to the toast, said that those in the Society of Chemical Industry believed that the progress of all industry is dependent on the progress of chemistry. Progress in chemistry, in its turn, was dependent on the progress of its interdependent parts, and those taking part in this Conference were promoting the progress of the leather industry in a manner which set an example to all the other branches of chemical industry. By coming together as leather chemists had done on this occasion they were doing very much to promote the science on which the progress of the leather industry depended. The progress of knowledge, however, was of value only as it promoted human happiness; that was the real test of research in the end. He would always maintain that the progress of the world in peace depended on the extent to which we can use knowledge to advance the happiness of the workers and the people of the country generally.

CORRESPONDENCE

THE COLLEGE MAN AND CHEMICAL INDUSTRY

SIR,—Recent correspondence under this heading which has appeared in the last few numbers of this JOURNAL appear to me to neglect one important point, viz., the attitude of the employer.

The usual questions put to the "raw" university graduate seeking employment are:—

1. Did you get a "First"? (Which means are you a quite exceptional case where pure science alone is concerned?)

2. Will you come for "x" £ per week? (Where "x" is usually the lowest integer he can think of and works out at perhaps 2s. or 3s. per week more than the wages of the man who sweeps the floor.)

Consequently, (1) drives men, while at college, to strive after that elusive "honour," thus leaving no time, energy, or inclination for economics and the like, and (2) drives them East to become rubber planters.

If the manufacturer will create the demand, which means nothing more than offering reasonable salaries for the right "type," surely the supply will be forthcoming. Especially must this be so when an "article" so close to the desired "article" as the college man is, already exists.

Therefore, Mr. Editor, I feel that, like the steel industry, what the manufacturer needs is a little "self-help" and a cheque-book.

Yours faithfully,

Bickley, Kent

W. HENRY STEVENS

A SUGGESTION

SIR, In the current issue of CHEMISTRY AND INDUSTRY, you ask for a new word in place of "hydrogen ion concentration." In the next sentence you suggest one. Why not "hiocon"? Insist on its use in the JOURNAL and it will doubtless find favour—at any rate with the compositors.

Yours faithfully,

H. V. HODGSON

PERSONAL AND OTHER ITEMS

It is with deep regret that we announce the death, at the age of 85, of Mrs. Carr, the mother of the President of the Society, Mr. F. H. Carr, C.B.E. Throughout her life Mrs. Carr was conspicuous for her kindly actions, and she was busy and active until the last. She leaves a fairly large family to mourn her loss. General sympathy will be felt for the President and his family in their sad bereavement.

At the Congregation of the University of Leeds, held last week, the Chancellor, the Duke of Devonshire, announced that Col. Sir Edward Brotherton had given £100,000 to defray the cost of the new University Library. In conveying the University's profound appreciation of this magnificent benefaction, the Chancellor said the library, when built, would be permanently associated with the name of Sir Edward Allen Brotherton. Sir Edward, who is head of the well-known chemical manufacturing firm of Brotherton & Co., Ltd., has given generously to Leeds institutions, and has never been sparing in his public service.

Sir William Bragg, F.R.S., has been elected president of the British Association for the year 1928-29.

Mr. E. Gurney Buxton has been elected to the board of Callender's Cable & Construction Co.

Mr. Harold Cox has been appointed a director of the Calico Printers' Association, in place of the late Lord Emmott.

The University of London has conferred the degree of D.Sc. on Dr. S. Judd Lewis for a thesis on "Spectrophotometry in relation to chemistry."

Prof. Charles Weizmann, D.Sc., the well-known chemist, has been re-elected President of the Zionist organisation.

At the International Congress of Physics, held at Como, in connexion with the celebration of the centenary of Volta, the British delegates were Dr. F. W. Aston, Prof. W. L. Bragg, Prof. A. S. Eddington, Prof. J. A. Fleming, Prof. O. W. Richardson, Sir Ernest Rutherford, and Sir J. J. Thomson.

Mr. W. T. Chadwin has succeeded Mr. A. Wood as Secretary to the British Sugar Beet Society.

The death is announced of Mr. J. Taylor, chairman of British Insulated Cables, Ltd., and a director of the British Aluminium Co., Ltd., and other companies.

The death is announced of Dr. A. Jonas, factory manager to the I.-G. Farbenindustrie A.-G., at Leverkusen.

Dr. T. Fischer, chemist to the Westfälisch-Anhaltische Sprengstoff A.-G. Chem. Fabriken, has died aged 62.

The late Mr. T. W. Stainer Hutchins, managing director of the Electro Bleach and By-Products, Ltd., Northwich, left £38,477, with net personalty £36,375.

Chemical Combines

Sir Alfred Mond, in the course of an interview published in the *Morning Post*, said that he had seen it suggested "that an agreement is in contemplation between the Imperial Chemical Industries and the German Dye Trust, which might tend to favour Germany as far as

manufacture is concerned, and leave this country in a state of inferiority in time of war, and its chemical industry in an inferior position." "Nothing could be more incorrect. I can state emphatically," continued Sir Alfred Mond, "that we do not consider the British chemical industry to be in any way inferior to the German industry. We, in England, can produce synthetic ammonia quite as cheaply as the Germans. Further, our costs of production of chemical products are as low as, if not lower than, in other countries. Far from it being in our minds to conclude any agreement which would tend to give advantage to Germany at the expense of Great Britain, the whole trend of any discussion has been to get for the British Empire such advantages of new inventions as synthetic oil, and to form a harmonious mutual interchange of inventions, processes, and ideas of which we have as many as any other country. As far as national security is concerned," he concluded, "the present Imperial Chemical Industries is formed of firms who were responsible for the chemical supplies in the late war, and it should be remembered that we supplied both our selves and our Allies with explosives and gas at a very short notice. In point of fact, this country is far better off to-day for explosives than it was in 1918. Our British combine is in close touch with the Government, but in my opinion it would be contrary to all conservative doctrines to expect a trading concern to submit its plans and arrangements for sanction to any Government department. Such a course would paralyse all business activity, and put quite an unreasonable responsibility on the Government officials."

"Our negotiations with the German Dye Trust are in no way sensational. There can be no question of amalgamating, but only of discussing points of common interest, which has been the practice of every great firm or combine in the world."

Sir Max Muspratt, speaking at Liverpool recently, said that he was convinced that those industries which had combined for mutual improvement would be able to show an increase in the total employment and a reduction in the price to the consumer. Under a sound system of rationalisation, it was the duty of manufacturers to absorb the workers displaced by improved industrial methods.

New Device for Degreasing Machine Parts

Considerable interest attaches to a British invention which has been taken over by Imperial Chemical Industries, Ltd. The invention, known as "Crawshaw's chemical colander," consists essentially of a tank, in the bottom of which a special chemical known as "Crawshawpol" is placed. The chemical, which boils at a very low temperature, is heated by such means as may be available. In the upper portion of the tank there is a condensing coil, through which cold water circulates. The parts of machinery to be degreased are placed in the tank, which may vary in pattern and size to suit any class of article, small or large. On heating, the chemical begins to vapourise, the vapours being condensed by means of the condensing coil. The result is a shower bath of "Crawshawpol," which literally eats the grease off the metal parts. In a very few minutes the heating apparatus may be turned off and the tank opened, when

the parts will be found to be dry and absolutely free from grease, all that is then necessary being the use of a soft brush or air blow to rid the surfaces of dry dust.

After the chemical has dissolved and washed away the oil and grease from the work it falls back to the supply at the bottom. Here the grease is locked, and the continuous boiling of the chemical will not vapourise the oil, because it has a considerably higher boiling point than the chemical itself so that once the oil is down in the bottom it will never get back on the work. It is stated that the saving in suitable instances by the use of this colander cuts down labour times from as much as a full day spent in cleaning a whole machine to a matter of a quarter to half an hour, and that the general average of labour time saved is the difference between $1\frac{1}{2}$ to 2 hrs. cut down to 3 or 4 min. The invention is exhibited at the Shipping, Engineering and Machinery Exhibition, and probably will also be shown at the Public Works, Roads and Transport Congress and Exhibition.

Explosion at Cordite Factory

Three men were killed in an explosion at the Royal Naval Cordite Factory at Holton Heath, Dorset, on September 10, whilst they were working on an acetone recovery pipe. It is thought that some nitro-glycerin got on a screw, and that when it was turned the nitro-glycerin exploded.

Sir John Cass Technical Institute

The new session of the Sir John Cass Technical Institute, which extends over about 36 weeks, begins on Monday, September 19, and students will be enrolled on September 14, 15 and 16, from 6 to 8.30 p.m. The Institute, which is one of the London Polytechnics, provides instruction in pure and applied mathematics, physics, chemistry, the fermentation industries, petroleum technology, gas manufacture, metallurgy, mining, modern languages, arts and crafts, etc. In order that those who are engaged during the day may have the opportunity of obtaining an adequate education, the courses of instruction, which meet the requirements of those engaged in chemical, metallurgical, electrical, petroleum, and the fermentation industries, and in artistic crafts, etc., are held from 6 to 10 p.m. Full facilities are provided in the well-equipped laboratories of the Institute for special investigations and research. The instruction in experimental science also provides systematic courses for the examinations of London University and the Institute of Chemistry.

Gas Industry in Conference

Gas undertakings in all parts of the country will be represented at the Sixteenth Annual Conference of the British Commercial Gas Association, to be held in Southampton from Monday to Wednesday, October 3 to 5, under the Presidency of Sir Russell Bencraft, M.R.C.S.E., J.P., Deputy-Chairman of the Southampton Gaslight and Coke Co. Matters of public health will figure prominently in the discussions. Not only is Sir Russell Bencraft a medical man, and likely to survey the gas industry's contribution to public health in his Presidential Address, but on the evening of October 4, at a Mayoral Reception in connexion with the Conference, Sir Bruce Bruce Porter, K.B.E., C.M.G.,

M.D., one of the founders of the New Health Society, will lecture on "New health; the importance of health in industry." Other subjects are to be dealt with by Miss Gladys Burlton, Principal of the Burlton Business Institute, who is to speak on "Salesmanship in the showrooms," and by Mr. Ralph Halkett, General Manager of the Sheffield Gas Company, who will read a paper on "The commercial prospects and future co-operation of the gas industry."

Tinplate Pooling Scheme

The Welsh tinplate pooling scheme is to be abandoned, as no revival in the Welsh industry has followed its operation, owing to foreign competition. The pool was formed by a general contribution, and under the scheme, works without orders drew from it, and it was hoped thereby to regulate output and prices.

International Zinc Cartel

It is reported from Brussels that negotiations for the establishment of an international zinc cartel have been initiated by leading producers in Germany, Great Britain and Belgium. No great enthusiasm appears to be felt for the project.

Chemical Trade of the United States

During the first six months of 1927 the value of exports of chemicals and allied products amounted to \$97,188,000, an increase of 15% over the first six months of 1926. The imports, consisting mainly of crude and semi-manufactured products not indigenous to the United States, amounted to \$103,936,000, being 11% below those of the corresponding period in 1926. The improvement in exports was general in most of the groups, the largest, 97%, being in coal-tar products—especially in crudes. Increases were also notable in industrial chemicals and pigments and paints. There was a marked drop in the prices of rosin and turpentine. Exports of rosin amounted to 625,500 barrels (compared with 491,200 barrels during the corresponding period in 1926), whilst exports of turpentine amounted to 5,957,000 gals., against 3,724,000 gals. There was a large increase in the shipments of sulphur to Australia, France, Germany, the Netherlands and the United Kingdom also purchased considerably more during the first half of 1927 compared with the same period in 1926. Creosote oil was the largest single import. There was an increase of 16% in the purchases of colours, dyes, and stains, and a growing demand from foreign consumers for American insecticides, disinfectants, deodorants, etc. Imports of citrate of lime decreased from 2,318,000 lb. in the first six months of 1926 to 155,000 lb. during the same period of 1927. Although more refined glycerin was purchased from abroad, less crude came into the country. The largest export increases in the pigment, paint, and varnish group were in carbon black, which gained 25% in value and 14% in quantity, and in varnishes other than oil including lacquers. Exports of ammonium sulphate increased one fifth in quantity shipped to a total of 84,000 tons, the Netherlands East Indies affording the best outlet, with Japan second. The decrease in imports of fertilisers continued throughout the first half of 1927 until only two thirds as much was received compared with 1926, the most important decline being in sodium nitrate.

Carbon Black in the U.S.A.

The output of carbon black from natural gas in the U.S.A. in 1926 was 180,576,176 lb. (\$9,939,221), an increase of 2%. Sales totalled 167,304,710 lb., a decrease of 5% compared with 1925; 49.2% of the sales went to the rubber industry, 12.7% to ink, 6.7% to paint, 6.8% to miscellaneous uses, whilst 21.6% (39,210,389 lb.) was exported, Great Britain being the chief customer, followed in order by France, Canada, and Germany. Most of the production was made by the channel process.

The I.-G. Farbenindustrie

Application has been made by the German Dye Trust to the railway authorities for the transport of synthetic oils at a cheaper rate, the loading stations named in the application being Leuna, Ludwigshafen and Kötchen. From this it is concluded that the Trust's experiments at the Leuna works near Merseburg have been successful, and that the new synthetic fuel will shortly be placed on the market. It is also thought that coal distillation plants have been established at Ludwigshafen and Kötchen.

German Industry

Official statistics of the profits of limited liability companies in Germany in 1926 show that those engaged in the chemical industry (including the I.-G.) made average gross profits of 12.1%, the average net profits being 5.4%. In other branches, the gas, water, and electrical companies made 12.9% gross, 8% net, the paper industries 13.9% gross and 6% net, and the mining industries 11.6% gross and 6.2% net.

Speaking at the annual meeting of the Federation of German Industry on September 2, the chairman, Dr. Duisberg, said that the number of unemployed in Germany had decreased during the past year from about 1,500,000 to 576,000, the gain being confined chiefly to industries supplying the inland markets. In 1925 and 1926 the adverse balance of trade amounted to about £200,000,000, which would probably be exceeded during the current year. New debt totalling about £500,000,000 had been incurred during the last three years. Germany had to pay at least £225,000,000 a year in interest, which was more than double the pre-war figure. He impressed upon the meeting the need for economy in all branches of industry and for manufactures of first-class quality. It was essential to have healthy industrial, financial and social policies, and he warned them against the pursuance of a dangerous credit policy. In support of his statement that German industry as a whole was not as sound as might be expected, Dr. Duisberg said that of the 850 companies registered in Berlin during 1926, 309 had paid no dividends, and the average dividend paid by the others was only 6.88% compared with 10.02% in 1913. One of the chief reasons for this was that the wages of skilled workers had increased by 47% and unskilled by 81% since 1913.

An Enquiry

A correspondent wishes to get into touch with manufacturers of pectin for jelly making. Replies should be addressed to The Editor, CHEMISTRY AND INDUSTRY, 46—47, Finsbury Square, E.C.2.

REVIEWS

COAL CARBONISATION, HIGH AND LOW TEMPERATURE.—

A TREATISE ON THE PRINCIPLES AND PROCESSES OF MANUFACTURING COKE AND SEMI-COKE. By JOHN ROBERTS. Pp. xvi + 406. London: Sir Isaac Pitman & Sons, Ltd., 1927. Price 25s.

This is on the whole a well-designed and useful book. It begins with a rather sketchy chapter on the origin of coal, followed by two on the origin of anthracite. The author holds definite views on this subject, which he develops at considerable length. Not everyone will agree with him, or with his contention that knowledge of the mode of production of anthracite is of vital importance to the coke maker; but the chapters are full of interest. After a chapter on "Why coal should be carbonised" comes a series of chapters on coking and non-coking coals, the coking process, and the factors which influence or modify the coking quality—pre-heating, partial oxidation, the blending of coals, the effects of moisture, of compression, and of briquetting. Seven chapters on low-temperature carbonisation and eight on high-temperature carbonisation follow, in which are given descriptions, with diagrams, of the chief forms of retort or oven that have been or are in use; then three chapters on gas-works practice, one on the production of "semi-coke" (easily ignitable coke) in coke-ovens or gas-retorts, and a short account of the cognate processes of Bergius, Patart, and Fischer.

The purely descriptive portions of the book (and these form the greater portion of it) are very well done. The other portions are for the most part interesting to read, though they suffer from drawbacks which might readily be removed in a future edition by a little care. The author is an enthusiast, and perhaps carries his enthusiasm a little far for a textbook. He is of the school which holds that all bituminous coal should be carbonised, and draws a picture of the "All-embracing coal-mining enterprise" in which all coal brought to bank is carbonised; but he indicates one of the strong arguments against the practicability of universal coking treatment when he suggests that *as much as would be economically practicable* of the by-products should be worked up into finished products. What of the portion which it is not "economically practicable" to deal with, and how large would that portion be?

The drawbacks I have mentioned are, first, a lack of arrangement, and consequently of conciseness—within three pages, for instance, we are told three times that a strongly-coking coal carbonised at a low temperature will stick to the walls of the retort; and, second, a frequent looseness and inaccuracy of language, far too common in technical works, which at times puzzles the reader, and at times annoys him and distracts his attention from the matter. Early in the book the author distinguishes between those coals which yield smoke when burnt as they usually are, and those which do not. With the words "Smoky" and "Smokeless" at command, it would seem unnecessary to go further; but if other descriptive words are to be used, surely it would have been difficult to find less appropriate ones than "proximate" and "ultimate," which have entirely other meanings, and have no connexion whatever

with smokiness. In another place we find that a *prospect* is within measurable distance of becoming a *proposition*. The author has plenty of company when he speaks of "In the region of" or "In the neighbourhood of," where people in general say "About," just as the American will write "In the event that" where "If" is meant; but the shorter form is greatly to be preferred. This kind of thing is very frequent, and the book would be greatly improved if the author would edit it carefully in regard to orderly arrangement and choice of language. In spite of these blemishes and looked at broadly it is a book heartily to be commended.

One protest I must make, however. It is sad to think that any Briton, having that good and honest word at his command, should in serious discussions, designate his fellow countrymen by the objectionable, vulgar sounding, Yankee slang term "Britisher." I hope Mr. Roberts will gratify me by expunging that term from the second edition, an early call for which I am sure his book deserves.

J. T. DUNN

THE OIL AND COLOUR CHEMISTS' HANDBOOK. Translated from the German by W. H. HILTON-BROWN. Pp. 176. London: The Trade Papers Publishing Co., 1927. Price 10s. 6d.

This little book, which is a translation of the "Taschenbuch für die Farben- und Lackindustrie" by H. Wolff and W. Schlick, is interesting as a sidelight on the German paint and varnish industry, with which the activities of the authors have for so long been connected.

In Part I, pigments, oils, resins and solvents are covered, but the section describing the properties of pigments is hardly adequate. No blacks are included, except for a passing reference to "soot," and, judging from the information given, it would appear that the pigments in general use in Germany are distinctly inferior to those employed in this country.

Part II contains, considering the short space available, a good description of various varnishes and driers and their manufacture according to German practice. The section on cellulose ester varnishes is somewhat behind the times, but this is doubtless explained by the fact that, when the book was written, interest in these materials had not awakened in Germany to the extent which it has since done.

Part III can hardly be considered as an adequate summary of information on oil paints and enamels, even for a short handbook of this description; but the general schemes of analysis included in Part IV form a useful supplement to the methods of examination described in the earlier sections.

Taking into account its many good features, it is a pity that the book has suffered so much in translation. It is evident that the translator, although he has carried out his work conscientiously, has been handicapped by a lack of knowledge of the paint and varnish industries, with the result that the English equivalents of German technical terms have not always been quite happily rendered. It is to be hoped that in subsequent editions of the book an opportunity will be given for a paint chemist to overhaul, and where necessary edit, the whole of the book.

J. A. F. WILKINSON

DIE SELTENEN ERDEN VOM STANDPUNKTE DES ATOMBAUES. By Dr. G. VON HEVESY. *Struktur der Materie in Einzeldarstellungen*, edited by M. BORN and J. FRANCK. Pp. viii + 140. Berlin: Julius Springer, 1927. Price, paper, 9 m.; bound, 10.20 m.

The name of the author should in itself be a sufficient guarantee that this book is worth reading; if any further were needed, it would be that the book forms volume V of Professors Born and Franck's series entitled "Struktur der Materie." The first part deals with the position of the elements in question in the periodic system, reviews their general behaviour from the point of view of atomic structure, and discusses the regularities apparent in the group. In the second part, the chemical characteristics are more closely investigated and the analytical characters, separation, and occurrence are summarised. Original investigations, chiefly those published during the last ten years, are freely quoted, and an account is given of the history of the discovery of the rare earths, including that in 1926 of element No. 61.

A. A. F.

LE MANUEL DU PARFUMEUR. By H. ASKINSON. 4th French edition, revised and corrected by R. Sornet. Pp. 111. Paris: Gauthier-Villars et Cie. 1927. Price 18 fr.

It is extremely difficult to know to what particular class of reader this brochure is intended to appeal. It is quite elementary, and contains little, if anything, that is not to be found in other works, and it is so incomplete in its treatment of many subjects as to be of but little practical use. For example, after an incorrect differentiation between artificial and synthetic perfumes (natural isolates being classed as artificial perfumes), the author proceeds to describe a few synthetic perfumes without a single reference to the modern discoveries which have revolutionised the perfume industry. Hydroxycitronellal, the acetylenic carbonates, the higher fatty aldehydes, and many other substances which are in every up-to-date perfumer's laboratory, are not even mentioned. For a sin of commission we will only quote the following statement from page 17:—"With the exception of perfume materials made in Turkey and the Indies, particularly the essences of Rose, almost all of them are brought upon the market from the south of France and the neighbouring country, Italy. Some, however, come from England, such as oils of lavender and peppermint." So utterly incorrect is this statement that it needs no comment.

We do not think this little book will appeal to English readers.

ERNEST J. PARRY

COMPANY NEWS

B. LAPORTE, LTD.

After transferring £203 to reserve account and allowing for depreciation etc., the profit for the year ended June 30, 1927, was £11,459, plus £9815 brought in. A dividend has been recommended on the ordinary shares of 6%, less tax (compared with 9% for the previous year), carrying forward £6095. The first half of the year under review was adversely affected by the coal strike, the extra cost of fuel and motive power alone amounting to over £10,000.

BURT, BOULTON, AND HAYWOOD, LTD.

A dividend has been declared of 5% on the ordinary shares, compared with 10% for the previous year.

BRITISH ALUMINIUM CO., LTD.

An interim dividend has been declared of 4% (actual), less tax, on the ordinary shares, being the same as for each of the two preceding years.

BRITISH OIL AND CAKE MILLS, LTD.

An interim dividend has been declared on the cumulative preferred ordinary shares of 5%, less tax.

UNITED INDIGO AND CHEMICAL CO., LTD.

The net profits for the year to June 30, 1927, amounted to £21,892, compared with £21,707 for 1926. The dividend has been increased on the participating preference and the ordinary shares from 7½% to 8½%, subject to tax, carrying forward £15,282, against £14,170 brought in.

INTERNATIONAL HOLDINGS AND INVESTMENT CO., LTD.

At the annual ordinary general meeting, held on September 9, and presided over by the chairman, Mr. A. Loewenstein, C.B., the resolution was passed for the sale of the company's assets to the International Holding and Investment Co., Ltd. (incorporated in the Province of Quebec, Canada). Details of the transaction were given in *CHEMISTRY AND INDUSTRY* on September 9, 1927, page 816.

ONVERWACHT PLATINUM, LTD.

During the year ended June 30, 23,673 tons were milled, from which 8,963,755 fine ounces of platinum and allied metals in the form of crude platinum were produced, equivalent to a yield of 7.572 dwt. per ton milled. The net profit was £90,782, of which £78,750 was absorbed by the two dividends, totalling 17½% already paid, and £6813 by taxes, leaving £5219 to be carried forward. During the year 8322.9 fine ounces were sold, realising £142,858 net, or £17 3s. 3d. per fine ounce.

BULMER RAYON CO., LTD.

The accounts for the period from November 21, 1925 (date of incorporation of company), to January 31, 1927 show a loss of £32,390, which the directors attribute to the coal strike, to general market conditions, and to certain unavoidable delays in the development programme. One unit of the plant commenced operations last February; the second unit will be in operation by the end of September, and the third unit will probably start production by January or February next. The company is finding a ready outlet for its product, which is claimed to be of equal quality to any on the market. Sales are steadily increasing, and the production is fully sold for some months ahead. No dividend has been paid on the 8% cumulative preference capital since its issue in November, 1925.

BRITISH PLATINUM AND GOLD CORPORATION

It is announced that, as a result of suggestions made by the advisory committee set up in connexion with the recent issue of debentures, changes have been made in the Board, which now consists of the Hon. Lionel Guest (chairman), Mr. C. Chantrey Inchbald, Major F. W. D. Gwynne, O.B.E., Mr. T. J. Ive, Mr. G. H. Short, and Senor J. A. Mayolo.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
Bisulphite of Lime.—£7 10s. per ton, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate.—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton, home market, 1-cwt. iron drums included. Sod. Chlorate, 2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.r. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.r. London, 1-cwt. kegs included.

RUBBER CHEMICALS
Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
Arsenic Sulphide, Yellow.—1s. 9d. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 1d. per lb.
Diphenylguanidine.—3s. 9d. per lb.
Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.

Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P. £47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide. 2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9—£9 5s. per ton. Good demand. Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carbohc. Crystals.—8d.—8½d. per lb. Crude 60's, 2s. 6d.—2s. 7d. per gal.
 Acid Cresylic, 99/100.—2s. 9d.—2s. 10d. per gal. 97/99.—2s. 4d.—2s. 5d. per gal. Pale, 95%, 2s. 2d.—2s. 3d. per gal. Dark, 90%, 1s. 9d.—1s. 10d.; 95%, 2s. 1d.—2s. 2d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9½d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons, Pure, 1s. 5d.—1s. 6d. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 4d.—1s. 5d. per gal. Pure, 1s. 6d.—1s. 7d. per gal.
 Xylol.—1s. 3d.—1s. 4d. per gal. Pure, 2s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d. per gal. Heavy, 9d. per gal. Standard specification, 7½d.—7¾d. per gal. ex works. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 8½d.—9½d. per gal. Solvent 95/160, 1s. 4d.—1s. 5d. per gal. Solvent 90/190, 8½d.—9½d. per gal.
 Naphthalene Crude. Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals.—£11 10s.—£12 per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—88s. 9d.—91s. 3d. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 9d.—6s. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb. 100% basis d/d.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Wintner.—4s. 9d. per lb.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 20/31° C.—5½d. per lb.
 m-Cresol 98/100%.—2s. 7½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C. 9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol. 11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb. d/d.
 β-Naphthylamine.—3s. per lb. d/d.
 p-Nitraniline. 1s. 8d. per lb.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline. 5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb. d/d.
 R. Salt.—2s. 2d. per lb. 100% basis d/d.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb., naked at works.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xyldine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.
 Acid, Benzoic B.P. 2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P. Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 3½d. per lb. Technical 11½d.—1s. per lb. Good demand.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P. Lump £37 per ton, Powder £30 per ton, in 5 cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—11s. per oz. for English make.
 Barbitone. 6s. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—10s. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 2d.—2s. 3d. per lb. Potassium. 1s. 9½d.—1s. 10½d. per lb. Sodium.—2s.—2s. 1d. per lb. Granulated ½d. per lb. less. All spot.

Calcium Lactate.—1s. 2½d.—1s. 3½d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 6d. per lb., duty paid.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate. 6s. per lb.
 Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively;
 730.—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.
 —1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P.B. 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—5s. per lb.
 Hexamine.—2s. 4d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols. 2s. 3d. per gal. In carboys: Winchesters, 2s. 11d.—3s. 9d. per gal.; 20 vols., 4s. 3d. per gal.; Winchesters, 5s.—6s. 6d. per gal. Special prices for larger quantities.
 Hydroquinone.—2s. 11d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate. B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—4d. per lb., 22s. per cwt.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 10s. 12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 5d.—7s. 7d. per lb., Levig. 6s. 11d.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 8d.—5s. 10d. per lb., Powder, 5s. 1d.—5s. 3d. per lb.; White precip., Lump, 6s. 10d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 3d.—6s. 5d. per lb.; Yellow Oxide, 6s. 9d.—6s. 11d. per lb.; Persulph B.P.C., 6s.—6s. 2d. per lb.; Sulph. nig., 5s. 9d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonal.—9s. 6d.—9s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—2s. 9d.—3s. per lb.
 Phenazone.—4s. 3d.—4s. 9d. per lb.
 Phenolphthalein.—6s.—6s. 3d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2½%.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—2s. per oz.; 1s. 8d.—1s. 9d. per oz. in 100 oz. tins (1000 oz. lots).
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 8d.—1s. 9½d. per lb. Crystal, 1s. 9d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s. per ton, 5 ton lots.

Sulphonal.—£28 per ton, 2 ton lots.

Tartar Emetic B.P. cryst. or powder.—£28 10s. per ton, 1 ton lots.

Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.

Aubepine (ex Anethole).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.

Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.

Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 17s. per lb.

Coumarin.—10s. per lb.

Citronellol.—13s. 9d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—6s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—8s. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb.—(ex Shui Oil) 10s. 6d. per lb.

Linalyl Acetate.—(ex Bois de Rose) 18s. 6d. per lb.—(ex Shui Oil) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—17s. 9d. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—3s. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.

Camphor.—75s. per cwt. Cananga, Java, 26s. per lb.

Cassia, 80/85%.—7s. 6d. per lb. Cinnamon. Leaf.—6d. per oz. Citronella.—Java, 1s. 10d. per lb., Ceylon, Pure, 1s. 9d. per lb. Clove, pure—5s. 6d. per lb.

Eucalyptus.—2s. 3d. per lb. Lavender.—Mont Blanc 38/40%. 19s. 3d. per lb. Lemon.—8s. per lb. Lemon-grass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb.

Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. 6d. per lb. Peppermint.—Wayne County, 16s. 9d. per lb. Japanese, 8s. 3d. per lb.

Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Nov 8th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Sept 22nd. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Boving. Absorption refrigerators. 22,855. Aug. 31.
 Denham and Simon. Grinding etc. machines. 23,193.
 Sept. 3.

- I.-G. Farbenind., Manufacture of acid-proof materials. 22,750. Aug. 30. (Ger., 30,826.)
 Larson. Machine for making emulsions. 22,852. Aug. 31.
 Tinson. Furnaces. 22,735. Aug. 30

I.—Complete Specifications

- 12,639 (1926). Dessauer. Analysing substances by means of Röntgen or cathode rays. (252,206.)
 31,165 (1926). Trautmann. Apparatus for heating substances in a finely divided state. (262,791.)
 1227 (1927). Synthetic Ammonia and Nitrates, Ltd., and Humphrey. Centrifugal apparatus. (276,557.)
 10,822 (1927). Lister & Co., and Lister. Grinding mills. (276,591.)
 14,645 (1927). Siemens Elektrowärme-Ges. Bucht annealing furnaces. (272,214.)
 120,608 (1927). Lanthoffer, and Lanthoffer. Conveying powdered or granular material. (276,648.)
 *21,114 (1927). Wiggins. Storage tanks for gases and volatile liquids. (276,653.)

II.—Applications

- Broadhead, and Broadhead Constructions, Ltd. Gas purifiers etc. 22,749. Aug. 30.
 Colas Products, Ltd. (Hammond), Terry, and Whiting. 23,074. See IX.
 Imperial Oil, Ltd. Treating hydrocarbon oil. 22,745. Aug. 30.
 Johnson (I.-G. Farbenind.). Production of hydrocarbons of low b.p. 22,681 and 23,191. Aug. 29 and Sept. 3. Production of gases rich in olefins. 23,017. Sept. 1. Recovery of soluble products from coal etc. 23,018. Sept. 1.
 Knowles. Drying gases. 23,183. Sept. 3.
 Siemens & Halske A. G. Determining constituents in mixture of gases. 23,189. Sept. 3. (Ger., 49,26.)
 Soc. O. Monnet et Cie. Manufacture of agglomerates of wood charcoal. 22,905. Aug. 31. (Fr., 2,427.)
 Still and Still. Purification of benzol fractions. 22,869. Aug. 31. (Ger., 13,127.)
 Studienges. für Gasind. Apparatus for preparing compressed gases. 21,384. Sept. 3. (Ger., 18,1026.)
 Wolmski. Treatment of coal. 22,983. Sept. 1. (Ger., 1,926.)

II.—Complete Specifications

- 1417 (1926). Frankl. See VII.
 9523 (1926). Shadbolt, and Chem. Engineering & Wilton's Patent Furnace Co., Ltd. Recovery of pyridine, phenols, oils, etc., from gas liquor and like ammoniacal liquors. (276,393.)
 11,421 (1926). Soc. Anon. D'Explosifs et de Prod. Chim. Treatment of gases produced in cracking hydrocarbons. (251,632.)
 13,343 (1926). Florentin, Kling, and Matignon. Obtaining light hydrocarbons from hydroxylated, carboxylated, and like oxygenated organic compounds. (263,082.)
 13,348 (1926). Carpmael (I.-G. Farbenind.). Purification of hydrocarbons obtained by cracking processes. (276,427.)
 25,480 (1926). Synthetic Ammonia & Nitrates, Ltd., Slade, and Harrison. Low-temperature distillation of carbonaceous material. (276,522.)
 28,055 (1926). Misco. Generating carburetted water gas from bituminous fuel. (276,530.)
 28,559 (1926). La Ribonniere. Cracking of mineral oil and other hydrocarbon material. (276,532.)
 *21,349 (1927). Akt. Separator Nobel. Separating paraffineous constituents etc. from oils. (276,658.)
 *22,488 (1927). Gewerkschaft der Steinkohlenzeche Mont-Cenis. See VII.

III.—Application

- Verkaufsv. für Teererzeugnisse Ges. 22,649. See IX.

III.—Complete Specification

- 9523 (1926). Shadbolt, and Chem. Engineering & Wilton's Patent Furnace Co., Ltd. See II.

IV.—Applications

- Gubelmann, Stallmann, and Weiland. Making 1:3-diamino-2-hydroxyanthraquinone. 22,688. Aug. 29.
 Imperial Chemical Industries, Ltd., Gibson, Hailwood, Payman, and Shepherdson. Naphthalene derivatives. 22,663. Aug. 29.
 Inray (I.-G. Farbenind.). Manufacture of azo dyestuffs. 22,657. Aug. 29.
 Johnson (I.-G. Farbenind.). Manufacture of black tetra-trisazo dyestuff. 22,686. Aug. 29. Manufacture of black trisazo dyestuff. 23,016. Sept. 1. Dyestuffs. 23,192. Sept. 3.

IV.—Complete Specifications

- 12,381 (1926). Carpmael (I.-G. Farbenind.). Manufacture of products of the anthraquinone series. (276,408.)
 19,205 (1926). I.-G. Farbenind. Manufacture of azo dyestuffs. (256,272.)
 22,381 (1926). Silesia Ver. Chem. Fabr. See XX.
 5245 (1926). Inray (Soc. Chem. Ind., in Basle). Manufacture of aromatic tetrahydronaphthylamines or derivatives thereof. (276,571.)
 8146 (1927). I.-G. Farbenind. Manufacture of substituted aromatic sulphonic acids. (269,155.)

V.—Applications

- Arnold Print Works. 23,147. See VI.
 Brandwood. Treatment of fabrics with fluids. 23,154. Sept. 3.
 Feldmühle A. G. vorm. Loeb, Schonenfeld, & Co. Manufacture of viscose. 23,130. Sept. 2. (Ger., 1,827.)
 I.-G. Farbenind. Manufacture of sulphonated cellulose derivatives. 22,656. Aug. 29. (Ger., 10,926.) Production of strips from cellulose derivatives. 23,098. Sept. 2. (Ger., 13,427.)
 Imperial Chemical Industries, Ltd., and Wilson. Treatment of cellulose derivatives. 23,198. Sept. 3.
 Inray (I.-G. Farbenind.). Obtaining cellulose from ligno-cellulosic material. 22,749. Aug. 30.

V.—Complete Specifications

- 14,185 (1926). British Dyestuffs Corp., Ltd., Baddiley, Chorley, and Butler. See VI.
 *22,362 (1927). I.-G. Farbenind. Manufacture of viscose silk. (276,679.)

VI.—Applications

- Arnold Print Works. Treatment of cellulosic fabrics. 23,147. Sept. 3. (U.S., 9,1226.)
 Ratignier. Printing fabrics in several colours. 22,790. Aug. 30.
 Velour u. Filzhatfabr. Smdermann & Co. Dyeing shapes of hats. 22,761. Aug. 30. (Austria, 22,327.)

VI.—Complete Specification

- 14,185 (1926). British Dyestuffs Corp., Ltd., Baddiley, Chorley, and Butler. Dyeing artificial silk. (276,450.)

VII.—Applications

- I.-G. Farbenind. 22,750. See I.
 Johnson (I.-G. Farbenind.). Conversion of alkali chlorides into nitrates. 22,685. Aug. 29.
 Studienges. für Gasind. 21,384. See II.

VII.—Complete Specifications

- 1417 (1926). Frankl. Separation of gaseous mixtures. (276,381.)
 7709 (1926). Meyerhofer. Production of complex hydrofluoric acids. (250,211.)
 9227 (1927). Jacobsson. Dissolving aluminiferous raw materials by means of sulphuric acid or acid sulphates. (269,174.)

*18,838 (1927). Siemens & Halske A.-G. Generation of ozone. (276,637.)

*21,439 (1927). Petersen. Manufacture of sulphuric acid. (276,659.)

*22,180 (1927). Gewerkschaft der Steinkohlenzeche Mont-Cenis. Purifying hydrogen. (276,668.)

*22,488 (1927). Gewerkschaft der Steinkohlenzeche Mont-Cenis. Purifying hydrogen and gases containing hydrogen. (276,687.)

*22,750 (1927). I.-G. Farbenind. Manufacture of acid-proof material. (276,697.)

VIII.—Applications

Abson, Brodie, and Mackenzie. Decoration of pottery etc. 23,042. Sept. 2.

Carborundum Co., Ltd. (Power). Abrasive compositions. 22,795. Aug. 30.

Carpmael (I.-G. Farbenind.). Manufacture of ceramic products. 22,705. Aug. 29.

VIII. Complete Specification

12,848 (1926). Crabb. Cleaning of clay. (252,379.)

IX. Applications

Borgestad Fabr., and Knudsen. Refractory building materials. 23,176. Sept. 3.

Colas Products, Ltd. (Hammond), Terry, and Whiting. Bituminous emulsions etc. 23,074. Sept. 2.

Koninklijke Stearine Kaarsenfabr. Gouda. Manufacture of asphalt concrete. 22,668. Aug. 29. (Holland, 2,8,27.)
Verkauf-ver. für Teerzeugnisse Ges. Bituminous road material. 22,649. Aug. 29. (Ger., 7,10,26.)

IX. Complete Specification

13,581 (1926). British Portland Cement Manuf., Ltd., Baxter, Bamber, and Dickinson. Manufacture of cement. (276,438.)

X.—Applications

Akt. Ferriconcentrat. Enriching iron ores etc. 23,203 Sept. 3. (Sweden, 28,10,26.)

Beatty (Bell Telephone Laboratories, Inc.). Magnetic alloys. 22,700. Aug. 29.

Coles. Sherardising. 23,057. Sept. 2.

Harris. Separating impurities from lead etc. 23,174. Sept. 3.

Krupp Grusonwerk A.-G. Extraction of precious metals from ores etc. 22,788. Aug. 30. (Ger., 6,9,26.)

X.—Complete Specifications

*25,863 (1926). Siemens & Halske A.-G. See XI.

*31,534 (1926). Krupp A.-G. Low-carbon steel. (276,615.)

*20,317 (1927). Zahner & Schuess & Co. Lead coating of articles. (276,643.)

*22,340 (1927). Siemens-Schuckertwerke A.-G. Bright-annealing furnaces. (276,674.)

*22,343 (1927). British Thomson-Houston Co., Ltd. Carburisation of metals. (276,675.)

*22,750 (1927). I.-G. Farbenind. See VII.

XI.—Applications

André. Conductors of high negative temperature coefficient. 22,786. Aug. 30. (Fr., 17,11,26.)

Bannister and Cooper. Electroplating etc. 22,839. Aug. 31.

Birmingham Electric Furnaces, Ltd. Electric furnaces etc. 23,162. Sept. 3.

Dicker (N. V. Philips' Gloeilampenfabr.). Electric discharge tubes etc. 22,697—8. Aug. 29. Electric incandescence lamps. 22,699. Aug. 29.

General Electric Co., Ltd. Electric incandescence lamps etc. 22,629. Aug. 29. (Ger., 6,9,26.)

Metcalfe and Read. Photo-electric cells. 23,021—2. Sept. 1.

Neale, J. Selenium cells. 22,652. Aug. 29.

XI.—Complete Specifications

*25,863 (1926). Siemens & Halske A.-G. Apparatus for galvanic processes, e.g., chrome-plating. (276,610.)

*18,838 (1927). Siemens & Halske A.-G. See VII.

XIII.—Applications

British Thomson-Houston Co., Ltd., Newbound, and Warren. Lacquers etc. 22,862. Aug. 31.

Carbide & Carbon Chemicals Corp. Lacquer compositions. 22,996. Sept. 1. (U.S., 10,2,27.)

Stabner. Manufacture of pigments etc. 22,766—7. Aug. 30. (U.S., 23,9,26.)

XIII.—Complete Specifications

12,933 (1926). Marks (Bakehte Corp.). Liquid coating-compositions. (276,417.)

24,584 (1926). Johnson (I.-G. Farbenind.). Manufacture of artificial resins. (276,518.)

*16,332 (1927). Naugatuck Chem. Co. Removing liquid from resinous products. (276,627.)

XIV. Application

Imperial Chemical Industries, Ltd., Naunton, and Payman. Vulcanisation accelerators for rubber. 22,872. Aug. 31.

XIV. Complete Specification

13,564 (1926). Marks (Du Pont De Nemours & Co.). Manufacturing vulcanisation accelerators. (276,435.)

XV.—Application

Browne. Chrome tanning. 22,627. Aug. 29.

XVII.—Application

Stein. Making starch conversion products. 22,770. Aug. 30.

XVII.—Complete Specifications

27,453 (1926). Raffinerie Tirlémontoise Soc. Anon. Removing the fine grain contained in sugar syrup and molasses. (276,527.)

2767 (1927). Berten & Co. Ges. Apparatus for boiling and evaporating sugar solution. (276,563.)

*27,452 (1926). Raffinerie Tirlémontoise Soc. Anon. Preliminary treatment of raw sugar, after-product sugar, etc. before refining. (276,611.)

XVIII.—Applications

Henkel et Cie. Manufacture of dry urease preparation. 22,769. Aug. 30. (Ger., 15,9,26.)

Internat. Takamine Ferment Co. Producing diastatic product. 22,662. Aug. 29.

XVIII.—Complete Specification

12,473 (1926). Internat. Yeast Co., Ltd. Manufacture of yeast. (252,193.)

XIX.—Applications

Denham and Simon. Purification of cereal products. 22,986. Sept. 1.

Smith, and Smith, Hughes, & Co., Ltd. Steeping etc. compounds for vegetables. 22,858. Aug. 31.

Weishond. Obtaining extracts from beverages. 22,997. Sept. 1.

XX.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of ethers of 6:8 dioxiquinoline. 23,037. Sept. 1. Manufacture of 8-hydroxyquinoline etc. 23,117. Sept. 2.

Chem. Fabr. auf Actien vorm. E. Schering. Preparation of gland substances. 22,706. Aug. 29. (Ger., 4,9,26.)

Ellis (Chemical Works, formerly Sandoz). Separation of the cardio-active glucoside of bulbous scilla into two components. 23,005. Sept. 1.

Imperial Chemical Industries, Ltd., Payman, and Piggott. Manufacture of compounds of the morpholine series. 23,006. Sept. 1.

Newport Co. *p*-Amino-*o*-benzoylbenzoic acid. 22,689. Aug. 29. (U.S., 8,12,26.)

Soc. Chem. Ind. in Basle. Use of medicaments insoluble in water. 22,870. Aug. 31. (Ger., 1,926.)

XX.—Complete Specifications

8516 (1926). Patart. Synthesising and separating higher alcohols. (250,563.)

16,060 (1926). Eckermann. Decreasing the toxic action of cocaine. (267,463.)

22,381 (1926). Silesiu Ver. Chem. Fabr. Oxidising organic compounds. (259,930.)

29,299 (1926). Bottegay. See XXII.

8146 (1927). I. G. Farbenind. See IV.

11,998 (1927). Chem. Fabr. auf Actien (vorm. E. Schering)

• Manufacture of derivatives of aminometalmercaptosulphonic acids and salts thereof. (270,729.)

*3918 (1927). Soc. des Brevets Etrangers Lefranc & Cie. Extraction of butyric acid and its homologues. (276,617.)

*22,360 (1927). Soc. Chem. Ind. in Basle. Manufacture of complex gold nucleic acid compounds. (276,677.)

XXI.—Application

Sury. Photographic plates etc. 22,991. Sept. 1. (Belg., 2,926.)

XXI. Complete Specification

*22,361 (1927). Simon. X-ray photography. (276,678.)

XXII. Complete Specification

29,299 (1926). Bottegay. Nitration process. (262,097.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number: *British India*: Medicines (193); Patent medicines (194). *Colombia*: Chemical and pharmaceutical products (208). *Egypt*: Two semi-Diesel engines (A.X. 5166). *New Zealand*: Transformer-oil drying and testing apparatus (A.X. 5175). *South Africa*: Motor-driven centrifugal pump (A.X. 5157); suction gas engine and electric generator (B.X. 3772).

Merchandise Marks Act, 1926

In accordance with the provisions of Section 2, Sub-section (1), of the Merchandise Marks Act, 1926, the Board of Trade give notice that in pursuance of applications received by them for the making of Orders in Council to require imported goods of certain classes and descriptions to bear an indication of origin, they have made a reference to the Standing Committee appointed by them under the Act in respect of (*inter alia*) the following classes and descriptions of imported goods.

(1) (a) Electric cables, insulated, of all descriptions; (b) electric wires, insulated, of all descriptions. (2) Rubber manufactures of the following descriptions: rubber in sheets; piping and tubing of rubber or rubber and other materials, armoured or not; rubber balls of all descriptions (including golf balls and tennis balls); toys, wholly or mainly of rubber; elastic cords, webs, braids and fabrics; mats, matting and tiling of rubber; rubber gloves; rubber proof cloth and articles made therefrom, as well as any other manufactures consisting wholly or mainly of rubber, and including ebonite, vulcanite and manufactures thereof (but not including motor covers and tubes, solid and semi-solid tyres, boots,

shoes and slippers, or screw bottle stoppers). (3) Electric incandescent lamps.

Attention is called to the fact that under the provisions of the above-mentioned Act, while the Committee in every case referred to them must consider whether the goods should bear the indication of origin at the time of sale or exposure for sale, they may also at their discretion consider and report upon the question whether such goods should bear an indication of origin at the time of importation. Representatives of any interests substantially affected by any of these applications who desire to be heard in opposition at the public enquiry, which will be held later by the Committee, are requested to communicate with the Secretary, Mr. E. W. Reardon, New Public Offices, Great George Street, London, S.W.1, as early as possible, and not later than the end of September.

Import and Export Restrictions

The Board of Trade announces that an International Conference has been summoned to meet at Geneva on October 17 to frame an international agreement for the abolition of import and export prohibitions and restrictions. H.M. Government will be represented by Sir Sydney Chapman, K.C.B., C.B.E., Economic Adviser to the Government, assisted by Mr. H. V. Reade, C.B., an assistant secretary to the Commissioners of Customs and Excise, as deputy delegate and customs adviser, and by Mr. Gilbert C. Vyle, President of the Association of British Chambers of Commerce, and Colonel the Hon. F. Vernon Willey, C.M.G., ex-President of the Federation of British Industries, as deputy delegates and commercial advisers.

Precious Metals

Two brochures, which are of an elegance well in keeping with their subject, have been published by Johnson, Matthey & Co., Ltd., of Hatton Garden, London. One brochure describes the service which the firm can render to laboratory workers, in supplying not only apparatus in platinum and kindred metals, but also platinum salts, platinised materials, osmic acid, iridium sesquioxide, silver nitrate, etc., which are required in the laboratory. The second brochure describes the forms of the precious and rarer base metals which the firm supplies for industrial use, such as platinised asbestos and pumice, various platinocyanides, salts of gold and silver, uranium oxide, selenium dioxide, sodium selenite in addition to platinum, gold, silver, palladium, iridium, osmium and ruthenium, and other precious as well as various base metals. There are many other products described in these brochures, which should be consulted for further information.

News from Advertisements

A highly-trained chemist requires a junior partnership in a chemical concern (p. v).

The Colonial Office invites application for the appointment of an analytical chemist (Medical Department) Tanganyika Territory (p. v).

Particulars are announced of two British patents, for which the owners desire to enter into negotiation (p. v).

There are 115 firms represented under various headings in our Buyers' Guide.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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EDITORIAL

Fuel Technology as a New Profession

THE Commercial is a weekly review published by the *Manchester Guardian*. Its issue of the 8th inst. contains an article by Prof. J. W. Cobb, with the title we have chosen for this note. We read the article with much pleasure, and for more than one reason—those who are real readers, not collectors of facts, find that one great delight in reading is to be taken back to a period in early life, when they were romantic, sensitive, innocent and unalloyed by industrial or technical pursuits. We can find again, as we read Rob Roy or Esmond, some of that first careless rapture which we can now recover in no other way. No very recent book, however pathetic, really moves us, and yet there are passages in Virgil and Homer which we can even now hardly read without the thrill of a feat, just as it was when we read them twenty or thirty years ago. This was one pleasure in reading Prof. Cobb's article, for we were fellow students together on many subjects, scientific and otherwise, and worked, and idled, together in a time and a place both of which are invested with a kind of purpled gleam—so far as his place is concerned, it is harder for him to picture them than it is for us; he lives in Leeds to this day, and has watched it grow, and it has not grown in beauty. Another reason why we enjoyed reading his account of fuel technology as a profession is that Prof. Cobb has delivered a round, unvarnished tale, and made use of words such as most fully and precisely convey his meaning to the great body of his readers; this is not an invariable practice of all writers. He tells us that at Leeds the B.Sc. in gas engineering follows a three-years' course; the first year is devoted to physics, chemistry, mathematics, engineering, and an introduction to fuel; the second year is spent in chemistry and engineering, including carbonisation, refractory materials, pyrometry, and so on; the third year is spent in carbonisation, gas producers, engineering economics, analysis, distillation, and similar studies; during two out of the three months of each long vacation the student gets work experience. As two hundred million tons of coal are consumed in this country every year and about five million tons of liquid

fuel, the industry of preparing and selling fuel is a large one; moreover, as not less than 10% of the coal is wasted by inefficient combustion, there is plenty of work for the fuel technologist to do. He has not only plenty to do, but his work is very varied: the burning of coal in domestic grates, its use for steam raising, whether in lump form or as powdered fuel, its distillation to make gas, low-temperature carbonisation, and hydrogenation are among the many things which require study. Not only must the fuel expert understand ordinary bituminous coal, he must also know about cannel and the distillation of oil from it, and about bituminous ironstones, and oil shales and lignites and peat, from which they say activated carbon may be prepared, and oil and how to crack it, and the coke which is made in the process. And then there is water-gas and all its uses in mixing with other gases; the fuel technologist is supposed also to know about tar and phenols and cresols and pyridene and naphthalenes, and the use of naphthalene and paranitrophenol as insecticides in agriculture. He must talk intelligently about petrol and knocking and pinking, and those who explore the constitution of coal have an endless task in front of them. One notable feature of this profession is that the demand exceeds the supply. As in chemistry, the man who wishes to indulge in research has only to take the first material that comes to his hand and he will find abundant problems. The discussion on coal by the Engineering Section of the British Association printed in this issue is another proof of the enormous range of fuel technology.

The Rothamsted Report, 1925-26

We suppose the Rothamsted Experimental Station at Harpenden is known to chemists and to students of agriculture all over the world. The report of the work carried out there, and of its publications for 1925-26, is, as usual, full of interesting matter. It gives a singular picture of the complexity of the soil, whether we are considering the animal, vegetable, or mineral components of this domain. Chemists are concerned in all three components, and we think that prolonged

study would be necessary to follow all that goes on. The soil may be conveniently divided into the dead portion and the live portion; the dead portion consists of the sand, clay, lime, water, acids, alkalis, salts, lignin and its derivative humus, cellulose and its many derivatives, which are finally carbonic acid and water. From the chemical point of view the various elements in the soil include some of the plant stuffs from which the plant is made, the nitrogen, phosphorus, potassium, calcium, sulphur, and so forth; another class includes elements which appear to be useful rather than necessary—sodium, which helps when the supply of potassium is inadequate, and silicon, which helps the plant to assimilate its due proportion of phosphorus. The silicon is usually present in the form of silicates, and soluble silicates in particular tend in many cases to cause an increase in the dry weight of the plant. The value of lime and limestone has so often been pointed out in this JOURNAL that on this occasion it seems hardly necessary to say more than this: lime and limestone should be used to neutralise the acidity of the soil, if any; they also improve the texture of a clayey soil. Then there is the class of elements present in such minute quantities that they may almost be classed as catalysts, iron without which the chlorophyll does not form, manganese without which oxidation is inadequate, chlorine and so on. Boron in any form of combination is essential to the activities of the organisms which make the nitrogenous nodules on leguminous plants. The live part of the soil seems to be very varied: it hardly seems necessary to divide it into animal and vegetable. These low forms of life are all so small and so simple—there is a constant struggle for existence between the bacteria, the protozoa, the algae and the fungi, and part of the skill of the farmer consists in maintaining a proper balance between these. The number of the bacteria is considerable and their habits are diverse; some decompose the cellulose of dead plants, others spend their time in making nitrates and nodules. Each leguminous plant seems to require its own special breed of bacterium; you cannot grow lucerne in soil which lacks the lucerne organism. The soil protozoa, of which at least 250 different kinds are known, devour the bacteria and in some instances preserve in their bodies the nitrogen collected by the bacteria. When the protozoa have waxed fat and preyed too much on the bacteria, you should steam them or kill them with phenols, nitrobenzene, and cresols. The habits of the algae are not clearly explained in those portions of the Report which we have read, but the fungi play important parts. The bulk of the decomposition of cellulose is due to them; the decomposition of lignins seems to be wrapped in some mystery, and is perhaps not to be attributed to fungi, but the fungi are terrible causes of plant ailments. The research workers at Rothamsted have great opportunities of research. The junior ones spray plants and trees with insecticides, and note the results. When they are proficient in this they breed parasites to kill earwigs and do similar work of an advanced character. The Report contains much information about aphides, the weather, wheat, barley, mangolds, statistical estimation and random sequences. It has a valuable list of publications, many abstracts and

statistics, and we imagine it is necessary to every scientific student of agriculture.

The Royal Society of Arts

This society has had a long and distinguished career, and has rendered important services to art, science, literature and industry. Its scientific lectures have attracted great attention, and many of these have appeared in the pages of this JOURNAL. Its Council includes several members of the Society of Chemical Industry, and we can recall many occasions when a popular account of a chemical investigation has been delivered before the Society of Arts by a recognised authority in a manner worthy of the subject and of the lecturer. We were interested to come across another branch of the Society's activity which is certainly interesting from the point of view of art, and may be of importance in certain industries which depend both on chemistry and on art; there are many of these: the textile industries and the pottery and glass industries are notable examples. Four years ago the Society of Arts promoted a competition of industrial designs, and offered prizes to the competitors whose designs were chosen by an expert committee; the competition was a success, and was repeated in subsequent years. This year the fourth competition was held, and prizes of the total value of £1200 were distributed. The judges were well known men in their respective industries, and we understand that many of the designs submitted were so excellent that the design, and in some cases the designer also, were rapidly absorbed into the industry. This year the competition was divided into architectural decoration, textiles, furniture, book production, pottery and glass, and a miscellaneous section, which was chiefly artistic advertising. Among those who gave prizes were many whose names are well known in chemical circles, Messrs. Lewis Berger & Sons, Messrs. Longmans, Green & Co., the Cambridge University Press, the Goldsmiths' Company, Messrs. Bryant & May, and Messrs. Henley's Tyre and Rubber Co., Ltd., being included. There are very many instances which occur to us in which art and science may conveniently go hand-in-hand; in some cases this is already done, but suitable artistic design is neither easy to learn nor easy to appreciate, and it seems to us to be a good thing that this sort of stimulus should be provided. A design may be excellent in appearance, but unsuitable for production, and these competitions had the advantage of being judged not only by those who have a well-developed artistic temperament, but also in conjunction with them, by men whose life is spent in manufacture, sale and distribution. Personally we are sorry that we did not know of this competition earlier; we should have enjoyed seeing the designs, and might possibly have learned a little about a subject of which we are wholly ignorant. We hope that next year the Society of Arts will let us, and our readers, know in ample time when and where the designs may be seen so that those of us who are interested may look out for an opportunity. Perhaps notices appeared in all the daily papers; these are not read by chemists with the same care and attention which they bestow on the JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY.

OUR AVAILABLE COAL SUPPLIES AND THEIR UTILISATION*

By Dr. C. H. LANDER, M.Inst.C.E., M.I.Mech.E.

In the past Great Britain, a pioneer in coal production, has been in a very favourable position, owing to the early working, wide variety, and high quality of the enormous stores of coal in her possession. The world's chief source of fuel is, and must long continue to be, found in the vast and widely distributed accumulations of coal; but other fuels which have been exploited during recent years are tending gradually to place Great Britain in a less favourable position, and to put her at a disadvantage with competing nations. This state of affairs is emphasised by the fact that certain of her commercial rivals have themselves large stores of coal, which are now being worked to a much greater extent than during the last century.

The output of coal in Great Britain may be taken, roughly, at 260,000,000 tons per annum, of which some 80,000,000 tons is exported. The remaining 180,000,000 tons is retained for home use. It is not possible to say with accuracy how this coal is distributed, but the annexed table, from the Fifth Annual Report of the Secretary for Mines, gives an approximate indication of the purposes to which it was put in the years 1921 and 1925.

The various headings can be considered in two groups, according to whether the coal is subjected to some pre-treatment before being finally burnt, or is burnt in its raw state. The two chief industries in the former group are the coking industry, whose main product is metallurgical coke for iron and steel manufacture, and the gas industry, whose main product is gas for town's purposes. The two together consume 35,000,000 tons to 40,000,000 tons, leaving in the latter group 140,000,000 tons, which are used in the raw state.

The requirements of industry in the direction of fuel are so varied as to render it impossible to lay down any single ideal method of utilisation; but, having regard to the large quantity of coal burned in the raw state, it is legitimate to consider whether improvements in utilisation could not be effected by wider adoption of methods of pre-treatment. It is a mistake to assume that it is fundamentally uneconomical to use coal in the raw state, since the products obtained by pre-treatment are, in the main, themselves ultimately burnt. If, however, it can be shown possible to split up the coal into such products as can be utilised with greater commercial efficiency than can the raw material, savings may be effected, but these savings must be sufficiently great to compensate for the inevitable loss of heat units involved in any process of pre-treatment.

Until the 'nineties of last century all our heat and power requirements were obtained directly from coal, but the growth of the internal-combustion engine, in conjunction with the exploitation of the world's great oilfields, has resulted in a rapid expansion of a method of power production, and to a smaller extent of heat production, which is not easily satisfied by using coal raw. According to our present practice, liquid fuels are required in large quantities for both land, sea and air

transport, but are procurable only from overseas sources. Thus our national defence is entirely dependent upon a fuel which has to be imported. It has been known for the last one hundred years that when coal is subjected to some pre-treatment, such as raising it to a high temperature in the absence of air, the coal substance is split up into three other fuels, solid, liquid and gaseous respectively—or, in other words, into coke, tar or oil, and gas. When coal is burned in the raw state, those portions which would, had it been carbonised, have gone to produce the liquid and gaseous constituents, are only completely utilised if special precautions are taken. Very different conditions are required within a furnace to burn coke, oil and gas, and we therefore find that a certain proportion of their volatile products is usually allowed to escape into the atmosphere in the form of smoke. The author hesitates to put forward the following figures, since the whole subject is so complicated that they only present a portion of the picture, but if the remaining coal in Great Britain can be taken as 180,000 million tons, and if it is assumed that 10 gals. of oil per ton could be extracted from this coal, we have actually in the country 1,800,000 million gals. of oil, a supply far exceeding the estimated petroleum reserves of the whole of the United States. Looked at from the fundamental point of view, it is surely somewhat Gilbertian to import nearly 2,000 million gals. of oil per year when such vast supplies lie dormant in the country. Since, however, oil obtained from coal must at present be regarded as a by-product, it does not follow that the production, even from the whole of the coal raised in the country, would make it possible to do altogether without imported oil; but it is obvious that the present situation could be considerably eased by the institution of methods whereby pre-treatment of coal could be carried out economically in a much widened field.

The desirability of improving the present position is further emphasised in view of the vast amount of damage to property, and possibly also to health, which is caused by smoke. It has been estimated that in Manchester the damage by smoke exceeds three quarters of a million pounds per annum. For London, Russell a few years ago gave a figure of £1 per head per annum. In Pittsburgh, a careful investigation in 1913 led to an estimated loss of £1 per head. Again, the Samuel Commission pointed out that the work of over a million miners for three days every year was devoted to providing the soot which pollutes our atmosphere.

From the table it is impossible to gather what proportion of coal is utilised in industry for power production as differentiated from the production of heat, and there are no data yet available from which this item of fundamental knowledge can be deduced. When a fuel is required for power purposes it can only be used with a thermal efficiency which is comparatively low (say an average of 20% in the steam turbine), the remainder of the heat being dissipated in the condensing water etc. On the other hand, when fuel is required for heating purposes, its efficiency of utilisation may be very much higher, perhaps three times as much as the example cited above. It will, therefore, be seen that, if it were possible to make an accurate estimate for the country, or even for some particular district, of

* Paper read before Section G of the British Association at Leeds on September 2, 1927.

the proportions in which fuel is used for these two purposes, a much better conception might be formed of the degree to which it might be subjected either to carbonisation processes or to the production of electricity.

There are, of course, many instances in which useful supplies of electricity might be generated as a by-product, if large quantities of heat were also required as such, say for carrying out chemical processes.

From what has been indicated it is obvious that our fuel utilisation is to say the least of it, imperfect, and it must be emphasised that there are means available whereby great improvements could be made. Far more knowledge exists for the improvement of both thermal and commercial efficiency than was available during the last century, and this knowledge should be applied to a very much greater degree than is the case at present. As the late Sir George Bellby stated: "The out-standing feature of the situation appears to be that, while on the one hand there already exist among

ship. The bulk of the work undertaken at East Greenwich is, therefore, of the large-scale type, such as the development of improvements in methods of carbonising in gasworks plant; experiments on boiler firing, using full-sized boilers; investigations into different systems of coal cleaning, using for the purpose full-scale units of typical coal cleaning plant; and so on.

There are, of course, well equipped laboratories, which are used for purposes of works control, and also for such fundamental enquiries as are essential to ensure the most fruitful results being obtained from the full-scale plant. In spite of this, however, the bulk of fundamental work, as such, must be left to outside workers. The present deficiencies are continually being felt in the full scale investigations, and the speaker will instance one or two interesting cases where difficulties have arisen through lack of basic information.

Some time ago a carbonisation process was suggested, in which the coal was ground, heated up to a temperature at which it became plastic, and finally briquetted at

TABLE OF APPROXIMATE COAL CONSUMPTION IN GREAT BRITAIN

Consumption	1913-14 (tons)	1924-25 (tons)	1926-27 (tons)
Coal (except metallurgical coke)			
Total quantity	16,291,000	18,861,000	
Less: equivalent of coke (included)	1,250,000	1,300,000	
Net home consumption		17,611,000	17,561,000
Gas works			
Total quantity	17,709,000	18,761,000	
Less: equivalent of coke (included)	1,310,000	1,300,000	
Net home consumption		17,451,000	17,261,000
Manufactured fuel			
Total quantity	1,071,000	1,088,000	
Less: equivalent of home extracted fuel (expected, or shipped on account of domestic coal in foreign trade)	1,071,000	1,088,000	
Net home consumption		12,000	12,000
Electricity generating stations (before deduction for authorised undertakers' and to railway and tramway undertakers)			
Railway companies (not locomotive fuel)	8,200,000	7,700,000	
As well as use of the railways (locomotive fuel)	1,367,000	1,351,000	
Other (including use of the railways (locomotive fuel))	1,162,000	1,200,000	
Total (including use of the railways (locomotive fuel))	10,729,000	10,251,000	
Less: equivalent of home extracted fuel (expected, or shipped on account of domestic coal in foreign trade)	880,000	1,170,000	
Domestic coal (including minerals coal (approx.))	10,000,000	10,000,000	
General manufacturing and all other purposes	9,120,000	9,700,000	
Total		16,950,000	18,000,000

experts a widespread knowledge of means whereby the extravagant methods of consuming fuel which are widely prevalent might be so improved as to reduce the consumption for industrial purposes by a very substantial amount, there is, on the other hand, still so much inertia on the part of the consumers that even the simplest and most obvious steps towards improvement are not taken.

Whilst it is of little use doing research work, unless the results will be applied in practice, there is an enormous field still to be explored. The author proposes to deal briefly with the work of the Fuel Research Board. This Board, which was instituted in 1917, had perforce to attack the fuel problem mainly from the industrial point of view. It is an unfortunate fact that our fundamental knowledge of the behaviour of coal, when subjected to various treatments, is yet so incomplete as to render it imperative that a great deal of work should be done upon plant of full unit scale. In developing a process no assistance is available equivalent, say, to the method of testing by models, which has proved such a potent factor in improving the efficiency of the steam

thus temperature. Using the most reliable information existent, it was concluded in the laboratories, and indeed was shown on a laboratory scale, that if the coal were subjected to temperatures of 360° C., robust briquettes should result from most coals at a pressure of 2 tons per square inch. When, however, this was applied to large-scale working, incipient decomposition was found to occur long before this temperature was reached, and this caused grave difficulties in the large-scale plant. On this account, further work was instituted in the laboratory, and it was discovered that the decomposition point of coal started, and indeed became serious, at temperatures more than 100° lower than had previously been believed.

It is apparent that this information has bearings in many other cases than that of the particular process referred to, for instance, that of direct briquetting at elevated temperatures, or of any processes where preliminary heating or drying is applied.

The recent work of Bergius and others on the "hydro-generation" of coal at high pressures and temperatures, while being of the greatest importance as pointing a

possible way of obtaining oil in large quantities from bituminous and other coals, is also likely to have an important bearing on our knowledge of the constitution of coal. Recent work at the Fuel Research Station has shown the possibility of conferring, by hydrogenation, marked coking properties on coals otherwise absolutely devoid of coking power. Coke has been made at the Station from non-coking coal without the addition of any substance other than an extremely small proportion of hydrogen. The importance of the field opened up for investigation in this direction cannot be over-estimated.

Another important direction, in which further knowledge is required, is the selective effect of various reagents, temperatures, pressures, or processes on different coal constituents.

Investigations, which have been recently carried out in several quarters, indicate that the inorganic constituents of coal cannot be taken as merely inert diluents. Some of these constituents have a marked effect on the behaviour of a coal or coke when carbonised or burnt. There is still much work to be done before we shall know which constituents have that effect. This leads to a consideration of the methods of purifying coal. After a coal has been through a cleaning process, the ash-forming constituent will not only be reduced, but its composition will also differ from that originally present, and it may well happen that this change is of importance. The methods of cleaning coal have been developed by trial and error, and little is known regarding the real basis underlying some of the processes. Here again is an opening for valuable investigations, and the problem is being taken up, both at the Fuel Research Station and elsewhere.

It has been found that the size of the coal charged to retorts and coke ovens has a marked effect on the products, or on the ease of working, partly due to its effect upon the transference of heat to the charge. Physicists can tell us something of the laws governing heat transference by conduction, radiation and convection to and through more or less homogeneous bodies, but coal is such a heterogeneous mixture, and the conditions of heating are so complicated, that theory alone cannot be relied upon.

Were the investigation of all the problems so far touched upon far more advanced than is the case, we should still be unable to apply our knowledge satisfactorily without a detailed knowledge of the individual coals. It is well known that, while a coal seam may remain fairly constant in its properties over a wide area, different seams vary widely from each other. What has been, perhaps, less fully realised is that in nearly all cases the different layers in a single seam, even if only a narrow one, also differ widely from each other. These variations should be known in some detail before the method of mining, cleaning, grading, and blending best suited to the coal as it occurs, and the use to which it is to be put, can be stated. It is the object of the Physical and Chemical Survey of the National Coal Resources to provide information on this side. This Survey forms one of the most important activities of the Fuel Research Board, and is being pushed on as rapidly as the provision of the necessary staff and the frequent difficulties of the mining industry admit.

Enough has been said to emphasise the importance of systematic study in extending our knowledge of the constitution of coal in the broad sense, but a note of caution must be sounded regarding the necessity of such work proceeding on a systematic basis. In the past a large amount of so-called fundamental work has been of the nature of empiricism on the small scale, and has been of little, if any, value, or, indeed, has sometimes been positively misleading. Such work should only be undertaken by those who can free their minds from prejudice and view the matter in an impartial manner, taking into consideration the work of others, who may be looking at the subject from somewhat different angles.

It is of vital importance that a proper use should be made of our bountiful coal resources. In the first place, existing knowledge must be applied to a much greater extent than hitherto. Research work on a large scale will always be required, but the labour and expense of such work may be materially reduced in the future by further knowledge of the fundamentals, both of the materials and the processes. In this way grounds for controversy will be removed, and the energies of those interested may be devoted more to work and less to talk than, unfortunately, is the case at present.

THE UTILISATION OF OUR COAL SUPPLIES*

By PROF. J. W. COBB, C.B.E., B.Sc.

THE ideal utilisation of our coal supplies would necessitate the complete realisation of the potential thermal and chemical values of coal, without the emission of smoke. Burning raw coal is an obvious failure to realise the ideal, and we are in revolt against it. On the other hand, if coal is carbonised, the two principal products, gas and coke, are smokeless fuels, while the tar and ammonia are valuable chemical by-products. Carbonisation is a standard industry, as carried out in gas works and coke ovens, and there are other well-known processes of gasification.

The position at present may be stated thus:—In 1924, according to the report of the Secretary for Mines, the allotment of 180 million tons of coal available for home consumption may be made approximately as 16·7, 7·7, and 100·3 million tons for gas works, electricity generating stations, and domestic use, respectively, and for the carbonisation industries, taken together, gas works and coke ovens, 32·9 million tons. It is interesting to consider what are the factors at present limiting the applications of carbonisation or similar processes to the great bulk of our coal supplies, and what is being done, or may be done, to remove those limitations.

One feature common to all such processes of treating coal before burning it, is that they entail thermal and monetary expenditure, and the success of the treatment under ordinary economic conditions depends upon whether the expenditure is justified by the enhanced value of the products. Unless that condition is satisfied, the wide and increasing adoption of a process is impossible.

* Paper read before Section G of the British Association at Leeds on September 2, 1927.

The enhancement in value of the products has been sought in several ways. If a valuable by-product with a ready market is forthcoming in large quantities, that may in itself justify the process. Thus, the large yield of liquid fuel obtainable by such a process of hydrogenation as that of Bergius, may cover the cost of hydrogen and the provision and working of an apparatus which has to be maintained hot under enormous pressure. Again, the motor spirit obtainable from our own coal supplies may be sufficiently valuable to justify a catalytic treatment of water-gas and hydrogen, necessitating a preliminary carbonisation of coal and gasification in steam of the resultant coke. The Mond process of gasifying coal in steam and air was largely based on the very high yield of sulphate of ammonia obtainable. Such dependence upon the value of a particular chemical by-product is not, however, a feature of the normal process of carbonisation and gasification as carried out in gas works, coke ovens and producer plants, the position of which may now be examined.

Beginning with carbonisation, and taking thermal efficiency first, the carrying out of this process does not necessarily involve any large expenditure of the potential heat of the coal carbonised. In a gas works, for every hundred heat units contained in the coal, 75 to 80 should be available in the gas, coke and tar produced, after heating the retorts with a portion of the coke. In the most modern plants, using waste heat boilers, an efficiency of 80 to 85% has been obtained. The immediate thermal expenditure of, say, 20% in the process, does not, however, represent an ultimate thermal loss, because it is more than covered by the greatly enhanced value for most heating purposes of each heat unit carried in the gas, as compared with that of a heat unit in the coal. From the purely thermal standpoint, therefore, the gas industry is in a strong position, and its progress can be readily comprehended. Gas and coke go far to replace raw coal for most domestic, and many industrial, purposes, and they have advantages, to which I need not now refer further, apart from thermal efficiency.

At the same time, we have to recognise that in the replacement of coal by carbonised fuel for many large uses, of which steam raising for electrical generation or other uses may be taken as an example, a limit is imposed by the monetary cost of carbonisation (and gasification) in its present form. The outstanding technical factor limiting the economies of carbonisation seems to be that of speed in operation. I might point out briefly at this stage, that the burning of carbon by air at the temperature of a good boiler fire can take place at a speed which is limited solely by the rate at which air can be brought into effective contact with the carbon. Combination is, to all intents and purposes, instantaneous and complete. The position is quite different in carbonisation, and even in such processes as the gasification of coal in steam and air in a producer for the manufacture of producer gas, or of coke in steam for the manufacture of water gas. There, the processes of heat penetration and the reactions of gasification are very much slower. The consequence is that much higher expenditure on the plant and its working, per ton of coal, have to be incurred.

It is not strange, then, that in one way and another, a vast amount of work is being applied to determine how these reactions of coal and coke, other than their direct burning in air, can be accelerated. Let us consider carbonisation from this point of view. In the case of an ordinary plant, the heat has to be transmitted through the wall of a fireclay retort, and then through the mass of coal. It is a slow process. The retort, for high-temperature working, is made of fireclay of low conductivity. Heat in penetrating the coal is partially conducted by the solid, and partly radiated across spaces between the solid particles. Some heat is also convected from point to point of the charge by the gases evolved during carbonisation. The condition of affairs is complicated, since it is not only heat transmission which is important, but also keeping the charge in such a condition that the volatile products may be evolved as easily and escape as quickly as possible. Such considerations are responsible for much experiment in design and treatment. Narrower retorts or tubes have been tried, and fireclay replaced by the iron employed in the older days of the gas industry. Careful inquiry has been directed to find the type of iron which will not suffer from the growth and distortion which ruined the old retorts. Other alloys, such as "Cronite," have been used experimentally with considerable success, as I can say from first-hand experience, although the cost of "Cronite," is too high to allow of its general use in large-scale work.

The use of metal as compared with such refractory materials as fireclay or silica has, however, one disadvantage, in the sense that it imposes a much lower limit upon the temperature of the combustion chamber, which has the effect of lowering the temperature head available for rapid working. The present tendency in gas works and coke-oven practice is to use a high quality of refractory material, usually silica, in order to get as high a temperature head as possible between the combustion chamber and the charge. There is much to be said for seeking to produce the material sometimes known as semi-coke, containing a certain proportion of volatile matter, not by simply carbonising of set purpose at a lower finishing temperature (what is usually understood by low-temperature carbonisation), but by rapid incomplete carbonisation at a high temperature. To bring that about, everything must be done to facilitate penetration of heat and the escape of volatile matter. The condition of the charge at every period of its carbonisation should be the best possible.

The nature of the coal, its manner of fusion, the rate of escape of volatile matter, and the degree of its contraction and expansion, are all important. The transmission of heat by conduction through the solid depends directly upon temperature differences, but the radiation of heat across intervening gas spaces increases much more rapidly than the temperature. The heat transmission by conduction and radiation varies very much with temperature, and also with the size of gas spaces. Heat convection by the gases, as has been mentioned, comes into play. Moreover, although the carbonisation process, considered as a whole, does not either absorb or evolve appreciable

amounts of heat, the reactions occurring at one range of temperature are markedly exothermic, and at another endothermic, which must have its effect on the heat transmission between the cooler and hotter portions of the charge, usually the inside and the outside layers, respectively.

The position is too complicated to allow of any satisfactory exploration, except by direct and systematic experiment on the influence of each variable taken in its turn. Hence, the work which is on the way to determine the behaviour of coal of different kinds, caking and non-caking, swelling and non-swelling; the influence of the size of the pieces of coal used, either when one size alone is employed, or sizes in admixture; and the possibility of blending coals so as to secure better behaviour from a mixture than either would give separately; all these at different temperatures and rates of working. It is not simply necessary to study what are the differences obtained when carbonisation is complete, but also the larger differences which often declare themselves earlier in the process, when only a partial carbonisation has been effected, because, as has been already indicated, such partial carbonisation may be enough for many purposes, and indeed may be the only form of treatment economically practicable for many uses. Useful results have been and are forthcoming from such investigations, but more radical methods of speeding up carbonisation can be employed if the solid coke can be accepted in powdered form, as it can, for example, nowadays for the raising of steam by dust firing. The problem of heat transmission is enormously simplified in this case, because radiation and convection can be made so quickly operative upon the surface of every particle.

Mr. Sinnatt, of the Fuel Research Board, has shown how each individual particle of coal responds to the stimulus of heat by the rapid formation of a little bulb or cenosphere. This principle is receiving large-scale investigation in the McEwen-Runge process, in which the transmission of heat to each particle is facilitated not only by the fine sub-division of the coal, but by causing the particles to descend through an ascending current of hot gas, which acts as a heat carrier and carbonises them by direct contact. The imparting of heat by using a current of hot gas is a feature of several new proposed processes. In another process, that of Piron, the heat is transmitted to the powdered coal by the contact of molten lead. Rapid carbonisation in a revolving cylinder was carried out by Yeadon, of Leeds, in 1889, and is now being thoroughly tried out.

I would like now to speak of something more speculative in character, but worthy, I believe, of consideration. It is open to us to make progress not solely by an alteration of the thermal and mechanical treatment of coal, but, by modifying, if we can, its chemical behaviour and reactivity. We need not assume that coal, as it has been naturally deposited, is in the best chemical condition for use, and that there are no practicable means of stimulating its reactivity—of inducing a different behaviour in carbonisation from that natural to the coal as it is mined, and imparting where desired greater reactivity to the resulting coke. How far is it practicable to catalyse the reactions with which we are

concerned in the carbonisation and gasification of coal? Dr. Lessing has pointed out that the behaviour of coal on carbonisation in the laboratory is affected materially by the presence in small quantities of many inorganic compounds, and Haber suggested that the ash of coal might catalyse the reaction of gasification in steam.

Further investigation has shown clearly that if one considers such oxide constituents as commonly occur in the ash of coal, alumina and silica, which usually occur in the greatest quantity, these have little or no effect, but lime, oxide of iron and soda materially influence the process of carbonisation. This is very apparent on the laboratory scale, where much finer grained, stronger, and more homogeneous cokes have been produced by the addition of 5% of these materials. The full explanation is not forthcoming, but it would appear that the evolution of volatile matter during the plastic stage is slowed down, and the puffing-out and honey-combing of the coke lessened on that account. On the larger scale, these special cokes are, however, not obviously different in structure from pure coke made without additions, presumably because the process is in any case so much slowed down that the differences are smoothed out. It is likely that in processes of rapid carbonisation on any scale, they will be retained. There are some interesting points in the larger scale results. Thus, the gas yield was increased 20% with a sodium-carbonate coke, and the ammonia yield by 35%, with a calcium-carbonate coke. But what is of greatest importance from our present standpoint is the interesting change which has been brought about, on either the laboratory or the large scale, in the properties of the coke by these additions. The following are one or two illustrations: On gasification in steam, the laboratory equivalent of the water-gas process, the cokes made with alumina and silica additions behaved exactly like the pure coke, but the cokes made with lime, oxide of iron and particularly sodium carbonate, behaved quite differently. They gasified much more quickly, and gave a much better water-gas.

It may be pointed out that as the rate of steam passage through a bed of red hot coke is increased, some of it begins to come through undecomposed, and the water-gas, instead of being practically all carbon monoxide and hydrogen, contains carbon dioxide in gradually increasing quantity. With the pure coke in the laboratory apparatus at 1000° C., using 10 g. of coke, the gas made contained 5.2% of carbon dioxide (taken as a permissible amount) when the rate of steam supply was 2.5 litres per hour, and the coke was being gasified at the rate of 1.15 g. per hour. With the silica coke, the figures were practically the same. With the iron-oxide coke, the rate of steam supply had to be increased ninefold, to 21.9 litres per hour, with a coke gasification of 10.5 g. per hour, before the carbon dioxide in the gas amounted to 5%. With the calcium-oxide coke, a carbon dioxide content of 5.4 was obtained with a rate of steam supply of 11.2 litres per hour, and a coke gasification of 5.2 g. per hour. The figures obtained with sodium carbonate were even more remarkable. With a steam supply of 21 litres per hour, the carbon dioxide was only 4.4%, and in order to get 5% of carbon dioxide in the gas, it was necessary to make

the column of coke only one quarter of its original length.

It is plain from these figures, collected in the table, that the reactivity of coke to steam was so far enhanced by the additions, that the rate of working could be increased tenfold, or more without impairing the quality of the gas made. These results were obtained working at a temperature of 1000° C. At lower temperatures the influence of the added constituent was, in some ways, even more remarkable. It is to be remembered that the maintenance of such a temperature as 1000° C. in all parts of the fuel bed, in many gasification processes is not practicable and that, for example with steam, the rate of gasification falls off rapidly with temperature, and the quality of the gas made is lowered by the production of more carbon dioxide.

Gasification of special cokes in steam and carbon dioxide

Coke used	Weight of coke in g.	Gas entering	Rate of gas entering in litres per hour	Rate of coke gasification in g. per hour	CO ₂ in gas leaving in g.	CO in gas leaving in g.	Temp. of bed in °C.
Pure	10	Steam	2.5	1.15	0.2	-	1000
5% Fe ₂ O ₃	10	"	21.9	10.5	5.0	-	1000
5% CaO	10	"	11.2	5.2	5.4	-	1000
5% Na ₂ CO ₃	10	"	21.0	10.4	0.4	-	1000
" Pure "	10	"	19.0	9.8	0.8	-	1000
5% Na ₂ CO ₃	10	"	10	5.8	1.7	-	800
" Pure "	10	CO	6	6	17.8	-	1000
5% Fe ₂ O ₃	10	"	6	6	91.0	-	1000
CaO	10	"	6	6	95.0	-	1000
Na ₂ CO ₃	10	"	6	6	97.0	-	1000
" Pure "	10	"	6	6	11.0	-	900
5% Fe ₂ O ₃	10	"	6	6	70.0	-	900
CaO	10	"	6	6	64.0	-	900
Na ₂ CO ₃	10	"	6	6	82.0	-	900

Perhaps one of the most striking examples of the influence of an added constituent was obtained by the comparison of the behaviour, at 800° C., of a pure coke and a sodium-carbonate coke, with the steam supply at 10 litres per hour to 10 g. of coke. With pure coke 0.9 g. of coke was gasified per hour, yielding a gas containing 18% of carbon dioxide. With the sodium-carbonate coke, 5.8 g. was gasified per hour, and the gas made contained only 1.7% of carbon dioxide, which represents six times the rate of gasification with only one tenth as much carbon dioxide in the gas. This enhanced reactivity of coke towards steam is obviously of direct importance for the making of water-gas, and the steaming of coke in gas retorts, and also in nearly all gas producer practice where coal and coke are gasified in air and steam, since even if the producer is charged with coal, as is most commonly the case, expulsion of volatile matter at the top of the producer soon converts the coal to coke, and it is the gasification of coke with which we are concerned, as responsible for the great bulk of the gas made.

When, however, as in the gas producer blown with air alone, air is the gasifying agent, the fundamental limiting factor in the rate of gasification is the reactivity of the coke to carbon dioxide. The rate of blowing with air can easily be increased with the production of carbon dioxide at the grate, but unless the coke above it can reduce that carbon dioxide to carbon monoxide, excessive heat is generated in the producer itself, and largely lost, while the producer gas is high in carbon dioxide and of low quality. I might mention, incidentally, that for those uses in which the generation of the

maximum amount of heat in the fuel bed is required, the less reactive coke would be the better, but the requirement of gas-producer practice is the opposite: as much heat as possible is wanted as potential heat of combustion in the gas leaving the producer.

It is plainly then an interesting point as to whether the same stimulation of reactivity towards carbon dioxide can be secured in these special cokes as towards steam. This has been investigated, and it has been shown that the stimulation of reactivity in the special cokes towards carbon dioxide does occur, although, in some cases, there seems to be a falling off after a time which has not been noted with steam, and is being further examined. Passing carbon dioxide over coke at 1000° C. under such conditions that pure coke gave only 47.8% of carbon monoxide, the iron oxide, lime and sodium-carbonate cokes gave 93, 95 and 97% of carbon monoxide respectively. Similar effects were obtained at lower temperatures. The figures quoted above have been in every case for 5% additions, but experiments made with small quantities show that useful effects can be obtained thereby in a more than proportionate measure.

In bringing these particular results forward I would emphasise that they are not intended to represent the working out of a technical process, or the completion of laboratory investigation. They do seem to me to be suggestive. They do seem to demonstrate that we should make a mistake if we did not keep our eyes fully open to the possibility of speeding up the processes employed for the utilisation of coal to an extent which it is quite impossible to forecast.

Summarising, my main thesis is that one great reason militating in practice against the replacement of the direct burning of coal by methods which would be more scientifically, economically, and hygienically satisfactory, is that none of the other processes of transforming coal is anything like so rapid as that of direct burning. Consequently, much is being done, and more remains to be done, in investigating, on the laboratory and on the large scale, how the speeding up may be effected. The investigation is necessarily taking many forms, through the design of apparatus, the study of the nature of coal in the molecule and in the mass in order to understand its potentialities under many thermal and chemical conditions, and enquiry into the possibilities of modifying the properties of coal in directions found desirable by suitable additions.

THE CHEMISTRY OF COAL*

By PROF. R. V. WHEELER, D.Sc.

WHEN reviewing, some years ago, the knowledge then available regarding the constitution of coal, Dr. Marie Stopes and I suggested that, in view of the number and apparent complexity of the plant materials that had contributed to its formation, the rational mode of study of coal would be to determine separately the character of the contribution made by each of the more important individual coal-forming materials of plants. We outlined the programme of research that we proposed to follow at the meeting of the British Association at

* Paper read before Section G of the British Association, Leeds, September 2, 1927.

Newcastle-upon-Tyne in 1916. Such a mode of attack has of necessity taken a long time to develop, and it has not yet yielded all the results desired. Nevertheless, the work has reached a stage at which a review of progress can profitably be made. This paper is intended to present such a review.*

Coal-forming materials.—The various plant entities and residues that have contributed to the formation of the organic substance of coal can conveniently be grouped according as they are :—

(1) Resistant to decay. Amongst the more important members of this group are :—(a) Spore exines and cuticular tissues ; and (b) resins

(2) Subject to decay. The members of this group are either :—(a) Organised, such as cellulosic and lignified tissues ; or (b) amorphous, the contents of plant cells

(3) The products of decay. The ulmins

An accumulation of plant remains immediately after deposition consists mainly of the first two groups, but in an older deposit, such as a peat bed, whilst the members of group (1) are still present in an apparently unaltered form, the celluloses and lignin of group (2) have suffered decay, undergoing such minor alterations as dehydration produces, or becoming converted into ulmins (probably in conjunction with certain of the cell-contents), or disappearing altogether. Judging from the nature of peat, the formation of ulmins is the main chemical process during the decay of plants, and it becomes more pronounced the older the deposit. Thus, whilst a young peat may yield only 10 or 20% of ulmin material soluble in alkalis, from an older peat as much as 70 or 80% can be extracted.

In a deposit of the age of coal, it cannot be expected that the materials of any of the three groups will remain unaltered. Spore exines and cuticular tissues may not be much changed, nor need the resins, but the cellulose that is not totally destroyed will, in large part, be converted, together with the more resistant lignin and part of the cell contents, into the amorphous ulmins of group (3), or products derived from them. There will also be material corresponding with group (2) (a), consisting of altered woody tissues (not, apparently, converted into ulmins), such as compose many lignites and are recognisable in many bituminous coals. Cell wall structures, group (2) (a), as they finally appear in the coal, may not differ much chemically from the amorphous ulmins, but the materials of group (1) differ markedly.

It is therefore to be expected that, chemically, coal will be divisible into two main groups of substances differing considerably from each other : the one composed of the resistant plant materials, perhaps in a somewhat changed form, the other the ulmins derived from the less resistant cellular structures and cell-contents. It has been suggested that a third specific group, of nitrogenous substances, should also be present, but no evidence of such a group has been obtained, and it appears that the nitrogenous compounds in plants contribute, as the result of chemical combination, to the ulmin group.

Major constituents of coal.—By whatever means the constitution of coal is studied, evidence is obtained of the presence not of an indefinable mass of chemically heterogeneous *débris*, but of only a few well-defined types of materials. For example, early work on the behaviour of coal on destructive distillation, showed clearly the presence of two distinct groups of compounds, the one yielding a little phenolic tar, and much water, oxides of carbon and hydrogen, the other yielding mainly hydrocarbons, liquid and gaseous, and presumably resinic in nature. Again, a comparison of the properties of the bright and dull components (usually termed vitrain, clarain, and durain) of banded bituminous coals, has shown relationships between the several bright and dull bands, from which the logical deduction can be drawn that but two main types of materials form the major part of a bituminous coal. Such a comparison gives a clearer idea of the character of the constituents than can the results of destructive distillation of coal as a whole, and an extension of the comparison to include peat enables the two types to be recognised as (a) ulmins ; and (b) plant materials resistant to decay and to chemical treatment.

The general nature of coal is, however, best shown by its behaviour under mild but prolonged oxidation, which converts bituminous coals partially or almost wholly, according to their nature, into alkali-soluble substances, leaving a residue that varies in amount and in character, according to the nature of the coal. This residue is composed mainly of spore exines, with some cuticles, resins and particularly resistant woody tissues (including fusain), representatives of the non-ulmined resistant plant materials, one of the two major groups of coal constituents. These resistant materials have retained their morphological structures and, to a large extent, their chemical characteristics, throughout the process of coalification.

The alkali-soluble material is derived from the other main group of constituents of bituminous coal—the coal-ulmins. The coal-ulmins are themselves insoluble in alkalis, but oxidation renders them soluble, presumably by reason of replacement of some of the external groupings of the molecules by carboxyl. The alkali-soluble ulmins, produced from a bituminous coal on oxidation, are definite types of compounds, not mixtures of dissimilar types, which attain a nearly constant composition (C 62.65 ; H 2.53 ; O 32–35, N 1–2%) when the oxidation has been carried sufficiently far, whether the portion of a coal from which they are obtained be vitrain, clarain or durain. This uniformity of product is evidence of the uniformity in character of the material from which it is derived, namely, the insoluble coal-ulmin which forms the bulk of most coals. Moreover, the composition of the alkali-soluble ulmins, produced on the oxidation of coals, remains constant over a wide range of coals of different rank, indicating the presence of a similar type of material throughout such a range of coals. Actually, the coals differ as regards the ease with which alkali-soluble ulmins are produced from them, and it is probable that the differences in rank of coals are mainly due to modifications in the readily oxidisable and replaceable external groupings of the coal-ulmin molecules. The most

* Details of the researches briefly referred to are given in a series of papers in *The Journal of the Chemical Society*, e.g., 1910, **97**, 1917, **191**, **99**, 649, 1914, **105**, 131 ; 1916, **109**, 707 ; 1922, **121**, 2345 ; 1925, **127**, 1115, 2236, 1926, 1410, 1927, 700.

obvious example of a difference of this nature is obtained on comparing peat with bituminous coal. The ulmins, as they exist in peat, are soluble in alkalis, but they possess a similar nuclear structure to that of the coal-ulmins, which have undoubtedly been derived from materials akin to the peat ulmins. The loss of solubility in alkalis, which differentiates the peat-ulmins from the coal-ulmins, is the first of the changes indicated in the changing rank of coals.

The ready separation of the coal-ulmins from the resistant plant *debris* permits a rational analysis to be made of coal. Such a rational analysis is particularly interesting when applied to the several components of a banded bituminous coal. Thus, the analyses of the four component bands of the Hamstead coal, a markedly-banded bituminous coal, can be expressed as in Table I.

TABLE I
Analysis of component bands of Hamstead coal

Ulmmin compound-	Organised plant entities	Hydrocarbons and resins	General character of plant entities
Vitram	96	Nil	Cuticles and pore canals Cuticles, spore exines and woody tissues
Claram	92	5	
Durain	84	16	
Fusain	20	80	

For complete definition of the coals, a further expression, indicating the rank of the ulmin compounds, is required.

Chemistry of the coal ulmins. The insoluble coal-ulmins are held to be of one general type, for the alkali-soluble compounds produced by their mild oxidation are of uniform composition, which is the same whether they are obtained from the vitram, claram, or durain portion of a banded bituminous coal. It might be argued that these alkali-soluble ulmins are uniform mixtures of several types of compounds. There is no evidence of this. On more drastic oxidation, products derived from the nuclear groupings of the molecules are obtained, and the breakdown is progressive, giving no indication of the presence of compounds of different degrees of stability. For example, nitrogen appears to be distributed, in firm combination, throughout the nucleus of the ulmin molecule, and, on the breakdown of the nucleus, is eliminated *pro rata* with the carbon. No selective breakdown, with the survival of nitrogenous or non-nitrogenous molecules, can be detected.

The similarity of the alkali-soluble ulmins, obtainable from the several components of a banded bituminous coal, or from a number of coals of not too widely different rank, indicates that their nuclear structure, and that of the insoluble coal-ulmins from which they are derived, is the same. The alkali-soluble ulmins differ from the coal-ulmins with respect to their external groupings, which are mainly carboxylic, and have been produced by the oxidation of the external groupings of the coal ulmins, which may vary from coal to coal.

The stability of the nitrogen (and sulphur) in the oxidised ulmins indicates that these elements enter into the nucleus of the molecule. Further oxidation (by hydrogen peroxide or dilute nitric acid) yields products, such as mellitic and other benzene carboxylic acids, picric acid, dinitro-resorcinol, succinic and oxalic acids, derived from both six-membered carbon rings and

furan structures. The nuclear structure of the ulmin molecule may, therefore, be pictured as composed of hexacyclic carbon rings, linked by furan rings in which the oxygen may be replaced by nitrogen or sulphur.

Chemistry of the resistant plant remains.—(a) *Spore exines and cuticles.*—Spore exines and cuticles exist in coal in a form but little changed, either physically or chemically, from that which they possessed originally. The most marked features of these materials, as befits their purpose as protective coverings to delicate tissues, are their waterproof nature and their resistance to either chemical, fungal or bacterial attack. The exines and cuticles that can be isolated from coal, by resolution of the conglomerate with hydrogen peroxide, are found to have suffered but little from bacterial decay during their transformation into coal, or from the chemical treatment to which they have recently been subjected. They bear a close similarity, chemically, with corresponding structures from modern plants.

Though considered together here, cuticles and spore exines are not identical in chemical constitution. Both, however, are closely related to the oily and waxy constituents of plants, from which they were no doubt derived by oxidation processes. On destructive distillation, they both yield a high proportion of tar (from 40-60% by weight), with but little gas. The tar consists mainly of hydrocarbons. The proportions of organised plant entities present in coal varies from 1-5% in a claram up to 25 or 30% in a durain.

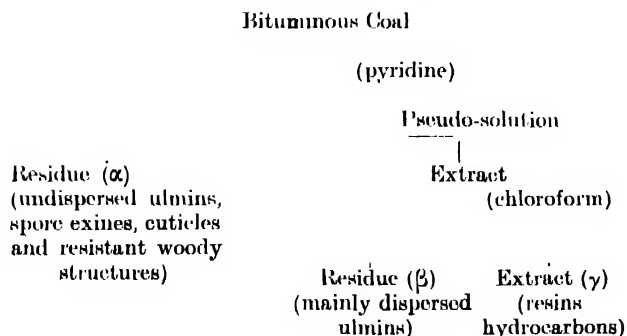
(b) *Resins.*—The resins, because of their resistance to decay and, to a less extent, to oxidation, are here grouped with the "resistant plant remains," though they differ profoundly from the spore exines and cuticles. Resins are difficult to define, but may perhaps best be regarded as the waste products of plant life, related to (oxygenated derivatives of) the terpenes. They are associated with the plant, not only as exudations, but distributed throughout the cell-structures. Resins can be isolated from some coals amongst the residue remaining after the oxidised ulmins have been dissolved in alkalis. They then appear as amber-coloured drops or rodlets, such as can be observed, in position in the plant tissues, in transparent sections of coal. Probably only a fraction of the total resins survives the oxidation treatment of coal employed to isolate them, and they are best obtained by extraction with suitable organic solvents. As thus obtained, they closely resemble the more resistant present-day resins in composition, behaviour on destructive distillation, and general properties. A typical example of a resin extracted from a bituminous coal contained C 84.0 and H 7.2%, and belonged to the class of resins termed "resenes": a saponifiable ester resin was associated with it. On destructive distillation, the coal resins give a comparatively small yield of gas, mainly paraffin hydrocarbons, with about 50% of tar, also mainly hydrocarbons. The amount of resin obtainable from bituminous coals varies, but is generally between 2 and 5%.

(c) *Hydrocarbons.*—Hydrocarbons enter into the composition of plants, e.g., associated with the cuticles, but not in any large proportion. Coals sometimes contain

free hydrocarbons in greater amounts than can be thus accounted for, and it is probable that they are mainly derived, during the later stages of coalification, from waxes and fatty oils (themselves absent from bituminous coals) originally present in the plants. The hydrocarbons are most readily isolated from coal by the selective action of solvents. Both saturated and unsaturated hydrocarbons, up to 4 or 5 %, have been so isolated. The bulk of the free hydrocarbons present in coal distills unchanged and thus contributes to the tar.

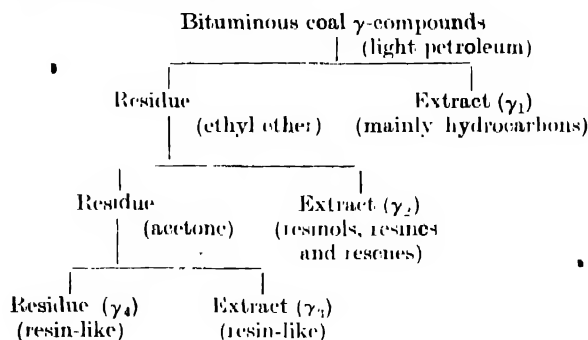
Extraction of coal by solvents.—Bituminous coal can be resolved by means of boiling pyridine, followed by chloroform. The portions (α) insoluble in pyridine and (β) soluble in pyridine but insoluble in chloroform are of similar type, but are distinct from (γ) the portion soluble in both pyridine and chloroform. These fractions have been termed "cellulosic" (insoluble in chloroform) and "resinic" (soluble), as indicating their probable origin, but they are now commonly referred to by the non-committal labels α , β and γ . Pyridine (for a short time in dislayour as a means of resolving coal, on the ground that its action might be chemical) causes a mechanical dispersion of the colloidal ulmin material (and to some extent, perhaps, of the resins), allowing of the more ready subsequent action of other solvents. Its use for coal extraction is to be preferred to that of benzene under pressure, a method that has sometimes been adopted because of its more ready removal from, and detection in, the extracts and residues, which most tenaciously retain benzene. Moreover, it is more effective than benzene at low temperatures. The behaviour of the major constituents of coal towards solvents can be stated as follows:—*Coal-ulmins*. Insoluble. Partially dispersed by pyridine (and several other solvents). The readiness with which dispersion occurs appears to be related to the rank of the coal. *Resistant plant remains*. (a) Organised plant entities, e.g., spore exines: Insoluble. Associated fats and waxes, if present, readily soluble in most solvents. (b) Resins: Soluble in such solvents as chloroform and ether. (c) Hydrocarbons: Readily soluble in most solvents.

The effect of resolving coal by pyridine and chloroform can, therefore, be expressed thus:—



The γ -compounds can be further separated by organic solvents, a suitable sequence being light petroleum, ethyl ether and acetone. Each of the fractions so

obtained has distinctive properties which enable them to be specified according to the following scheme:—



An example of the resolution of a bituminous coal according to this scheme, to show the proportions in which the various compounds are present, relates to coal from the Parkgate seam, a typical South Yorkshire coking coal, having analysis: C, 83.6; H, 5.46; O, 6.75; N, 1.72; S, 2.47; per cent. on the ash-free dry coal. By treatment with pyridine and chloroform, the proportions of α -, β - and γ -compounds obtained were 75.8, 17.3 and 6.9 %. Further resolution of the γ -compounds, in the manner described, gave the results shown in Table II.

% on the ash-free dry coal		Analysis, %			
		C	H	O	N
γ_1	2.3	83.90	30	6.74	6.36
γ_2	2.51	82.72	30	6.91	9.47
γ_3	0.83	79.00	70	0.89	14.41
γ_4	1.23	80.00	90	1.10	13.00

The distillation of coal.—When attempting to deduce the character of coal from its behaviour on heating and from the products of its distillation, two main difficulties are encountered. Coal being a heterogeneous substance, the effects observed when it is heated may be compounded of the effects produced by each ingredient independently, whilst the primary products of distillation may be subject to secondary decomposition. The latter difficulty can be largely overcome by adopting suitable measures to remove the primary products of decomposition, at carefully regulated stages, as rapidly as they are formed. Valuable information has been obtained in this way. Destructive distillation of coal *en masse*, however, fails to disclose the individual contributions of the various constituents, though broad generalisations can be made regarding the character of the types of compounds responsible for the major effects—obvious stages of decomposition—observed.

Thus, at low temperatures there is an evolution, almost exclusively, of oxides of carbon and water, which, by analogy with the behaviour of carbohydrates on destructive distillation, have been assumed to come from those portions of the coal that are derived from the various celluloses. At moderate temperatures the decomposition products are mainly hydrocarbons, both liquid and gaseous, such as might be yielded by "resinic" material. At high temperatures the products are mainly hydrogen and the oxides of carbon, from the "cellulosic" portion of the coal. These suggestions have received support from the results of distillations

of the several fractions into which coal can be separated by means of solvents.

Knowledge of the individual contributions of the various constituents of coal towards its distillation products can, however, best be obtained: (a) by the separate distillation of such individual substances as can be isolated, *e.g.*, resins and hydrocarbons (by solvent extraction), spore exine, and cuticles (by oxidation and treatment with alkali); (b) by comparison of the results so obtained with the result of distillation of modern plant materials of a similar nature; and (c) by a suitable choice of coals for destructive distillation, *e.g.*, the components of a banded bituminous coal or coal in which one or other ingredient is known to be concentrated in abnormal amount. The information obtained by these means can be summarised as follows.

The ulmins. The ulmin constituent cannot be separated from bituminous coal without modifying its character. Perhaps the nearest approach to a pure coal ulmin is a vitrain from which all resins and hydrocarbon material has been removed by extraction with solvents. Peat ulmins can readily be isolated, and their behaviour on distillation can be compared with that of extracted vitrains and oxidised ulmins prepared from them. Peat ulmins on distillation yield much water and a little phenolic tar, with, at higher temperatures, a large volume of gases, mainly hydrogen and the oxides of carbon. This behaviour is typical of the natural ulmins whatever their source. It is shown, also, by the synthetic ulmin (containing nitrogen) yielded by the interaction of amino acids and carbohydrates. These so-called "amino ulmins" are of considerable interest, not only because of their general similarity, in composition and behaviour, with the natural ulmins, but because they are derived from materials which occur amongst decayed and decaying plant accumulations, and are formed under conditions that can occur in nature.

The products of distillation of a vitrain closely resemble those of a peat ulmin, the main difference, a smaller yield of water and carbon dioxide, being attributable to loss of hydroxyl, carboxyl and other external groupings during the change in rank of the ulmin from that of peat to that of bituminous coal. The oxidised ulmins prepared from a vitrain yield greatly increased quantities of carbon dioxide (owing to the introduction of carboxyl groups), but the products of distillation, carbon monoxide and hydrogen at high temperatures and a phenolic tar, are otherwise characteristic of ulmins in general. As the ulmin constituent changes in rank with the carbon content of the coal, the products of distillation contain lesser quantities of water and oxides of carbon.

The resistant plant remains. Spore exine and cuticles, as already stated, yield between 40 and 60% by weight of liquid hydrocarbons. Resins partly distil unchanged and partly decompose, yielding gases (mainly paraffin hydrocarbons), and up to about 50% by weight of hydrocarbon tar. The resins extracted from coal (or separated from it mechanically) behave similarly to such fossil resins as have been examined. The hydrocarbons isolated from coal distil unchanged. By close

observation of the course of the distillation of a bituminous coal, it is possible to detect the independent decomposition of each of the ingredients: to note, for example, the early distillation without change (liquefaction) of the hydrocarbons, the later decomposition of the resins, and the main decomposition of the ulmin constituent. In general, therefore, it can be said that when a bituminous coal is distilled, the phenolic tars, water, and oxides of carbon and hydrogen produced are derived from the ulmin constituent. Gaseous hydrocarbons are derived in part from the ulmin constituent and in part from the resistant plant remains. Liquid hydrocarbons are yielded mainly by the plant remains.

Oxidation of coal. It has already been explained that the mild oxidation of a bituminous coal affords means of separating the major constituents, the ulmins and the resistant plant remains. From early work, the presence in coal of two main types of constituents has been deduced, the one "reactive," the other relatively "inert." It was demonstrated that the difference, chemically, between the vitrain, clavin, durain, and fusain of a banded bituminous coal lay in the proportions of "inert" material with which the "reactive" material in each was associated, the latter being of the same chemical composition throughout the banded coal. The later work, on the oxidation of coal, specified as the "reactive" group of compounds those that can be converted by mild oxidation into alkali-soluble ulmins, and as the "inert," those that remain insoluble in alkalis - the plant remains. The "reactivity" of the ulmin constituent of coal, as contrasted with the "inertness" of the plant remains, is displayed not only by its oxidisability, but by its behaviour towards reagents in general, its response to the dispersive action of pyridine, and to the action of heat, more particularly as regards the production of gases on distillation.

The mechanism of the atmospheric oxidation of the coal-ulmins seems to be, in sequence: (a) The adsorption of oxygen on the colloidal material; (b) the addition of oxygen to the external groupings of the molecule; and (c) the splitting off of external groupings and their replacement by carboxyl. Attack on the nucleus of the coal-ulmin does not begin until more vigorous oxidation than atmospheric is employed. The oxidisability of a coal thus depends on the nature of the external groupings of the ulmin molecules. The effect of the progressive condensation and elimination of external groupings from the ulmin molecules, as coals progress in rank, is seen in their gradual decrease in oxidisability.

General considerations. The materials, all forms of plant structures, that may have contributed to the composition of coal, are numerous and diverse in character. Except for certain specific substances, too small in amount to require consideration here, these materials are, however, substantially the same in chemical nature, though varying widely in form and in the relative quantities present, whatever the type of plant life to which they belong. The relative amounts of the different plant materials that ultimately form coal may be considerably altered by the conditions of their accumulation in the coal-forming beds. There will, for example, be

a tendency for the heavier woody matter, containing much lignin and cellulose, to be segregated from the lighter *débris*, such as spores and pollens, so that the resulting coal may show local enrichments of such bodies. Local contributions of different plant materials account for the commonly banded appearance of bituminous coals. The differentiation of such banded coals into physically distinct components—vitrain, clarain, durain and fusain—enables a study to be made of the extent to which local enrichments affect the properties of coals, for these components of banded bituminous coals differ from one another almost entirely because of the different contributions made to them by the various parts of plants. For proper understanding of the character of bituminous coal it is, in fact, essential to study each physically distinct banded component separately.

As a result of numerous researches on banded bituminous coals, it has become increasingly apparent that the great complexity of character of the initial coal-forming materials has not been transmitted to the resulting coal. During the process of coalification, and, as it would appear, mainly during the initial stages, those of decay of the vegetable matter, many of these more important components (in quantity) of the accumulated plant-material lose their identity, and by extensive alteration and interaction find a common level as "ulmin compounds." These ulmins form a definite class of compounds, not necessarily homogeneous, but probably comprising several distinct types, yet sufficiently alike in their chemical constitution and behaviour to justify their being grouped under one head. So far, no separation of the naturally-occurring ulmins into markedly different classes of compounds has been obtained experimentally.

The plant materials that contributed to the ulmin group of compounds are the structural portions, the lignin and celluloses of the cellular framework, together with much of the cell-contents, namely, carbohydrates and proteins. These materials formed the bulk of the plants, and the resulting ulmins form the bulk of coal. The predominance of ulmins is already apparent in an accumulation of plant *débris* after a comparatively short process of decay, *e.g.*, in peats, in which alkali-soluble ulmins are found in increasing amounts as the age of the peat increases. The ulmins, as first formed, are not permanent, unchangeable compounds, but are subject to progressive alteration according to the conditions to which they are subjected. This progressive alteration becomes most apparent in a decrease of solubility in alkalis, partial in the lignites, complete in bituminous coals. Over the whole range of coals, also, the ulmins progressively alter, more particularly as regards their ease of oxidation, as the "rank" of the coal increases. There is good reason for the belief that the rank of a coal is mainly determined by the change that has taken place (by such factors as pressure, temperature and time) in the ulmins it contains.

The parts of plants which do not undergo decay, with the formation of ulmins, are the protective coverings of plant tissues, such as the coats or exines of spores and the cuticles of stems and leaves, together with certain special plant products such as the resins. These are not readily subject to decay, and are not readily

altered by the conditions attending coalification, so that they are found in coal but slightly modified from their original forms, and in quantity greater than corresponds with their original proportions in the plant *débris*. There are also present in coal small quantities of free hydrocarbons, probably derived from the oils and waxes of the plants during the processes of decay and coalification. These three classes of plant materials, protective tissues, resins and hydrocarbons, though different in character, can conveniently be grouped together as "resistant plant remains." A normal coal can be regarded as essentially a mixture of the two groups of compounds, "ulmins" and "resistant plant remains." It can be confidently anticipated that, as the result of work now in progress, the nature of any coal can be related to (a) the character of its ulmin compounds, and (b) the contents and nature of its resistant plant remains, so that a rational classification can be obtained. There seems to be no possibility of compounding the influence of these two groups of materials, for their effects on the character of the coal composed of them are independent.

At present our knowledge of the extent to which each of these main component groups of compounds affects the behaviour of coal under different conditions is incomplete, but it is possible to relate one or other property broadly to the presence of one or other component. For example, in those reactions or coal which involve its oxidation, the ulmin compounds play the major part; whilst the behaviour of coal on destructive distillation, as regards its yield of tar, is determined mainly by its contents of resistant plant remains. The "coking-power" of a coal (its ability to yield a commercial coke) depends on too many factors to permit of its being related so simply to the presence of some "coking ingredient"; nevertheless, it should be possible to deduce the coking properties of a coal from its chemical constitution. The resins, and to a certain extent the hydrocarbons, appear to play the part of agglutinating materials, but it is clear that the character of the infusible part of the coal is of equal importance.

The applications of coal, beyond its direct use as a raw fuel, are steadily increasing as knowledge of its properties grows; yet there is no question but that its most economic use is hampered by lack of definite knowledge of its chemical nature. It is significant that, of the various schemes suggested for obtaining oil from coal, the one regarded by many as the most promising involves the complete breakdown of the coal molecules, with the formation of carbon monoxide and hydrogen from which oils are laboriously resynthesised. With the more complete knowledge rapidly being attained of the chemistry of the major components of coal, it is not too much to hope that direct advantage may be taken of their properties to put them to the use for which they are best suited.

THE DISCUSSION

In the discussion which followed the presentation of the papers by Dr. Lander, Prof. Cobb, and Prof. Wheeler, Dr. A. Parker considered that Dr. Lander rightly emphasised the necessity for more fundamental work, but it was not easy to decide what was fundamental

when considering such a complex substance as coal. There were many variables—size of coal, temperature, the origin of the coal, the nature of its ash, the rate of heating, the thickness of the layer heated, and so on—and these variables in combination would give rise to thousands of factors affecting the results. Prof. Cobb had pointed out that, in the economic development of carbonisation processes, speed seemed to be the determining factor, and had also referred to the carbonisation of coal in powdered form. He (Dr. Parker) thought that an important development in this connexion, and one worth further investigation, was the transfer of heat to the coal by the passage of heated gases through the retort. Improvements might also be made by using better conductors for constructing retorts than the usual refractory materials. For the efficient utilisation of coal, there might be better co-operation between the carbonising and other industries; some of the coke produced in the gas industry was in the form of breeze or dust which might be employed for steam raising in electric power stations. Breeze was used for that purpose in the gas works, but the gas industry was now giving greater attention to waste-heat utilisation, and more breeze would be available for other industries. It was in this direction that the greatest step could be made to make use of the fundamental work in the near future.

Mr. A. Lupton, criticising the figure of 180,000 million tons given by Dr. Lander as the quantity of coal remaining in Great Britain, said the amount was probably twice as great. Mr. C. E. Stromeyer referred to a process used in Silesia for drying lignite, which contained 30–40% of water as mined, and when dried in the ordinary way completely disintegrated. It had been found, however, that by placing the lignite in vessels of water, gradually heating the water to boiling point, and then draining it off, the lignite subsequently contracted in drying without disintegration. Mr. Stromeyer further observed that, as powdered coal could now be burned efficiently, it might be possible to use some of the existing thin seams of coal if some form of scraper conveyor could be devised to extract the coal from such seams in the form of dust. If that were practicable, our coal resources would be doubled.

Prof. Sir T. Hudson Beare remarked that the use of pulverised coal would prevent the production of smoke in power plant, but could not be applied to domestic fires. He hoped that low-temperature carbonisation would assist in that respect. Prof. F. C. Lea said that many metallurgical problems must be solved before carbonisation processes became economical. During the next few years it would be necessary to give more consideration to the use of the gaseous products of carbonisation processes for domestic and industrial heating, and to use powdered coke for boiler firing. Dr. J. S. Owens, dealing with the use of gas for domestic heating, remarked that with gas heating little air was taken from the room, whereas an open grate gave good ventilation. A fuel was wanted which would burn smokelessly in the open grate; existing grates could be modified to burn gas coke.

Replying to the discussion, Dr. Lander remarked that many of the heat-transfer processes to-day seemed to be

working at minimum efficiency. The figure of 180,000 million tons as the coal reserve of this country was taken merely to calculate the equivalent amount of oil, and if the coal available was greater than he had assumed, the oil equivalent was correspondingly increased. He agreed with Prof. Hudson Beare's remarks about pulverisation, and added that the importance of the domestic fuel problem was fully realised. The metallurgical problems, mentioned by Prof. Lea, were most difficult, not only in connexion with carbonisation, but in many other industries. It was largely a question of obtaining heat-resisting metals much cheaper than those at present available. Metallurgists might well pay more attention to cast iron, as a 20% improvement in its heat-resisting properties would render possible many processes which could not be worked economically to-day.

Prof. Cobb, in his reply, agreed with Dr. Owens as to the importance of ventilation, and that the open fire was not only a heating but also a ventilating appliance. The solid-fuel fire was likely to have a very long life yet, and one important reason for this was that it formed a useful domestic refuse destructor. A solid-fuel fire did not, however, necessarily mean a smoky fire, if smokeless solid fuels were used. He was sorry that Dr. Owens had suggested that a gas fire was not an effective ventilator; if a room heated by a gas fire was not well ventilated the fire could not have been properly fitted.

CANADIAN INDUSTRIAL NOTES

The large pulp and paper mills, built a few years ago on the west coast of Newfoundland by British and Newfoundland interests, and guaranteed by the Governments of the Dominion and Great Britain, have been sold to the International Paper Co., of New York. This is the first large-scale invasion of the Newfoundland pulp and paper field by United States financial interests.

Oil of 42° Be. has been encountered in the Dalhousie well 5, located in Turner Valley, Alta. The company is a subsidiary of the Imperial Oil Co., Ltd. The flow is coming from a depth of 4525 feet, and at the rate of 400 barrels daily. It is a paraffin base oil.

The Regal Oil Refinery, Ltd., is erecting a refinery, with an initial capacity of 500 barrels crude oil, at Calgary, Alberta, which will be increased to 750 barrels.

The Guggenheim Distilleries of Canada, Ltd., has purchased the large beet sugar factory of the Dominion Sugar Co., at Kitchener, Ontario, and is converting it into a large modern distillery.

The Royal Crown Soap Co., Ltd., Vancouver, B.C., is erecting additions to its factory to increase output.

The Mexco Co., Ltd., Great Britain, has erected a factory at Swastika, Northern Ontario, for the manufacture of Klox explosives.

Courtaulds, Ltd., is making an addition to its viscose factory at Cornwall, Ontario. The addition will cost about \$250,000, and, when operating, necessitate the employment of 300 more employees.

The Canadian Goodrich Rubber & Tire Co., Kitchener, Ontario, will expend about \$150,000 in the erection of an additional building to its establishment. The company at present employs 900 people.

REPORT OF THE SECRETARY FOR MINES*

This report, which marks the completion of the sixth year of the Mines Department, contains, in addition to the report of the Chief Inspector of Mines, a review of general subjects arising out of the regulation and inspection of mine and quarry working, and also deals with the conduct and encouragement of research and inquiry, the testing and approval of safety lamps and explosives, and the testing of samples of mine air and dust, and other subjects.

In 1926 the output of saleable coal was 126½ million tons, or less than one half the annual rate of output during the years 1922—25. In the first four months of the year an average of 22 million tons a month was raised, this rate falling to very little in May, and reaching 2·2 million tons in September, subsequently rising to 5 million tons in October, to 8·75 million tons in November, and to 19·55 million tons in December. The number of wage-earners on colliery books was 1,111,900 at the beginning of April. Of 94,100 wage-earners at work at the end of July, two-thirds were safety men. At the end of the year there were 952,100 wage-earners once more in employment, and this number has continued to grow up to May, 1927. Comparison of accident figures with preceding years is not satisfactory on account of the general stoppage, but these figures in the first four months of 1926, when the pits were generally working normally, do not show any departure from the experience of recent years.

During the first four months of 1926, 17·5 million tons of coal was exported, compared with an average of 19·1 million tons during the corresponding periods of 1924 and 1925, and the total for the whole year amounted to 20·6 million tons. Owing to the coal stoppage on May 1, the export of coal and manufactured fuel was prohibited from that date, except under licence, and only about 5000 tons of coal per month was exported under these licences during the continuance of the coal dispute. Increasing quantities of coal were imported during the stoppage period, the amount during the year totalling 19,972,000 tons of coal and 1,069,000 tons of coke and manufactured fuel. Home consumption of coal in 1926 is not readily calculable, but from information available it is estimated that 128 to 133 million tons of coal were used for home consumption compared with 169 million tons during 1925.

The output of minerals in the United Kingdom is shown in the following table :

Kind of mineral	Quantity of mineral raised or quarried in	
	1926 Tons	1925 Tons
Coal	126,278,521	243,176,231
Iron ore and ironstone	497,123	951,873
West Coast hematite (non-phosphoric)		
Jura	976,562	2,284,186
Cleveland	2,161,290	6,464,081
Other sorts	122,461	343,021
Coal measures	33,960	90,717
Other occurrences		
Total Iron ore and ironstone	4,094,386	10,142,878

* Sixth annual report of the Secretary for Mines for the year ended December 31, 1926, and the annual report of H. M. Chief Inspector of Mines for the same period, with a statistical appendix to both reports. Mines Department. Pp. 179. H.M. Stationery Office, 1927. 8s. 6d.

Kind of mineral	Quantity of mineral raised or quarried in	
	1926 Tons	1925 Tons
All other minerals—		
(i) Non-ferrous ores :		
Tin ore, dressed (black tin)	3,878	4,032
Lead ore, dressed	19,076	15,578
Zinc ore, dressed	1,944	1,603
Tungsten ore, dressed	19	1
Uranium ore, dressed	—	114
Copper ore, dressed	155	—
Copper precipitate	128	148
Manganese ore	128	829
Chromite	—	448
(ii) Minerals for chemical and allied industries		
Arsenic (white) and arsenic soot	1,666	2,545
Arsenical pyrites	—	—
Iron pyrites	4,230	5,288
Bog ore	3,583	4,791
Ochre,umber, etc.	10,203	11,224
Salt brine—		
Salt obtained from brine	668,591	793,221
Salt contained in brine used for other purposes than salt making	913,279	1,088,036
Salt, rock	34,597	34,724
Barytes and witherite :		
(a) Not ground	27,976	36,336
(b) Ground		
Bleached	2,000	1,878
Unbleached	12,819	10,467
Celestine (sulphate of strontium)	380	1,072
Gypsum	465,102	414,302
China clay	825,954	850,160
Mica clay	25,863	20,834
Pottery clay (including ball clay)	184,526	206,826
China stone	47,769	57,379
Felspar	—	—
Chalk	315,376	5,035,350
Galespar	14,806	12,807
Fuller's earth	—	—
Alum clay and shale	8,260	11,255
Oil shale	959,795	2,464,829
Petroleum	279	383
(iii) Minerals used in iron and steel making and other smelting processes :		
Fluot spar	—	39,079
Glauber (including silica rock, silica stone and silica sand used as refractory)	337,811	494,293
Moulding and pig-bed sand	521,031	679,559
Fireclay	1,191,648	2,229,274
(iv) Minerals for building and road-making and for all other purposes :		
Limestones	11,018,779	13,969,753
Sandstone	2,984,181	2,888,741
Slate	300,124	305,763
Clay and shale	12,918,739	13,073,940
Chert, flint, etc.	119,162	134,088
Gravel and sand	4,181,251	3,741,961
Igneous rocks	8,215,720	8,221,983

* This information is not available for publication.

† Exclusive of the produce of quarries less than 20 ft. deep.

‡ Revised figures for 1924 and 1925.

§ The heading "Limestone" in Section (i) includes limestone used for fluxing purposes and Dolomite used as a refractory.

Iron.—The output of pig-iron for the year was 2,458,200 tons, the lowest figure recorded since 1850. It compares with 6,261,700 tons in 1925, and 10,260,300 tons in 1913. Steel followed the same course, decreasing to 3,596,100 tons. In the first four months of the year, however, there was an increase of 250,000 tons of steel over the corresponding period of 1925. Imports of iron and steel in 1926 reached the unprecedented total of 3,740,279 tons, while the total exports, including re-exports, amounted to only 3,001,672 tons.

Tin.—The production of dressed tin ore ("black tin") in Great Britain (Cornwall and Devon) showed no great change during the year, the total amount being 3878 tons as compared with 4032 tons in 1925, 4858 tons in 1920, and 8355 tons in 1913.

Lead.—An increase of 22% is recorded in the production of dressed lead ore (80% metal) during 1926, the total figure being 19,076 tons compared with 15,578 tons in 1925, but it was only 79% of the 1913 production of 24,282 tons.

Zinc.—During the early part of 1926 consumption of

spelter was well maintained, but fell away later on account of the coal stoppage. The galvanisers and others in Great Britain absorbed 160,186 tons of spelter during the year. British production of dressed zinc ore (43% metal) was 1944 tons, an increase of 21% over 1925, but only 11% of the production for 1913 (17,294 tons). Production was confined to the North of England (50% of the total), Wales and the Isle of Man (38%), and Derbyshire (12%). Only four mines produced over 100 tons, namely, Great Laxey in the Isle of Man, Nentsbury and Threlkeld in Cumberland, and Mill Close in Derbyshire, the combined output of these mines amounting to 93% of the total.

Minerals used in the chemical and allied industries.

Production of most of these minerals decreased, compared with 1925 figures. The output of oil shale in 1926 was 1,959,795 tons, compared with 2,161,829 tons in 1925, and the number of persons employed in 1926 in the oil shale mining industry was 2966 compared with 1395 in 1925.

In the barytes industry British production for the most part remained confined to the medium and low-class grades used in the chemical industry and in manufactures where the "finest white" and the "finest ground" qualities are not essential. Continental producers retained the trade in the best qualities. Imports of ground barytes (including *blanc fixe*) were 38,414 tons, compared with 12,609 tons in 1925. The output of witherite in 1926 was 7538 tons (7780 tons in 1925) and of barytes the output in 1926 was 35,237 tons compared with 40,901 tons in 1925. The china clay industry of Devon and Cornwall suffered in common with other industries in which coal is an essential to manufacture. 1 ton of coal being required to dry and prepare for the market about 12 tons of china clay. Exports of this product were, however, well maintained, the total exports amounting to 651,990 tons (including a small amount of china stone) as against 652,576 tons for 1925. Salt exports in 1926, excluding table salt, amounted to 290,200 tons, compared with 313,203 tons in 1925 and 533,521 tons in 1913. Only about 30% of the salt exported goes to foreign countries, the bulk being sent to British India and other British Dominions. Gypsum production and the number of persons employed in the industry for the last five years has been one of progressive increase, the output in 1926 greater than that in 1922.

Minerals used in iron and steel-making and other smelting processes. The output of limestone and of dolomite for fluxing purposes and of gangster and silica rock reflected the depressed condition of the iron and steel industry, and were 57% and 32% respectively less than in 1925. Fireclay showed a reduction of 33%, moulding and pig bed sand one of 23%, and dolomite used as a refractory material one of 23%. The production of fluor spar was in 1926 35,883 tons, compared with 39,079 tons in 1925.

Minerals used in building and road-making, and for all other purposes. Of the 11 million tons of limestone for all purposes, 3,528,000 tons was used for lime and cement-making, 1,192,000 tons or 11% for fluxing in blast furnaces, and 4,530,000 tons or 41% for road-making.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, is now ready.

The reprints are in JOURNAL format, with paper cover, and the price is **2s. 6d. net and post free.**

Orders, accompanied by the appropriate remittance, should be sent to the **General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.**

DEATHS

Humphreys, Dr. Alexander C. (elected 1903), of the Stevens Institute of Technology, Hoboken, N.J., U.S.A., President. On August 14, 1927.

Hutchins, T. W. Stainer (elected 1923), of Hartford Lodge, near Northwich, Cheshire, Managing Director. On May 26, 1927.

Procter, Prof. H. R. (original member), of Polwim, Newlyn, Penzance, Emeritus Professor of Tanning. On August 17, 1927.

Smith, Dr. R. Greig (elected 1890), of 23, Itabaca Road, Elizabeth Bay, Sydney, N.S.W., Bacteriologist and Chemist. On August 6, 1927.

LONDON SECTION

The following provisional programme for the forthcoming 1927-28 session has been issued by the London Section:—On October 3, 1927, the Chairman's address will be delivered by W. J. A. Butterfield, M.A., F.I.C., who will speak on "The gas industry, past, present and future." The subject on November 7, 1927, will be "Recent advances in the hydrogenation of oils." The general introduction will be given by Mr. E. R. Bolton, F.I.C. Part I. (a) "Selective hydrogenation," (b) "Melting point of hydrogenated oils," by K. A. Williams, B.Sc., A.I.C. Part II. "Hydrogenation of fatty acids and neutral oils," by R. G. Pelly, F.I.C., and Part III. "The activity of a nickel catalyst," by E. J. Lush, M.A., A.I.C. On December 5, 1927, the paper will be "Automatic analysis of liquids and its application to control of water softening plants," by Dr. H. S. Hatfield.

On January 2, 1928, Prof. J. C. Drummond, F.I.C., will speak on "The future of biochemical research." On February 6, 1928, an address will be given by Francis H. Carr, C.B.E., the President of the Society. On March 5, 1928, a paper entitled "Syntheses under high pressure" will be presented by Prof. G. T. Morgan, F.R.S., R. Taylor, M.A., B.Sc., and T. J. Hedley, A.M.I.Chem.E., and on April 2, 1928, C. D. Adams, Assistant General Superintendent of the Anglo-Scottish Beet Sugar Corporation, Ltd., will speak on "The English sugar beet industry."

CALENDAR OF FORTHCOMING EVENTS

Sept. 23 to 26.—ASSOCIATION OF SPECIAL LIBRARIES AND INFORMATION BUREAUX. Fourth Conference, Trinity College, Cambridge. (*See CHEM. & IND., Sept. 16, p. 829.*)

Sept. 26 and 27.—CERAMIC SOCIETY. *Refractory Materials Section Meeting*, Town Hall, Bournemouth, commencing at

10 a.m. each day. The following papers will be read:—"A consideration of steel works refractories," by A. T. Green. "Note on silica bricks made without added bond," by W. J. Rees and W. Hugill. "Some experiments in the drying of clays," by R. S. Troop. "Crushing strength of unfired fire-clay bodies," by W. C. Hancock. "Determination of iron silicates," by A. E. J. Vickers. "Refractory material used as mortar for laying up refractories," by Prof. D. A. Moulton. "Characterisation of clay," by Dr. A. F. Joseph. Discussion to be opened by S. R. Hind. "Effects of temperature on the mechanical properties of silica products," by A. J. Dale.

Sept. 28.—FARADAY SOCIETY. *Ordinary Meeting.* Rooms of the Chemical Society, Burlington House, Piccadilly, W., at 8 p.m. (1) "The electronic theory of valency. Part VI. - The molecular structure of strong and weak electrolytes. (b) Reversible ionisation," by Prof. T. M. Lowry. (2) "The effect of temperature on diffusion potentials," by Dr. E. B. R. Pidgeaux. (3) "The ionisation of polyhydric acids," by C. Morton. (4) "The velocity of the decomposition of nitroacetic acid in aqueous solution," by K. J. Pedersen.

Oct. 3. SOCIETY OF CHEMICAL INDUSTRY. - *London Section.* "The gas industry, past, present and future," by W. J. A. Butterfield.

Oct. 5.—INSTITUTION OF SANITARY ENGINEERS. Opening Sessional Meeting.

Oct. 7. SOCIETY OF CHEMICAL INDUSTRY. *Manchester Section.* Chairman's Address, by C. J. T. Cronshaw.

Oct. 8. BIOCHEMICAL SOCIETY. Meeting at Cambridge.

Oct. 10.—INSTITUTE OF BREWING. *London Section.* Engineers' Club, Coventry Street, Piccadilly, W. Discussion on season's malts (made from 1926 barleys).

Oct. 11. INSTITUTION OF PETROLEUM TECHNOLOGISTS. General Meeting. House of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m.

Oct. 12.—INSTITUTION OF THE RUBBER INDUSTRY. *London and District Section.* Engineers' Club, Coventry Street, W.1. "Coagulation, structure and plasticity of crude rubber," by Dr. O. de Vries.

Oct. 13.—INSTITUTION OF THE RUBBER INDUSTRY. *Birmingham and District Section.* Grand Hotel, Birmingham. Selling, by A. E. Hensworth.

Oct. 17.—INSTITUTION OF THE RUBBER INDUSTRY. *Sales Section.* Engineers' Club, Coventry Street, W.1. "What advertising-salesmanship can do for the rubber industry," by H. Hadley.

Oct. 19.—ROYAL MICROSCOPICAL SOCIETY. *Ordinary Meeting.* 20, Hanover Square, London, W.1, at 7.30 for 8 p.m.

Oct. 20.—CHEMICAL SOCIETY. *Ordinary Scientific Meeting.* Burlington House, Piccadilly, W.1, at 8 p.m.

Oct. 21.—INSTITUTION OF MECHANICAL ENGINEERS. *General Meeting.*

Oct. 27.—INSTITUTION OF MINING AND METALLURGY. *General Meeting.* Burlington House, Piccadilly, W.1, at 7.30 p.m.

Oct. 27.—INSTITUTE OF BREWING. *Midland Counties Section.* White Horse Hotel, Congreve Street, Birmingham. Brewer's microscope - a demonstration of its selection and use, with some hints on photomicrography," by H. Lloyd Hind.

Oct. 27.—INSTITUTION OF THE RUBBER INDUSTRY. *Manchester and District Section.* Geographical Society, St. Mary's Parsonage, Manchester. "Transmission and conveyor belting," by W. A. M. Keith.

INTERNATIONAL SOCIETY OF LEATHER TRADES' CHEMISTS

The London Conference of the International Society of Leather Trades' Chemists was held at the Leather-sellers' Hall, St. Helen's Place, London, on September 12, 13 and 14. The work of the Conference was carried on by a number of Scientific Commissions, which dealt with the problems associated with the analysis of tanning materials, analysis of leather, analysis of various tannery products, and matters affecting leather manufacturing. Reports of these discussions were subsequently presented to the main Conference.

The Conference elected Prof. Dr. V. Kubelka (President of the Czecho-Slovakian Section) as President for the next two years, and the next Conference will be held either in Prague or Basle. Apart from the matters of scientific detail discussed by the various technical commissions, the feature of the Conference was the decision that the new international method of tannin analysis shall become official at the same time that the I.V.L.I.C. (Internationale Verein Leder Industrie Chemiker) adopts this method officially. It may be noted that the American Leather Chemists' Association, in May last, approved the method provisionally, and it practically only remains for the German Association definitely to adopt it for the method to come into international use.

Delegates to the Conference attended from England, France, Italy, Spain, India, Belgium and Czecho-Slovakia.

On September 13, a dinner was given to the delegates by the members of the British Section under the Chairmanship of Dr. J. Gordon Parker (President of the British Section). There was a large attendance and many speeches.

"Our Rulers" was proposed by the Chairman and duly honoured, after which followed the toast of "Our Foreign Colleagues," proposed by Prof. D. McCandlish, the retiring President of the International Society of Leather Trades' Chemists, who spoke of the unselfish support that had been given to him during his term of office by the Foreign Sections and his foreign colleagues generally. Referring to the election of Dr. Kubelka as President for the next two years, he said this was evidence of the unselfishness pervading the Society, because if the other Sections had exercised their voting strength they could easily have ensured the election of a President from Great Britain or France. The toast was responded to by representatives from all the countries attending the Conference in cordial terms of appreciation for the hospitality extended to them by the London Section during the Conference.

The Chairman proposed the health of the President-elect, and referred to the excellent work which Dr. Kubelka has already done in the interests of the Society.

Dr. Kubelka briefly replied, and said that, although he felt quite unequal to the task that had been imposed upon him, he would do everything possible to forward the work of the Society. The Chairman assured Dr. Kubelka that he could rely upon every possible help from his colleagues in this work.

Dr. R. H. Pickard, F.R.S., proposing "The British Leather Trades," said the leather trades of the country since he had known them for the past seven years had had their ups and downs—perhaps he had better say their downs and ups, and that the ups were now coming along: at any rate he hoped so. All those present, he was sure, would join him in wishing the leather trades an improvement in their position because the leather trades' chemists, and if the employers were doing well then the chemists hoped to share in that prosperity. The leather trades' chemists had reason to be proud of their trade organisations and he particularly congratulated the United Tanners' Federation for their successful effort in bringing together the International Conference of Tanners, which was indirectly responsible, at a later date, for calling together that body which had promised to settle the hide tanning analysis question. He coupled with the toast the name of Sir Samuel Barrow, a member of the Court of the Leathersellers' Company, to whom, through Sir Samuel, he expressed the thanks of the International Society of Leather Trades' Chemists for many favours received during the Conference.

Sir Samuel Barrow, in replying to the toast, said he did not think the occasion ought to pass without mention of the late Prof. Procter, whose death was so regretted. Continuing, he said the Society had 890 members, representing 12 countries, excluding the United States and Germany, and that was an indication of the importance of the leather trade. Undoubtedly, the Society had done a great deal for the trade, especially in helping in that most difficult problem, the tanning of raw materials and turning them to the best account. The prosperity of the British leather trade depended upon the prosperity of international trade. Chemists were international in their efforts, and the British producer of leather should lose no time in producing leather not only for this country but for all the countries represented at the Conference. In that sense the prosperity of the British leather trade depended upon the prosperity of international trade and the interchange of our commodity not only with our Dominions but with foreign countries also. He congratulated the leather trade upon having chemists who were giving their time to the work of the trade as were the members of the Society.

The final toast of the evening was "The British Section" proposed in a very few words by Prof. L. Meunier (President of the French Section), in which he expressed thanks for the hospitality extended to the foreign delegates during the Conference. The chairman replied and said that the work of organising the Conference was carried out by a Committee consisting of himself and Mr. Lamb, and as Mr. Lamb never consulted him, the work had gone forward very smoothly. He added that it is the intention to found a memorial to the late Prof. Procter, and he was certain nothing would have pleased Prof. Procter more than to found a research scholarship at the Procter Research Laboratory in Leeds. It was to be hoped that it would be possible to work out the details of such a scheme, and to be able to say that this was done at the London Conference.

OBITUARY

F. M. MRAZSEK

Dr. F. M. Mrazsek, who died on June 29 last, was a native of Vienna, but for nearly fifty years he had resided in London in practice as a sugar expert.

He was born in 1849, and when a mere youth served as an officer of Hussars in the Austro-Prussian war. At the close of the war, he entered as a student in the University of Vienna, and finally proceeded to the Doctorate in Chemistry. For a time he was Assistant Chemist in the Imperial State University; but in 1878 he came to London as chemical expert to the firm of Czarnikow, the well-known sugar brokers, and from 1909 till the close of his life he maintained a practice at 106, Queen Victoria Street, by arrangement with Messrs. Reaks and Hughes, analysts and assayers, of that address.

Mrazsek became a member of the Society of Chemical Industry in 1905, but was an infrequent attendant at its meetings. During his long residence in this country, he took, indeed, but little part in scientific activities. This was, in part, due to his temperament, which was sensitive and retiring, and, in later years, to precarious health. It was doubtless also due to the circumstances that, although he was an accomplished laboratory worker, well read in the literature of his subject, his essential interests were artistic rather than scientific. He was, for instance, a highly accomplished musician. He had little ambition of a professional sort, and small prompting to write or publish.

As a man, he combined much personal dignity with a most attractive modesty of mind. He had great capacity for affectionate and loyal friendship, and by a small circle of intimate friends he will be greatly missed.

PERSONAL AND OTHER ITEMS

Mr. A. G. Lobley, M.Sc., who, as we have previously announced, had resigned from the readership in electro-chemistry in the University of Manchester, has become managing director to the Birmingham Electric Furnaces, Ltd.

Dr. F. H. McDowall, M.Sc., who has been engaged in research work in the chemical laboratories of University College, London, has been appointed Dairy Research Chemist at the New Zealand Massey Memorial Agricultural College.

Mr. G. St. J. Perrott will succeed Dr. A. C. Fieldner as superintendent of the Pittsburgh Experiment Station, the largest of the eleven experiment stations of the U.S. Bureau of Mines.

Mr. F. A. Ernst, acting chief of the Fertiliser and Nitrogen Fixation Investigations of the U.S. Bureau of Chemistry, has joined the engineering staff of the Atmospheric Nitrogen Corporation, which is planning the erection of a large synthetic ammonia plant at Hopewell, Va.

Mr. M. L. Davies, who has come to England for the marriage of his daughter with the son of Sir Max Muspratt, is the president of the Standard Chemical Co., Toronto, and a director of various other chemical concerns. A

Liverpool man by birth, and a technical chemist by training, Mr. Davies was articled to the old firm of James Muspratt & Sons, and in 1890 became manager of the firm's Liverpool works, which was taken over by the United Alkali Co. in 1891; three years later he



Mr. M. L. Davies

was made manager of the Hutchison Works of the United Alkali Co. In 1899 he went to America as the general manager of the North American Chemical Co., and in 1913 he moved to Toronto to join the Standard Chemical Co., successively becoming vice-president in 1913 and president in 1924.

Honorary Degree for Sir Charles Parsons

In presenting The Hon. Sir Charles Algernon Parsons, O.M., K.C.B., F.R.S., to the Chancellor of the University of Leeds for the honorary degree of LL.D., Prof. J. W. Cobb said: "To bring the methods and results of scientific investigation into the service of the community through industrial application is one of the chief ends which this University has set before it, and no name could represent with greater distinction the attainment of that ambition in full measure than that of Sir Charles Parsons. He has been fortunate in seeing one child of his brain reach full and imposing stature in his own time, as he has watched the steam turbine take unquestioned first place among the prime movers known to engineering science, serving to open up the way to a much more general and efficient utilisation of mechanical and electrical power. Grasp of scientific principles and insight into their consequences, along with a rare capacity for right choice in experiment and design, have been the mark of this and other achievements of his genius, and they have been combined with a breadth of outlook which has increased their value and widened the sphere of his usefulness. His active interest in the British Association has displayed itself in many ways, including generous financial support, and he has filled the presidential chair. Other societies have benefited by his

guidance in the same high office, and he has controlled large industrial enterprises, including one for optical work which links to Lord Rosse and continues a family tradition. University education in Newcastle has found in him a warm supporter. In the spirit of adventure, he has summoned the forces of crystallisation to the making of diamonds, and contemplated breaking the earth's crust for the harnessing of the vagrant energies of the underworld. Recognition has been forthcoming of his many scientific and public services in the Honorary Fellowship of his College at Cambridge, the Fellowship of the Royal Society, the Knight Commandership of the Bath, and in the membership of the Order of Merit, into which distinguished company he enters as the first engineer. It was to Leeds that he came for works training in early years, to Yorkshire for his wife. To Leeds again we welcome him, and do him what honour we may."

Corrosion of Copper Pipes

The cause of the failure, by local corrosion, of tin-lined copper water pipes is explained by Messrs. A. F. Dufton and F. L. Brady in a note recently published in *Nature*. The potential difference between copper and tin is about + 0.4 volt, but when the tin becomes tarnished the potential difference in water is - 0.1 volt. Accordingly, if the coating develops defects it becomes actually pernicious.

Scottish Shale-Oil Industry

It is officially announced that the Broxburn (Linlithgowshire) Refinery & Crude Oil Works is to be permanently closed down, thus making the fourth shale-oil works to be closed down within the last two years. The works employed 1000 men.

Sesamum Crop of British India, 1927-28

From information based on reports received from provinces and states which comprise about 79% of the total sesamum acreage in India, the total area, so far reported, comes to 2,203,000 acres, as compared with 1,976,000 acres at this time last year, or 11% increase. Weather at sowing time was favourable, and the condition of the crop at present is, on the whole, fair.

New Use for *o*-Dichlorobenzene

Work of the U.S. Bureau of Chemistry (Colour Laboratory) has shown that commercial *o*-dichlorobenzene, which dissolves the oxides of aluminum, copper, nickel and silver, but does not attack the metals themselves, makes a very good cleanser for metals.

U.S. Bureau of Chemistry and Soils

Dr. H. G. Knight, dean of the College of Agriculture of the University of W. Virginia, has been appointed chief of the new U.S. Bureau of Chemistry and Soils, which combines the work of the old Bureau of Chemistry, the Bureau of Soils, and the Fixed Nitrogen Research Laboratory. Each group retains its identity, but works in close co-operation with the others. Dr. F. G. Cottrell, chief of the Fixed Nitrogen Research Laboratory, retains his post, as does Dr. C. A. Browne, chief of the old Bureau of Chemistry, whilst Dr. A. G. McCall has been appointed head of the Soils work.

The I.-G. Synthetic Fuel

We learn that the application of the I.-G. for reduced rail rates on "synthetic petrol" has been granted by

the German railway authorities (cf. CHEM. AND IND., Sept. 16, p. 833). Request for reduced rail rates was made, it is stated, because the higher rail tariff made it impossible to sell the "synthetic petrol" at a profit in Germany. *The Times* reports that the "synthetic petrol," also known as "Lenna petrol," will probably be placed on the market early next year.

Nitrogen Fixation in Japan

According to the U.S. Department of Commerce the Japanese Government has been unable, for fiscal reasons, to utilise the patents for nitrogen fixation acquired by it from Germany under the Reparations Scheme, and has, therefore, decided to allow these patents to be used by private companies on condition that the operating plants be completed within the next ten years. Last year the Oriental Nitrogen Association was formed comprising the Mitsui, Mitsubishi, Sumitomo, Furukawa and Sankyo interests, which received the patents. The Fertilizer Investigation Commission claims, however, that the association has not fulfilled its agreement in that it has made no preparation to utilise the patents, but is instead attempting to control the import of nitrogenous fertilisers from Germany, thereby defeating the primary object of the Government, which is to provide cheap fertilisers for Japanese agriculture.

At the time when the Oriental Nitrogen Association (apparently also known as the "Oriental Nitrogenous Fertiliser Co.") was formed, it was reported that the company was to use a synthetic ammonia process due to the Japanese Nitrogen Laboratory.

Nitrogen fixation in Japan really began in 1909 when the Nippon Chisso Hiryo K. K. began to make calcium nitrate. During the war, the company expanded greatly, increasing its capital to 22 million yen. Subsequently, rights to the Casale process were obtained, and three Casale plants were erected, with an annual capacity of 80,000 tons ammonium sulphate. Two plants are now being enlarged to give a capacity of 100,000 tons, and the total output will eventually be raised to 300,000 tons to eliminate imports. Another company has a total capacity (rarely attained) of 84,000 tons of ammonium sulphate, whilst the Kagoshima Electric Co. is developing a process. The total output of nitrogenous fertiliser made by nitrogen fixation in 1926 is estimated at 150,000 tons, against 129,043 tons in 1925 and 102,544 tons. The contribution from the coke and gas industries amounts to about 100,000 tons of ammonium sulphate yearly.

The Japanese output of ammonia amounts to, roughly, 400,000 lb. a year. The two plants responsible for this production are being enlarged, however, and the capacity, it is estimated, will shortly reach 1,000,000 lb. annually. Some 96,000 lb. of anhydrous ammonia was imported in 1925, but it is considered that domestic producers will shortly be able to fill all requirements. Ammonia is used in Japan mainly as a refrigerant, a use which is steadily increasing.

Synthetic Methanol in Japan

It is reported that the Japanese Nitrogen Laboratory (controlled by the Minister of Commerce and Industry) has developed a new process for the synthesis of methanol

from carbon and hydrogen at high temperatures and pressures. Working rights have been conceded to the Mitsui Bussan Kaisha, the Japan Oil Co., and the Japan Acetic Acid Co.

Synthetic Ammonia in Norway

The Norsk Hydro-Elektrisk Kvaestof A. is to build a new synthetic ammonia plant at Notodden, and will use a process stated to resemble that of Haber. This company formerly made ammonium nitrate at Notodden, but suspended manufacture some years ago. Production is expected to begin in 1928.

Beet Sugar in Poland

Although the area of sugar beet plantations in 1926 reached 184,000 hectares, compared with an average of 172,991 hectares for the last three years before the war, the output in white sugar will probably reach only 490,000 tons, against 521,206 tons in 1925, when only 173,000 hectares were under sugar beet, owing to heavy rain. The average percentage of sugar contained in the beet amounted in October to 17.63, against 17.38 during the same period of 1925.

Russian Chemical Syndicate

A Russian Chemical Syndicate is to be formed with a capital of 11,500,000 roubles to organise the sale of chemicals and prevent harmful competition between the different Russian chemical trusts.

Iodine Production in Russia

Iodine is now being recovered from the waste waters from boreholes at Baku at a cost of 60 to 70 roubles per kg., and developments are contemplated which would bring the price down to 20-22 roubles. It is estimated that some 400 tons of iodine are lost annually in the Baku basin.

Chilean Copper Industry in 1926

The decrease in exports of copper ores from Chile may be accounted for by the partial exhaustion of many small mines in the district of Atacama, which are worked by local companies using antiquated methods. Exports of refined copper from Chuquibambilla, where the plant of an American company is in operation, fell off 4600 tons from the 1925 figure, owing chiefly to world market conditions. The capacity of this plant is larger than the 1926 production of 96,614 tons, and with the installation of new crushing mills, an increase of 35% in production will be possible, and the company hopes to reach the 150,000-ton mark by the end of 1927. The average content of ore handled is below 2%, and the whole plant is situated over 100 miles inland in the midst of a desert, at an altitude of 9500 ft. above sea-level. Construction work at the other mine at Potrerillos is about completed, and the rate of production is estimated at 118 tons of blister copper, about 95% pure, per day. During 1926 the United States was again the largest consumer of Chilean refined copper, taking 59,561 tons out of the 96,614 tons produced in the district. Germany was the second largest consumer. In this district all the known high-grade deposits are nearly exhausted, and the low-grade ores remaining must be worked by concerns having large capital resources to provide the machinery necessary for profitable returns.

REVIEWS

VAN NOSTRAND'S CHEMICAL ANNUAL. A handbook of useful data for analytical, manufacturing, and investigating chemists, chemical engineers, and students. Edited by Dr. J. C. Olsen, assisted by Dr. T. R. Le Compté. Pp. xv + 882. Sixth issue, 1926. Thoroughly revised and enlarged. London: Chapman & Hall, Ltd., 1927. Price 21s.

This is a most valuable collection of what the title page calls "Useful data" for chemists. It consists almost entirely of tables of numerical data. These have been, wherever possible, compiled from the original sources, and as far as I have been able to test them, the work shows a very high degree of accuracy. A mere enumeration of the tables (there are 230 of them, besides matter of another kind) would occupy more space than is allotted to this review; but they cover data of almost every kind that the analyst or the technical chemist can need. The arrangement of the tables in the book is not severely logical or consecutive, but this defect, if defect it be, is compensated for by an excellent and full index. There is a very full and useful table of gravimetric factors and their logarithms, in which figures are given for each relationship in both directions, for example, BaSO_4 to S and S to BaSO_4 . There are tables of properties of long lists of elements and their inorganic (about 4800) and organic (about 5200) compounds, specific gravity tables, ionisation tables, vapour pressures, heats of formation and combustion, constants of oils, fats, waxes, gums, etc.; and there is a general discussion at the end of the book of certain questions—weight and mass, specific gravity, thermometers, gas volume calculations, etc., with a number of illustrative "problems."

Misprints are few, and Americanisms are few. One must regret that in a book of this standing *data* should be regarded as a singular noun; and one may reasonably cavil at the term "coefficient of expansion at constant volume," and the use, in a scientific book, of the word "heavy" for "dense." But these are slight blemishes. Errors in the text that I have noticed are the misspelling of "phosphorus" on p. 94, the need to lift the formula CO_2 by a line on p. 733, the accidental writing of millimeter instead of milliliter on p. 767, the use of p twice in treating the pycnometer on p. 772—the second p is probably meant to be p' —and the spelling of Nicholson with a k on p. 773. Paragraph (9) on p. 772 is only true if the "body" there spoken of has no coefficient of expansion, and the statement on p. 781 that 1 c.c. of uranium has a volume of 0.0535 c.c. is obviously wrong: the typography needs altering and the words "1 gram" need to be inserted before "has a volume."

The only other regret I would express, and it implies no reproach to the book, is that it should be necessary, in a book like this, to devote about 50 pages to tables which have no *raison d'être* except the perversity of the world in refusing to adopt universally the metric system and to use direct-reading hydrometers.

The book is well and clearly printed on good paper, well bound, with the corners of the pages rounded, and is very easy of reference. It can be unhesitatingly recommended to all chemists.

J. T. DUNN

Gmelin's Handbuch der Anorganischen Chemie. Eighth completely new and revised edition. Published by the Deutsche Chemischen Gesellschaft. Edited by R. J. Meyer and collaborators. System-Nummer, 20. Lithium. Pp. xxiv + 254. Berlin: Verlag Chemie G.m.b.H., 1927. Price 37.50 m. (Subscription price, 28.50 m.)

The section on lithium in the seventh edition contained 43 pages, whereas the present volume contains 254. This enormous expansion is partly due to the large amount of work on lithium published during the past 20 years, and partly to a fuller and more comprehensive treatment of the subject.

Every paper dealing with lithium, either directly or indirectly, seems to have been discovered by the compilers of the work, who have been careful to extract, either fully or in abstract, important numerical data on solubilities and other physical properties, a number of solubility and other diagrams being also reproduced.

The work should be invaluable to all who are particularly interested in lithium compounds, but essentially as a work of reference. It contains only a few pages, and those mostly near the beginning, which could be read with any degree of pleasure, but this is inevitable in a work of this character. It is essentially a dictionary, and an uncritical one. Its arrangement is satisfactory, it is well produced, and not so condensed or full of abbreviations as to be unintelligible. H. BASSETT

L'Alcool d'Industrie. By A. RICHARD. Les Automobiles sans Pétrole. Encyclopédie Leauté (2nd series). Pp. xi + 222. Paris: Gauthier Villars & Cie, 1927. Price 18 fr.

This book may be recommended with confidence to those seeking for information relating to the alcohol industry, and particularly to the position of that industry in France. In a small space many useful data are given, and in many cases full details concerning processes for the production of ethyl alcohol by chemical and biological means from sugar-containing substances such as beetroot, from cereals, and from cellulosic materials such as waste wood for use in internal-combustion engines. Account is taken of all by-products and suggestions made for their possible use. The difficulties connected with each method are pointed out, and the author states his opinion as to its commercial prospects. Reference is made in each instance to any research which has been carried out. The most recent development in the alcohol industry, namely the commercial production of absolute alcohol, is studied in detail. This is an important contribution, owing to the fact that absolute alcohol is miscible in all proportions with petrol.

The value of this book would have been greatly enhanced by the addition of an index. If space did not permit of this, a list of the processes mentioned in alphabetical order would have helped to supply the want. Such a deficiency in any scientific work is bound to limit the sphere of its usefulness.

The author is to be congratulated on his easy style of French, for which his English readers will be duly grateful.

E. C. CHOLMELEY

COMPANY NEWS

BURT, BOULTON & HAYWOOD, LTD.

A final dividend of 5% has been declared on the ordinary shares, making, with the interim of 5% already paid, 10% for the year, being the same as for the previous year. We regret that the declaration of dividend was announced in last week's CHEMISTRY AND INDUSTRY in a form which gave a misleading impression.

BRITISH GLUES AND CHEMICALS, LTD.

The seventh ordinary general meeting was held on September 11. Mr. T. Walton, chairman, presiding. After briefly reviewing the accounts (cf. CHEM. AND IND. Sept. 9, p. 816), the chairman stated that the losses in connexion with the coal strike had been aggravated by heavy falls in the selling prices of fats and greases, but minimised by the reduced cost of raw material. The prices of fertilisers were slightly lower: glue prices were a little higher, but were still at an unsatisfactory level. The question of heavy transport charges had been considered, and in this connexion the company had purchased the Newport factory in July, 1926, and also the Bermondsey factory of Messrs. B. Young and Co., Ltd., the latter bringing a valuable hide glue connexion. The company intended to remodel the Bermondsey factory so as to deal with some portion at least of the London raw material on the most efficient lines in the London area. This would result in considerable economy in transport charges. In the near future a scheme would be put forward for reduction of capital. Reference was made to the retirement of Mr. William Cotes from the Board.

BRITISH INSULATED CABLES, LTD.

On September 15 a board meeting was held at which Mr. Dane Sinclair was elected chairman of the company in place of the late Mr. James Taylor, J.P. (in addition to being managing director). Mr. Sinclair has been associated with the company for a long period, having been elected general manager in 1902 of the British Insulated and Helsby Cables. An interim dividend has been announced of 1s. per share, less tax, on the ordinary shares, being the same as last year's interim.

SWEDISH MATCH CO., LTD.

A new company called "The Great Amalgamated Match Co." has been formed in Japan with a share capital of 6,000,000 yen (about £600,000), to take over all the factories belonging to the Tokio Match Co., the biggest company in Japan and the chief competitor of the Swedish company there. The Nippon Match Co. and the Koyekisha Match Co., both owned by the Swedish company, will also be taken over. The Amalgamated Co. will control between 60% and 70% of the Japanese match production.

MALEHURST BARYTES CO., LTD.

The Malehurst Barytes Company has taken over the management of the old-established business of the Devonshire Baryta Co., Ltd., of Exeter and Bridford. It is proposed to re-equip the mine and develop its resources. The continued supply of the grades of barytes for which this company has been well known for the past 50 years will thus be assured and improved grades of Devonshire barytes will be placed on the market at an early date.

HARBEN'S (VISCOSE SILK MANUFACTURERS), LTD.

Trading profit for the year ended April 30, 1927, amounted to £9774, after transferring expenditure of £37,571 to experimental and development account. Debenture interest from January 1 to April 30 absorbed £2627, leaving £7147, which is carried forward. Trading commenced on the basis of a normal production about the end of 1926, so that the profit of £7147 was made over a period of about four months, during which time part of the labour employed was not fully trained. Rather more than 9 tons of artificial silk yarn is being manufactured every week, and practically the whole of the output has been sold for the remainder of this year, and large contracts have been taken for next year. Additional plant and machinery to increase the output to 18 tons per week is in course of delivery.

ROSARIO NITRATE CO., LTD.

The thirty-eighth annual general meeting, held on June 24, was presided over by the chairman, the Rt. Hon. Lord Cullen of Ashbourne, K.B.E., who referred to the death of Mr. H. W. Sillem. For reasons of economy it was not proposed to fill his place on the Board at present. After meeting interest and other charges and deducting £21,692 for amortisation and depreciation, £28,982 for repairs and renewals, and £22,183 for closing down and stoppage expenses, there was a loss of £50,534 for 1926, against a net profit of £37,592 for 1925. Deducting the credit balance of £30,458 brought forward, a debit balance of £20,076 remained to be carried forward. During the year, £29,000 had been spent on repairs and renewals to the Rosario maquina, and an expenditure of £22,000 had been entailed partly by the enforced restriction of production under the producers' agreement, which terminated on June 30. The ultimate effect of the breakdown of this agreement would be to the advantage of the industry. With the removal of the fixed selling price, Chilean nitrate would be able to contend with its competitors for a larger share of the world's consumption, but only at prices which would leave a narrow margin of profit to the cheapest producers and would prevent many of the less-favoured Chilean oficinas from producing at all. Faced with these facts, the Board decided to reopen on July 1 the Rosario oficina, which had been closed throughout the year. The Chilean Government had decided not to reduce the export duty at any rate before July 1, 1928. The company had spared neither effort nor expense to cheapen their cost of production in bringing both their oficinas into the highest state of efficiency. Operations by the Guggenheim process had now been commenced on a large scale, but the actual costs of this process had still to be proved.

DOMINION TAR AND CHEMICAL CO., LTD.

After placing £35,000 to depreciation and writing off the balance of the underwriting commission by transferring £7500 to ordinary share premium account and £500 to profit and loss account, the net profit was £86,640 (£49,698 for 1925). A final dividend has been proposed on the ordinary shares (excluding the new issue) of 6½%, less tax, making 12% subject to British tax less Dominion relief, and a bonus of 2½%, and after transferring £20,000 to general reserve, £9140 will be carried forward.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.b. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—3.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9—£9 5s. per ton. Good demand.
 Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£8—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals, 8d.—8½d. per lb. Crude 60's, 2s. 6d.—2s. 7d. per gal.
 Acid Cresylic, 99/100.—2s. 9d.—2s. 10d. per gal. 97/99.—2s. 4d.—2s. 5d. per gal. Pale, 95%, 2s. 2d.—2s. 3d. per gal. Dark, 90%, 1s. 9d.—1s. 10d.; 95%, 2s. 1d.—2s. 2d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9¾d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 7d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 4d.—1s. 9d. per gal. Pure, 1s. 6d.—2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 2s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8½d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7¾d. per gal. ex works. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 8½d.—9½d. per gal. Solvent 95/160, 1s. 4d.—1s. 5d. per gal. Solvent 90/190, 8½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals, £11 10s.—£12 per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—87s. 6d.—95s. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.
o-Cresol 29/31° C.—5½d. per lb.
m-Cresol 98/100%.—2s. 7½d. per lb.
p-Cresol 32/34° C.—2s. 8½d. per lb.
Dichloraniline.—2s. 3d. per lb.
Dimethylaniline.—1s. 11d. per lb.
Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
Dinitrochlorbenzene.—£84 per ton d/d.
Dinitrotoluene.—48.50° C. 8d. per lb., naked at works.
Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
Diphenylamine.—2s. 10d. per lb. d/d.
 α -Naphthol.—2s. per lb. d/d.
 β -Naphthol.—11d.—1s. per lb. d/d.
 α -Naphthylamine.—1s. 3d. per lb.
 β -Naphthylamine.—3s. per lb.
p-Nitraniline.—1s. 8d. per lb.
m-Nitraniline.—3s. per lb. d/d.
o-Nitraniline.—5s. 9d. per lb.
Nitrobenzene.—6d. per lb., naked at works.
Nitronaphthalene.—1s. 3d. per lb.
R. Salt.—2s. 2d. per lb.
Sodium Naphthionate.—1s. 8½d. per lb. 100% d/d.
o-Toluidine.—7½d. per lb.
p-Toluidine.—2s. 2d. per lb., ex works, naked.
m-Xylidine Acetate.—2s. 6d. per lb. 100%.
N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.
Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.
Acid, Boric B.P.—Cryst. 10s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.
Acid, Camphoric.—19s.—21s. per lb.
Acid, Citric.—1s. 7d.—1s. 8d. per lb. Less 5%.
Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 3½d. per lb. Technical 11½d.—1s. per lb. Good demand.
Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
Amidol.—9s. per lb. d/d.
Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.
Amidopyrin.—8s. 6d. per lb.
Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5 cwt. casks. Resublimed.—1s. per lb.
Atropine Sulphate.—11s. per oz. for English make.
Barbitone.—6s. per lb.
Benzonaphthol.—3s. 3d. per lb.
Bismuth Carbonate.—9s. 9d.—9s. 10d. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.
Bromides.—Ammonium.—2s. 2d.—2s. 3d. per lb. Potassium. 1s. 9½d.—1s. 10½d. per lb. Sodium.—2s.—2s. 1d. per lb. Granulated ½d. per lb. less. All spot.

Calcium Lactate.—1s. 2d.—1s. 3½d. per lb.
Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
Chloral Hydrate.—3s. 6d. per lb., duty paid.
Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
Cresote Carbonate.—6s. per lb.
Ethers: Prices for Winchester quarts; dozen Winchester quarts; carboys or drums; and 10 cwt. lots respectively; 730—1s. 2½d.; 1s. 2d.; 1s. 1½d.; 1s. 0½d.; 720 tech.—1s. 5½d.; 1s. 5d.; 1s. 4½d.; 1s. 3½d.; 720 pur. (Aether P B 1914)—2s. 4d.; 2s. 3½d.; 2s. 3d.; 2s. 2d.
Formaldehyde.—£39 per ton. Ex wharf in barrels.
Guaiacol Carbonate.—5s. per lb.
Hexamine.—2s. 4d.—2s. 6d. per lb.
Homatropine Hydrobromide.—30s. per oz.
Hydrastine Hydrochlor.—English make offered, 120s. per oz.
Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols. 2s. 3d. per gal. In carboys; Winchesters, 2s. 11d.—3s. 9d. per gal.; 20 vols., 4s. 3d. per gal.; Winchesters, 5s.—6s. 6d. per gal. Special prices for larger quantities.
Hydroquinone.—2s. 11d. per lb.
Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
Iron Ammon. Citrate.—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
Iron Perchloride.—19s.—22s. per cwt., according to quantity.
Magnesium Carbonate.—Light Commercial £31 per ton net.
Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
Menthol.—A.B.R. recryst., B.P., 17s. 9d. per lb. not. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 10d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
Methyl Salicylate.—1s. 9d. per lb.
Methyl Sulphonol.—9s. 6d.—9s. 9d. per lb.
Metol.—11s. per lb. British make.
Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
Paraldehyde.—1s. 4d. per lb.
Phenacetin.—2s. 9d.—3s. per lb.
Phenazone.—4s. 3d.—4s. 6d. per lb.
Phenolphthalein.—6s.—6s. 3d. per lb.
Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2½%.
Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
Potass. Permanganate.—6d. per lb. spot.
Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.
Resorcin.—3s. 9d.—4s. per lb. spot.
Saccharin.—55s. per lb., and lower in quantity.
Salol.—2s. 4d. per lb.
Sod. Benzoate, B.P.—1s. 10d.—2s. 2d. per lb.
Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—18s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.-95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 8d.—1s. 9d. per lb. (Crystal, 1s. 8½d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.)

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.

Sulphonol.—6s. 6d.—6s. 9d. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.

Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.

Aubepine (*ex Anethole*).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. **Amyl Butyrate.**—5s. 3d. per lb. **Amyl Salicylate.**—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. **Benzyl Alcohol** free from Chlorine.—2s. per lb.

Benzaldehyde free from Chlorine.—2s. 6d. per lb. **Benzyl Benzoate.**—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 16s. 3d. per lb.

Coumarin.—9s. 9d. per lb.

Citronellol.—13s. 9d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—6s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—8s. per lb. **Geraniol** (Palmarosa).—18s. 6d. per lb. **Geraniol.**—6s. 6d.—10s. per lb. **Heliotropine.**—4s. 9d. per lb. **Iso Eugenol.**—13s. 6d. per lb. **Linalol.**—(ex *Bons de Rose*) 15s. per lb.—(ex *Shui Oil*) 10s. 6d. per lb.

Linalyl Acetate. (ex *Bois de Rose*) 18s. 6d. per lb.—(ex *Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodmol.—32s. 6d. per lb. **Safrol.**—1s. 6d. per lb. **Terpincol.**—1s. 8d. per lb. **Vanillin.**—17s. 9d. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. **Anise.**—3s. per lb. **Bergamot.**—28s. per lb. **Bourbon Geranium.**—14s. 6d. per lb.

Cumpher.—75s. per cwt. **Cananga, Java,** 26s. per lb. **Caesin, 80/85%.**—7s. 6d. per lb. **Cinnamon, Leaf.**—6d. per oz. **Citronella.**—Java, 1s. 10d. per lb., c.i.f. U.K. port. For shipment over 1928, 1s. 6d. prompt shipment from Java. **Ceylon, Pure,** 1s. 8d. per lb.

Clove, pure.—5s. 6d. per lb.

Eucalyptus.—2s. 3d. per lb. **Lavender.**—Mont Blanc 38/40%, 18s. 9d. per lb. **Lemon.**—8s. per lb. **Lemon-grass.**—4s. 6d. per lb. **Orange, Sweet.**—11s. 3d. per lb.

Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 75s. per oz. **Palma Rosa.**—10s. 6d. per lb. **Peppermint.**—Wayne County, 16s. 9d. per lb. **Japanese,** 8s. 3d. per lb.

Petitgrain.—7s. 9d. per lb. **Sandalwood.**—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Nov. 15th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Sept. 29th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Akt. Svenska Maskinverken, and Eriksson. Evaporating apparatus. 23,364. Sept. 6.

Banz. Apparatus for heating fluids. 23,462. Sept. 6. (Holland, 22.6.27.)

British Rotary Filter Co., Ltd., and Joyce. Filters. 23,598. Sept. 8.

Donthitt. Desiccation of substances. 23,621. Sept. 8. Etabl. F. Labesse. Brickwork exposed to high temperatures. 23,836. Sept. 10. (Fr., 10.2.27.)

Gensbaur. Rotary tube kilns. 23,609. Sept. 8. (Czechoslovakia, 20.6.27.)

Hills. Drying-machines etc. 23,490. Sept. 7.

Internat. Cement Gun Co. Delivering and drying granular substances. 23,661. Sept. 8. (Ger., 14.9.26.)

Johnson (I.-G. Farbenind.). Manufacture of aqueous solutions of solvents etc. 23,400. Sept. 6. Measuring intensity of radiation of sources of ultra-violet light. 23,631. Sept. 8.

King, Tandevim, & Gregson, Ltd. Furnaces. 23,545. Sept. 7.

Lloyd. Apparatus for mixing liquids. 23,481. Sept. 7.

Lurgi-Ges. für Wärmetechnik. Utilising and producing adsorption media. 23,802. Sept. 9. (Ger., 11.11.26.)

MacCallum. Grinding, mixing, etc. mills. 23,269-72 and 23,274-5. Sept. 5.

MacCallum and Smith. Grinding-mills. 23,542. Sept. 7.

Musgrave & Co., Ltd., and Shillington. Apparatus for separating solids from gases. 23,642. Sept. 8.

Nelson. Furnaces. 23,545. Sept. 7.

Parker, Winder, & Church, Ltd., and Smith. Mixing-machines. 23,484. Sept. 7.

Prodorite, Ltd., and Fender. Acid-proof vessels. 23,287. Sept. 5.

Wilson. Instrument for detection of mineral deposits. 23,708. Sept. 9.

I. Complete Specifications

13,644-5 (1926). Whatmough. Dispersion of solids in liquids. (276,728.)

18,762 (1926). Lambert, and Lambert Heater & Engineering Co., Ltd. Heating of liquids. (276,807.)

20,514 (1926). Smith (Chattfield). Filtering-machines. (276,820.)

20,883 (1926). Rennerfelt. See XI.

9890 (1927). I.-G. Farbenind. Transforming substances into small pieces for reaction with gases. (269,209.)

*11,518-9 (1927). Jung. Blowing molten substances in the form of spray. (276,955-6.)

*22,333 (1927). Soc. Ital. Pirelli. Degassing liquids. (276,987.)

*23,189 (1927). Siemens & Halske A.-G. Determining a constituent in a mixture of gases. (277,025.)

II.—Applications

Arnold (Standard Development Co.). Distilling hydrocarbons. 23,624. Sept. 8.

Avenarius. Motor fuel. 23,381. Sept. 6. (Ger., 7.9.26.)

Bloxam (Allgem. Ges. für Chem. Ind.). Manufacture of petroleum hydrocarbons. 23,770. Sept. 9.

Coley. Extraction of oil from shale. 23,517. Sept. 7.

Denby. Washing-apparatus for coal etc. 23,485. Sept. 7.

Gill (Gasoline Products Co.). Conversion of hydrocarbons. 23,319. Sept. 5.

Internat. Combustion Engineering Corp. 23,417. See III.

Johnson (I.-G. Farbenind.). Recovery of oils of high b.p. 23,256. Sept. 5. Purification of gases. 23,257. Sept. 5.

Manufacture of products from montan wax. 23,258. Sept. 5.

Drying, carbonisation, etc. of coals. 23,259. Sept. 5. Separation of olefines etc. 23,628. Sept. 8. Production of butadiene hydrocarbons. 23,629-30 and 28,843. Sept. 8 and 10. Production of high viscosity oils. 23,632. Sept. 8.

Kirschner. Production of mixtures of mineral oil products and aliphatic alcohols. 23,715. Sept. 9. (Ger., 9.9.26.)

Masters and Masters. Vertical slot ovens etc. 23,242. Sept. 5. Regenerator gas-retort settings. 23,747. Sept. 9.

Munn. Composition fuel. 23,404 and 23,769. Sept. 6 and 9. National Processes, Ltd., and Lambert. Manufacture of catalysts for oxidation of gases. 23,386. Sept. 6.

Technical Research Works, Ltd., and Lush. 23,316. See XX. Urbana Coke Corp. Treating solid fuel. 23,680. Sept. 8. (U.S., 21,926.)

Wade (Standard Oil Co.) Coking hydrocarbon oils. 23,743. Sept. 9.

Zacon. Manufacture of hydrocarbons. 23,555. Sept. 7.

II.—Complete Specifications

5911 (1926). Penniman. Motor fuels. (257,886.)

6337 (1926). Niel en and Luing. Distillation of carbonaceous materials. (276,107.)

13,402 (1926). Lessing. Cleaning of carbonaceous materials. (276,723.)

14,080 (1926). Petroleum Chemical Corp. Composite motor spirit. (253,131.)

14,200 (1926). Humphreys & Glasgow, Ltd., and Stelfox. Manufacture of water-gas. (276,753.)

19,536 (1926). Red River Refining Co., Inc. Mineral oil distillation. (257,250.)

6818 (1927). Seelig. Process and apparatus for cracking oils. (269,499.)

21,203 (1927). Florentin, Kling, and Matignon. Obtaining light hydrocarbons from animal or vegetable oils. (276,007.)

*617 (1927). Kay. Apparatus for cracking oils. (276,947.)

*22,983 (1927). Wolinski. Treatment of coal. (277,011.)

III.—Application

Internat. Combustion Engineering Corp. Di-tillation of tar, oil, etc. 23,117. Sept. 6. (U.S., 21,926.)

IV.—Applications

Carpmael (I.-G. Farbenind.). Introducing sulphocyanide groups into organic compounds. 23,308. Sept. 5.

I. G. Farbenind. Manufacture of benzantrones etc. 23,529. Sept. 7. (Ger., 10,926.) Manufacture of anthraquinone derivatives. 23,771. Sept. 9. (Ger., 9,12,26.)

Imperial Chemical Industries, Ltd., Pope, and Wyler. Dyes etc. 23,658. Sept. 8.

Johnson (I.-G. Farbenind.). Manufacture of vat dyestuffs. 23,253. Sept. 5. Manufacture of dibenzanthrone. 23,399. Sept. 6. Production of aromatic amines. 23,841. Sept. 10.

IV.—Complete Specifications

11,551 (1926). Newport Co. Preparing 2 (or 3)-chloroquinizarine. (260,544.)

13,782 (1926). Bucherer. Manufacturing dyes. (252,745.)

15,515 (1926). British Dyestuffs Corp., Baddiley, Shepherdson, and Thornley. Manufacture of benzantrone derivatives. (276,766.)

15,516 (1926). British Dyestuffs Corp., Ltd., and Thornley. Black and grey vat dyestuffs. (276,767.)

15,609 (1926). British Dyestuffs Corp., Ltd., Baddiley, Shepherdson, and Thornley. Manufacture of vat dyes. (276,768.)

V.—Applications

Bleachers' Assoc., Ltd., Barrett, Gaunt, and Kershaw. 23,495-6. See VI.

Bonwill. Artificial textile products from viscose etc. 23,535-7. Sept. 7. (Holland, 11,2,27, 24,2,27, and 7,4,27.)

Carpmael and Carpmael (I.-G. Farbenind.). Manufacture of artificial silk. 23,457. Sept. 6.

Imray (I.-G. Farbenind.). Manufacture of acetyl-cellulose. 23,304. Sept. 5.

Johnson (I.-G. Farbenind.) 23,625. See VI.

Law. Treatment of bast plants etc. 23,589. Sept. 8.

Nederlandsche Kunstzijdefabr. Preparing artificial products from acetyl cellulose etc. 23,350. Sept. 6.

Holland, 11,2,27, 24,2,27, and 7,4,27.

V.—Complete Specifications

14,270 (1926). British Dyestuffs Corp., Ltd., Baddiley, Chorley, and Butler. See VI.

1792 (1927). Potts (Arnold Print Works). See VI.

8029 (1927). Rinman. Producing cellulose and paper from straw, esparto, etc. (269,154.)

18,167 (1927). Duhamel, and Comp. Gén. des Ind. Textiles. Cleaning wool. (274,100.)

VI.—Applications

Bleachers' Assoc., Ltd., Barrett, Gaunt, and Kershaw. Treatment of textiles. 23,495-6. Sept. 7.

Carpmael (I.-G. Farbenind.). Dyeing artificial silk. 23,458. Sept. 6.

Johnson (I.-G. Farbenind.). 23,524. See XII. Production of dyeings on cellulose esters. 23,625. Sept. 8. Manufacture of wetting-agents etc. 23,626. Sept. 8. Washing, dyeing, etc. textiles. 23,842. Sept. 10.

VI.—Complete Specifications

14,270 (1926). British Dyestuffs Corp., Ltd., Baddiley, Chorley, and Butler. Dyeing artificial silk. (276,757.)

1792 (1927). Potts (Arnold Print Works). Treatment of cellulosic materials. (276,877.)

6128 (1927). Charles. Apparatus for dyeing felt or other hats. (276,893.)

VII.—Applications

Carpmael (I. G. Farbenind.). Manufacture of aqueous solutions of carbon disulphide. 23,454. Sept. 6. Manufacture of alkali cyanides. 23,459. Sept. 6.

Carpmael, Carpmael, and Carpmael (I.-G. Farbenind.). Manufacture of new quaternary ammonium compounds. 23,549. Sept. 7.

Casman. Precipitating copper from its solutions. 23,622. Sept. 8.

Geere. Control of production of carbon dioxide. 23,749. Sept. 9.

Gelsenkirchener Bergwerks- A.-G., Dittmann, and Faerber. Production of manganese peroxide etc. 23,881. Sept. 10.

Johnson (I. G. Farbenind.) Production of nickel and cobalt carbonyl. 23,255. Sept. 5. Production of metal carbonyls. 23,260. Sept. 5. Treatment of materials with alkaline liquids. 23,398. Sept. 6.

Jungmann and Kolbert. Manufacture of solid alcoholic solution of free iodine. 23,552. Sept. 7. (Ger., 21,926.)

Klingspor. Liming process, and preparation of lime therefor. 23,746. Sept. 9.

National Processes, Ltd., and Lambert. 23,386. See II. Prodorite, Ltd., and Fender. 23,287. See I.

Robson. Preparation of sulphuric acid etc. 23,391. Sept. 6.

Siemens & Halske A.-G. Production of ozone. 23,650. Sept. 8. (Ger., 14,926.)

VII.—Complete Specifications

5908-10 (1926). Penniman. See XX.

869 (1927). Schendbauer & Giessing A.-G. See VIII.

7072 (1927). Krebs. Apparatus for electrolysing solutions of alkali chlorides. (267,560.)

8943 (1927). Metallbank u. Metallurgische Ges. A.-G. Treating lithium-containing silicates by means of neutral alkali salts. (269,878.)

*19,393 (1927). Rosenheim. Process for the production of base-exchanging substances. (276,967.)

*21,044 (1927). Büsching. Denitration of waste acid mixtures. (276,972.)

VIII.—Applications

Beton-Bohr u. Pressges. Manufacture of flower pots etc. 23,528. Sept. 7. (Ger., 10,12,26.)

VIII.—Complete Specifications

809 (1927). Scheidhauer & Giessing A.-G. Producing refractory, acidproof, and other products. (264,192.)

8454 (1927). Hartford-Empire Co. Producing a fired ceramic block. (276,903.)

*22,873 (1927). Barton. See X.

IX.—Applications

Etabl. F. Labesse. 23,836. See I.

Foulger, Fox, Stockell, and Fox, Stockell, & Co. Concrete blocks for paving etc. 23,762. Sept. 9.

Gensbaur. Manufacture of cement etc. 23,656. Sept. 8. (Austria, 20.7.27.)

Hubacek, Kneil, and Sticha. Manufacture of marble substitutes. 23,326. Sept. 5.

Kopelaviciene and Kopelavicius. Building materials. 23,470. Sept. 6.

X.—Applications

Ashcroft. Metallurgy of ores etc. 23,633. Sept. 8.

Gasman. 23,622. See VII.

Coley. Reduction of ores. 23,229-30. Sept. 5. Manufacture of zinc. 23,811. Sept. 10. Manufacture of tin. 23,812. Sept. 10.

Deutsche Gold- u. Silber-Scheideanstalt vorm. Roessler. Hardening iron etc. 23,282. Sept. 5. (Ger., 6.9.26.)

Elektronmetall Ges., and Wagner. Die-casting plant for magnesium etc. 23,520. Sept. 7.

Etchells. Case-hardening of alloy steels. 23,877. Sept. 10.

Hay. Ferrous alloys. 23,314. Sept. 5.

Hornsey. Reducing metal oxides. 23,311. Sept. 5. (U.S., 8.9.26.)

Johnson (I.-G. Farbenind.). Metallic ores for electro-magnets etc. 23,252. Sept. 5.

X.—Complete Specifications

11,265 (1926). Dunlop Rubber Co., Ltd., Lakeman, and Maccabe. Protection of metal surfaces. (276,705.)

14,005 (1926). Sulman and Picard. Treatment of tin ores. (276,743.)

109 (1927). Kamishima. Non-magnetic alloy of high resistance. (276,874.)

9514 (1927). Deutsche Versuchsanstalt für Luftfahrt. Manufacture of chemically-pure aluminium. (276,911.)

11,650 (1927). Eaton. See XI.

*22,788 (1927). Krupp Grusonwerk A.-G. Extraction of precious metals from ores, residues, and metallurgical products. (277,001.)

*22,873 (1927). Barton. Abrasive surfaces, and metals and alloys for their manufacture. (277,004.)

*23,035 (1927). Joseph. See XI.

*23,282 (1927). Deutsche Gold- u. Silber Scheideanstalt vorm. Roessler. Hardening iron and steel. (277,030.)

XI.—Applications

Ever Ready Co. (Great Britain), Ltd., and Koningsock. Electric batteries. 23,678. Sept. 8.

Johnson (I.-G. Farbenind.). 23,252. See X. 23,631. See I.

Marks (Batterien- u. Elemente-Fabr. System Zeiler A.-G.). High-tension etc. batteries. 22,533. Sept. 7.

Meyer and Spanner. Gas-filled discharge device. 23,804. Sept. 9. (Ger., 9.9.26.)

Müller. Ethylchloride tubes. 23,797. Sept. 9. (Ger., 28.6.27.)

Northrup. Electric furnaces. 23,672. Sept. 8.

Oldham & Son, Ltd., and Clarke. Galvanic batteries. 23,559. Sept. 7.

Siemens & Halske A.-G. 23,650. See VII. Induction furnaces. 23,647. Sept. 8. (Ger., 11.9.26.) High-frequency induction furnaces etc. 23,784. Sept. 9. (Ger., 11.9.26.)

XI.—Complete Specifications

20,883 (1926). Rennerfelt. Electric furnaces. (276,823.)

109 (1927). Kamishima. See X.

11,650 (1927). Eaton. Chromium-plating machines. (276,921.)

*22,330 (1927). Soc. Ital. Pirelli. Impregnating insulating materials. (276,985.)

*22,629 (1927). Gen. Electric Co., Ltd. Incandescence lamps. (276,992.)

*23,035 (1927). Joseph. Protection of the lead sheathing of cables. (277,017.)

XII.—Application

Johnson (I.-G. Farbenind.). Bleaching artificial fatty acids. 23,524. Sept. 7.

XIII.—Applications

British Thomson-Houston Co., Ltd., and Warren. Lacquers etc. 23,249. Sept. 5.

Imray (I.-G. Farbenind.). Manufacture of condensation products of the naphthostyryl series. 23,416. Sept. 6.

Johnson (I.-G. Farbenind.). Production of lacquer coatings. 23,254. Sept. 5. Manufacture of lacquers, films, etc. 23,397. Sept. 6.

MacCallum. Production of paints, pastes, etc. 23,276. Sept. 5.

XIV.—Applications

Goodyear Tire & Rubber Co. 23,440. See XX.

I.-G. Farbenind. Manufacture of coloured rubber goods. 23,305. Sept. 5. (Ger., 4.9.26.)

XIV.—Complete Specifications

11,265 (1926). Dunlop Rubber Co., Ltd., Lakeman, and Maccabe. See X.

*19,839 (1927). Du Pont de Nemours & Co. Age-resisting rubber compositions. (276,968.)

*23,305 (1927). I.-G. Farbenind. Manufacture of coloured rubber. (277,034.)

XV.—Applications

Klingspor. 23,746. See VII.

Maschinenfabr. Turner A.-G. Treating hides, skins, etc. 23,616. Sept. 8. (Ger., 11.9.26.)

XV.—Complete Specifications

9633 (1927). Röhm & Haas A.-G. Tanning with metallic salts and salts of silicic acid. (270,267.)

XVI.—Application

Martin. Fertiliser. 23,718. Sept. 9.

XVII.—Application

Gardner (Schneider et Cie. and Akc. Spolecnost drive Skodov Závody v. Plzni). Crystallisation mixer for treating masscinites in sugar works etc. 23,681. Sept. 8.

XIX.—Applications

Bell and Bilton. Manufacture of animal foods. 23,494. Sept. 7.

Brown. Preserving fish. 23,780. Sept. 9.

Carpmael (I.-G. Farbenind.). Protecting corn in storage from vermin. 23,455. Sept. 6.

Salerni. Manufacture of chocolate articles etc. 23,317. Sept. 5.

XIX.—Complete Specification

26,862 (1926). McKinlay. Manufacture of chocolate etc. (276,860.)

XX.—Applications

Carpmael (I.-G. Farbenind.). 23,308. See IV. Manufacture of acetic anhydride. 23,456. Sept. 6. Manufacture of basic oxime ethers etc. 23,787. Sept. 9.

Goodyear Tire and Rubber Co. Preparing dithiazyl disulphide. 23,440. Sept. 6. (U.S., 7.9.26.)

I.-G. Farbenind. Supports for sheets of material soluble in organic solvents. 23,641. Sept. 8. (Ger., 16.10.26.)

Johnson (I.-G. Farbenind.). 23,400. See I. 23,628-30. See II. 23,841. See IV. 28,843. See II.

Jungmann and Kolbert. 23,552. See VII.

Kirschner. 23,715. See II.

Müller. 23,797. See XI.

Technical Research Works, Ltd., and Lush. Apparatus for hydrogenation of organic compounds etc. 23,316. Sept. 5.

XX.—Complete Specifications

5908-10 (1926). Penniman. Oxidised products, cesses of making same, and apparatus therefor. (252,255,920, 256,922.)

15,641 (1926). Cassella & Co. Ge. Manufacture of solutions containing organic phosphorus and complex old compounds. (253,916.)

*22,706 (1927). Chem. Fabr. auf Actien (vorm. E. Schering). Preparation of active germinal gland substances in a water soluble form. (276,994.)

*22,870 (1927). Soc. Chem. Ind., in Basle. Use of medicaments insoluble or sparingly soluble in water. (277,003.)

XXI.—Applications

Dufay. Colour photography etc. 23,557. Sept. 7. Hamburger. Photographic films etc. 23,872. Sept. 10.

Mills. Production of cinematographic colour pictures. 23,396. Sept. 6.

Sokal (Kalle & Co.). Apparatus for photographic development. 23,324. Sept. 5.

XXII.—Complete Specifications

11,717 (1926). Scott and Mexico, Ltd. Explosives. (276,715.)

*21,044 (1927). Busehning. *See* VII.

XXIII.—Application

Pattison. Apparatus for purifying etc. fluids in boilers etc. 23,660. Sept. 8.

XXIII.—Complete Specifications

16,625 (1927). Warburg. Artificially preparing natural mineral waters. (274,834.)

*19,393 (1927). Rosenbaum. *See* VII.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Development and Intelligence, 35, Old Queen Street, London, S.W.1 has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number.

Argentina: Leather belting (232). *Australia*: Steel buckets for dredge (A.X.5193). *Brazil*: Drugs, perfumes (233). *British India*: Paper, stationery (211). *Canada*: Raw materials for the rubber, paint and kindred industries (216). Paint, paper, varnish (217). *Chile*: Steel rails (A.X.5194). Corrugated iron sheets, concrete (A.X.5198). *Colombia*: Mining and road-making plant, steel ropes (236). *Czechoslovakia*: Brass tubes, aluminium, raw copper (222). *France*: Raw and finished metal products (221). *Hungary*: Mica, mica-nite, synthetic resin, varnished cloth, ebomite (227). *South Africa*: Leather (218).

Information on Nickel

A Bureau of Information on Nickel has recently been established in Leadenhall Avenue, London, with the object of collecting and correlating technical and other information relating to the uses of nickel and nickel alloys, and to place such knowledge freely at the disposal of British industry.

Gasworks Plant

The Kidderminster Gas Co. has placed an order with the Woodhall Duckham Vertical Retort and Oven Construction Company (1920), Ltd., for an installation of continuously working vertical retorts, consisting of ten 62-in. retorts, capable of carbonising 56 tons of coal per 24 hrs. The setting will be arranged in a

steel-framed brick-panelled retort house, and is to be complete with coal handling plant, coke screening and storage plant, and waste heat boiler.

News from Advertisements

A highly-trained chemist requires a junior partnership in a chemical concern (p. vi).

The Northampton Polytechnic Institute announces particulars of its evening courses in pure and applied chemistry (p. vi).

There are 116 firms represented under various headings in our Buyers' Guide.

PUBLICATIONS RECEIVED

A TEXT-BOOK OF INORGANIC CHEMISTRY. By A. F. Holleman, Ph.D., LL.D., D.Sc., F.R.S.E. Issued in English in co-operation with H. C. Cooper. Seventh English edition, revised. Pp. x + 541. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. 17s. 6d.

COLLOIDS. A TEXTBOOK. By H. R. Kruyt. Translated from the manuscript by H. S. van Klooster. Pp. xi + 262. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. 17s. 6d.

RECENT ADVANCES IN ORGANIC CHEMISTRY. By A. W. Stewart, D.Sc. Fifth edition. Vol. I. Pp. xi + 387. Vol. II. Pp. xiv + 382. London: Longmans, Green & Co., Ltd., 1927. 21s. each volume.

THE ROYAL TECHNICAL COLLEGE, GLASGOW. Calendar 1927—28. Pp. xviii + 419. Glasgow: Robert Anderson, 1927.

THE DETEIORATION OF STRUCTURES IN SEA-WATER. Seventh (Interim) Report of the Committee of the Institution of Civil Engineers. Department of Scientific and Industrial Research. Edited by J. Purser, M.Sc., B.A.I., Assoc. M. Inst. C.E., and H. J. Grose, M.C., B.Sc. Pp. vi + 11. London: H.M. Stationery Office, 1927. 2s.

METHODS OF ANALYSIS OF COAL. Fuel Research. Physical and Chemical Survey of the National Coal Resources No. 7. Department of Scientific and Industrial Research. Pp. iv + 35. H.M. Stationery Office, 1927. 9d.

SIXTH ANNUAL REPORT OF THE SECRETARY FOR MINES FOR THE YEAR ENDED DECEMBER 31, 1926, AND THE ANNUAL REPORT OF H.M. CHIEF INSPECTOR OF MINES FOR THE SAME PERIOD, WITH A STATISTICAL APPENDIX TO BOTH REPORTS. Mines Department. Pp. 179. H.M. Stationery Office, 1927. 5s. 6d.

THE MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY. Prospectus of Part-time Courses in Chemistry and Chemical Technology, Session 1927—28. Pp. 68.

PROSPECTUS OF UNIVERSITY COURSES IN THE MUNICIPAL COLLEGE OF TECHNOLOGY, MANCHESTER. Session 1927—28. Pp. 310. Manchester: University of Manchester. Faculty of Technology, 1927.

THE EVOLUTION OF THE FERTILISER INDUSTRY. By Prof. J. Hendrick, B.Sc., Reprinted from the "Transactions of the Highland and Agricultural Society of Scotland." 1927. Pp. 18.

REPORT 1925-26 WITH THE SUPPLEMENT TO THE "GUIDE TO THE EXPERIMENTAL PLOTS" CONTAINING THE YIELDS PER ACRE ETC. OF LAWES AGRICULTURAL TRUST, ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN. Pp. 156. Harpenden: D. J. Jeffery, 1927. 2s. 6d.

REPORT BY THE MEAT FREEZING COMMITTEE OF THE AUSTRALIAN NATIONAL RESEARCH COUNCIL ON THE BULLOCK PROCESS FOR THE PRESERVATION OF MEAT. Circular No. 10. Council for Scientific and Industrial Research. Commonwealth of Australia. Pp. 24. Melbourne: H. J. Green, 1927.

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EDITORIAL

The Photosynthesis of Natural Products

DOES the old controversy about the origin of living matter still linger, one wonders? One can remember cogent arguments from the vitalists, fortified by explanations based on a mysterious vital principle, and one can remember equally hard facts brought forward by those who preferred to seek facts. Both sides would argue and afterwards would retain equally their previous convictions, but we never cared very much about the final opinion so long as the actual investigation went on. One of those who has steadfastly laboured to extend our knowledge of the chemistry of the plant organism is Prof. Baly, who, as a valued clerical correspondent once remarked, has made "... a syrup which may be sugar" from carbonic acid and water with the help of the energy in sunlight. This work of Prof. Baly is familiar to all who are interested in the growth of plants, and we recently reread with considerable pleasure the rejoinder to our clerical friend in which Prof. Baly described his investigations in a charming article, published in this JOURNAL in 1923. This important work on photosynthesis was subjected to a certain amount of criticism, but Prof. Baly and his colleagues have not been dismayed, and have now collected further evidence, which is given in three papers, published in the September issue of the Proceedings of the Royal Society. The greatest precautions were taken to ensure the purity of the materials used, and results were obtained which indicate that the direct photosynthesis of complex carbohydrates in a single operation has been achieved in the laboratory. Apparently ordinary formaldehyde is not present when an aqueous solution of carbon dioxide is exposed to ultra-violet light, but an organic compound, probably a complex aldehyde, is present. Further, when carbonic acid, adsorbed on nickel or cobalt carbonate suspended in water, is exposed to visible light, organic products, of which at least one is a carbohydrate, are photosynthesised. From the negative results obtained in over 200 central experiments it is concluded that it would seem impossible that the photosynthesised carbohydrates arise from organic impurity. Finally, the authors find there is a marked similarity between photosynthesis *in vivo* and that now achieved *in vitro*. We must defer further consideration of this fascinating work and its far-reaching implications; but we are glad to note that the authors' experimental

work was made possible by the generous grants which Messrs. Brunner, Mond & Co. have made from time to time to the Liverpool University Chemical Laboratories.

The Paint Research Association

The British Paint, Colour and Varnish Manufacturers have opened the laboratories of their Research Association at Teddington and marked the occasion in the accustomed way, lunching and drinking each other's health and making speeches. An account of the ceremony appears in this issue. The Research Association has made a good beginning, its opening ceremony was attended by a number of guests, including three Presidents or ex-Presidents of the Society of Chemical Industry, all of whom spoke, and spoke well. It was fortunate or wise - the words are nearly synonymous -- to secure the attendance of Dr. Weidlein, the director of the Mellon Institute of Industrial Research, who encouraged the Association by stating the benefits derived, in the United States, from prolonged and careful study. The Association was wise in choosing as its President Mr. S. K. Thornley, and as its Vice-Presidents Dr. H. H. Morgan and Mr. C. F. Hare. These three are all well-known in the paint and colour industry. They have breadth of vision, public spirit, and sound common sense, and they realise, and have for years past realised, the important part which science should play in this branch of industry. In making the choice of these three leaders the Association showed wisdom; the Association was perhaps fortunate in choosing Dr. L. A. Jordan as director of research, for Dr. Jordan was not well-known in the industry, and it was to a certain extent due to chance that he was available for the post. Dr. Jordan has qualities which, we judge, mark him out as specially suited for research of the kind necessary to this great industry. We hope before the end of the year to visit the laboratory quietly and deliberately, and are confident that when we do so we shall find much to interest ourselves and our readers. The paint and varnish industry has changed greatly during the last twenty or five-and-twenty years, and the change is still going on. New pigments and new solvents are rapidly taking the place of the old ones; thousands of motor-cars are sold every week enamelled with materials unknown at the beginning of the century; we see no reason why other new materials should not be found useful in painting

houses, ships and bridges. The main function of paint is to protect against corrosion, its secondary function is to adorn the protected structure. There are already plenty of pigments which are suited for adornment; new pigments and new solvents to last for six years instead of four will be very valuable; it should not pass the wit of the chemist to find materials that will last eight years or even more and can still be applied in thin layers on wood and iron. We have in our cabinet fossils from the carboniferous limestone showing a portion of the original coloured pattern of the shell; there's a pigment for you!

Chemical Nomenclature

A flattering correspondent wrote to us the other day suggesting that we should adopt the word *hiocon* as a contraction for that frequent phrase hydrogen ion concentration. We are greatly pleased and honoured, but nevertheless feel that CHEMISTRY AND INDUSTRY must, in matters of chemical nomenclature, follow the fashion of the respectable chemists rather than lead it. We remain, however, of opinion that the advantages claimed for "hydrogen ion concentration" over "acidity" are over-rated. The word "ion" itself is now used in so vague a sense as to convey several meanings, intelligible to those who are familiar with the subject, but not to others. There are many other words in common daily use which have the same defect. If a chemist tells you that somebody's speech or hat is simply priceless, you can, if you heard the speech or saw the hat, agree with him, and even add that it is frightfully topping, and each of you knows what the other means. Ion means in the Greek, going or moving, and it has long been used for a moving, electrically charged, elementary particle, with a separate existence of its own, darting about in a fluid medium in a vigorous and independent way. It is also used to mean an elementary particle firmly fixed in a crystal, held there tightly by a number of adjacent particles, and having its electrical charge completely neutralised by the electrical charges of the adjacent particles. In fact, nearly every substance which is not composed of an aggregate of separate molecules is now spoken of as built up of ions. When you come to such a word as ionisation, unless you are trained to know what the speaker means by his use of the word, you are equally in the dark. There are some well-known writers of text-books who tell you that when sulphuric acid is mixed with water, the sulphuric acid splits up into two ions, and that these dart about in the way denoted by the original Greek word: this is one use of the word ionisation. Other chemists take a different view of the situation, and if they use, as they do, the word ionisation in this case, they mean that the molecule of sulphuric acid combines with several molecules of water to make a new chemical compound, which is a hydrate of sulphuric acid, and that this hydrate can itself effect a loose chemical composition with more water, until a mass is formed, mainly consisting of water, some of which is firmly attached to the sulphuric acid and some very loosely. Some chemists regard the glue, or threads, holding the mass together to be the oxygen particles: we hardly know whether to call them atoms or ions—others think the oxygen and the hydrogen each

act in this way and they call the hydrogen bivalent, though we think they do not really mean that it has twice the combining power or electrical attraction of the univalent elements. Finally, this hydrate of sulphuric acid conglomerate becomes so large and its parts become so diffused that the threads become weak and the whole thing becomes unstable in the sense that it may readily split up into two parts each of which is liable to make a weak and temporary union with other portions or molecules or aggregates of hydrate or water. This is what they mean by ionisation; other chemists call this dissociation; we have only to remember that the cohesion of the crowd is less than the cohesion of the football team, and we see how both phrases fit in. We imagine that one unit of oxygen may be strong enough to hold together a whole molecule of sulphuric acid and in addition a considerable quantity of water, but if you go on long enough adding to the two sides connected by the original unit and you also weaken the oxygen unit by hanging water on to it a time will come when the strength of the oxygen unit gives way and the whole dropsical body either parts or else becomes so loose that for electrolytic purposes it acts as if it were in two parts. Until chemists are more unanimous in their views, we must continue to use the word ion, with all its ambiguities. The modern chemist, as we have mentioned on earlier occasions, is compelled to make use of terms and diagrams which were formerly exact and free from ambiguity. Some of these are no longer capable of this high praise. The part that water plays in making hydrates is poorly explained in our ordinary small text-books; one is even sometimes hastily tempted to imagine, only for a moment, that the author himself is not very clear about the chemical activity of water and the nature of the compounds or mixtures so formed. Reasons could be furnished for arguing that some of the crystalline hydrates are not compounds but mixtures whose definite chemical composition is due to the fact that they have a definite shape which permits a definite proportion only of the constituents of the mixture. In a very few cases we think water may even be driven off from the crystal and re-absorbed by it without any visible change in the shape of the crystal. No doubt some chemists can tell us which of these solid hydrates are chemical compounds and which are not: it is not a matter we have ever studied ourselves. So, too, we trust, some chemists can tell us which of the liquid hydrates are chemical compounds and which are not. Perhaps a rigid definition of the phrase chemical compound is a desirable preliminary. Until we get to that stage we propose to adopt ionisation and hydrogen ion concentration as part of the current speech of chemists, remembering that the ion is either moving rapidly or sitting down, is either separate or combined with other ions or with atoms, molecules or aggregates; it may display intense electrical activity or its electricity may be so quenched and subdued by the electricity of those who hold its hand that it cannot be detected; if we remember also that ionic means un-molecular we shall have so clear an idea of this valuable conception that we may use the word ion and its derivatives in our editorial paragraphs without transgressing the conventions.

RESEARCHES ON MENTHONES, MENTHOLS AND MENTHYLAMINES*

By PROF. JOHN READ, M.A., Ph.D.

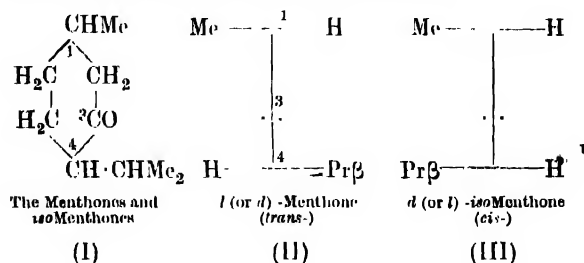
Introductory

The earlier investigatory work in the menthone series was based mainly upon *l*-menthol, $C_{10}H_{20}O$, one of the main components of peppermint oil. Although peppermint appears to have been cultivated in Japan for more than two thousand years, the first recorded allusion to crystalline menthol, or "mint camphor," was made by the Dutch botanist, Gambius, in 1771.

Menthones.—In 1881, Moriya, working in the University of Tokyo under the supervision of Prof. Atkinson, prepared an optically inactive oil, $C_{10}H_{18}O$, by heating *l*-menthol from Japanese peppermint oil with chromic acid in a sealed tube at 120° . "In a note appended to the paper, Prof. Atkinson suggests that menthol is a secondary alcohol derived from a saturated closed chain hydrocarbon formed by the addition of six atoms of hydrogen to ordinary *cymene*, and that the oxidation product, $C_{10}H_{18}O$, obtained by Mr. Moriya, is the corresponding ketone." This is the first reference in the literature to menthone (*Journ. Chem. Soc.*, 1881, 39, 77). Moriya also stated that "it is not improbable that this substance, which holds the menthol [of peppermint oil] in solution, is the same body as that formed by the action of the chromic acid liquid upon the camphor." However, Andres and Andreef were the first to isolate menthone from peppermint oil (*Ber.*, 1892, 25, 617). Meanwhile, Beckmann had shown that *l*-menthol when carefully oxidised with warm chromic acid mixture yielded *l*-menthone; the product was found later to be substantially identical with the ketone of peppermint oil. Slight variations were noticed in the specific rotatory powers of different preparations, the maximum value of $[\alpha]_D$ being -28.46° ; moreover, *l*-menthone was found to be "inverted" by the action of certain acid or alkaline reagents, and even when heated alone. Cold strong sulphuric acid gave rise to the most pronounced "inversion," a ketone having a maximum value of $[\alpha]_D +28.14^{\circ}$ being produced by treating *l*-menthone with this reagent (*Annalen*, 1889, 250, 335). That this dextro-rotatory ketone is not the enantiomorphous form of *l*-menthone, as was sometimes assumed, is shown by Beckmann's observation that it yields a liquid oxime, the properties of which are quite distinct from those of an optical antipode of the well-defined crystalline oxime of *l*-menthone (m.p. 58°).

The accepted constitutional formula (I) for menthone, which was proposed by Semmler in 1892, affords an interpretation of the "inversion" through the assumed occurrence of a reversible keto-enol change. Carbon atom (1) retains its asymmetry throughout this process, while the asymmetry of carbon atom (4) is temporarily suppressed in the enol-form. The ultimate return to the keto-form, consequent upon the removal of the enolising influence, thus results in the production of a mixture of *l*-menthone and *d*-isomenthone, the relative proportions of these stereoisomerides varying in accordance

with the prevailing conditions. Menthone and *iso*-menthone, which are readily interconvertible through the common enol-form, are therefore to be regarded as *trans*- and *cis*-forms of *p*-menthan-3-one:—



The *cis*-configuration (III) has usually been adopted for menthone; since, however, the recent observations of Zeitschel and Schmidt (*Ber.*, 1926, 59, 2298) indicate that the density and refractive index of *l*-menthone are somewhat lower than the corresponding constants of *d*-isomenthone, it appears in the light of the Auwers-Skita rule that menthone should be assigned the *trans*-configuration (II). In agreement with this conclusion, measurements of the parachors made by Carter (*Journ. Chem. Soc.*, 1927, 1278) gave slightly higher values for *d*- and *dl*-isomenthone than for *l*- and *dl*-menthone; but further evidence is needed before a decisive solution of this interesting configurational problem can be reached. As indicated below, *d*-menthone and *dl*-menthone also have been rendered available through the researches of Pickard and Littlebury, and by alternative methods in the new work now under review; menthone is therefore known in all three of the stereoisomeric forms corresponding to one of the above configurations.

Menthols.—Each of the three stereoisomeric forms of both the ketonic configurations corresponds theoretically to two secondary alcohols: consequently, there should be two externally compensated and four optically active menthols together with a like number of isomenthols. The six members derived from menthones (as distinct from isomenthones) were all isolated and characterised by Pickard and Littlebury (*Journ. Chem. Soc.*, 1912, 101, 124) during an investigation of the products obtained in the catalytic hydrogenation of thymol. By an ingenious application of phthalic anhydride to this complicated mixture of substances it was found possible to prepare *dl*-menthol (m.p. 34°) and *dl*-neomenthol (m.p. 51°), and to resolve each of them into *d*- and *l*-forms. All these menthols oxidise to menthones, from which they are configurationally derived.

Conflicting views have arisen concerning the spatial disposition of the groups ($-H$ and $-OH$) about the additional asymmetric carbon atom (3) of the menthols and neomenthols. Vavon and Coudere (*Comptes rendus*, 1924, 179, 405) consider the hydroxyl group (3) of neomenthol to occupy the *trans*-position with respect to the hydrogen atom (4), since *d*-neomenthol esterifies more easily than *l*-menthol. A *cis*-configurative arrangement of these groups is denoted, however, by the readiness with which *d*-neomenthol is dehydrated to form *d*- Δ^3 -menthene when treated with formic acid, phosphorus pentachloride, or thionyl chloride (Zeitschel and Schmidt, *loc. cit.*).

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Menthylamines.—Andres and Andreef (*loc. cit.*) prepared *l*-menthylamine by reducing *l*-menthoneoxime, and a similar method was used by Wallach (*Annalen*, 1893, 276, 296). In addition, Wallach found that when *l*-menthone was heated with ammonium formate it gave not only *l*-menthylamine, but also a so-called "R-menthylamine," which, although dextro-rotatory, was not enantiomorphous with *l*-menthylamine. Subsequently (*Annalen*, 1898, 300–378) Wallach showed that while *l*-menthylamine reacts with nitrous acid to yield ordinary *l*-menthol, the stereoisomeric "R-menthylamine" gives partly racemised *d*- Δ^3 -menthene in this reaction; he concluded, therefore, that the groups NH_2 (3) and H (4) are in the *trans*- and *cis* configurative positions, respectively, in the molecules of *l*-menthylamine and "R-menthylamine." Whether the new base was to be regarded as a menthylamine or as an isomenthylamine remained undecided. Finally, in 1913 (*Lundén*, 397, 218), Wallach described a base, named "i-menthylamine," obtained by reducing *dl*-menthoneoxime; recent work indicates that this base was a mixture, owing possibly to the occurrence of "inversion" during the oximation of the optically inactive ketone (*Journ. Chem. Soc.*, 1926, 2225).

isoMenthone and its derivatives. Prior to the inception of the work outlined below, very little reliable information had been gathered for the isomenthone series, although the literature contained sporadic and conflicting statements concerning supposed members of this group. The most important observation was that of Beckmann (*Ber.*, 1909, 42, 846), who gave brief particulars of a supposed *d*-isomenthylamine hydrochloride, having $[\alpha]_D^{25} + 17.7^\circ$ in dilute aqueous solution; this was prepared by reducing the crude liquid oxime furnished by "inverted" *l*-menthone. When treated with nitrous acid it yielded a dextro-rotatory isomenthol, which upon oxidation gave a ketone having $[\alpha]_D^{25} + 93.2^\circ$; this was regarded as *d*-isomenthone.

Summing up the earlier researches, it is apparent that in the menthone series the chemistry of the menthylamines required considerable amplification; while in the isomenthone series practically the whole field awaited exploration. The fundamental importance to the terpene chemistry of accomplishing a complete survey of the stereoisomeric menthones, isomenthones, and their derivatives was emphasised many years ago by Semmler ("Die ätherischen Öle," 1906, III, 333; compare also Meyer u. Jacobson, "Lehrbuch der organischen Chemie," 1923, II, i, 891); but further progress on the lines hitherto adopted was beset with difficulties. With the exception of Pickard and Littlebury's investigations, departing from thymol, most of the work summarised above had been based upon *l*-menthol, which, as already stated, first attracted attention as a crystalline principle in 1771. It is necessary to go back to the same period in introducing a new substance, the study of which has done much to complete our knowledge of the field of organic chemistry under discussion.

Recent investigations

In 1788, soon after Governor Phillip's arrival in New South Wales, a species of eucalypt growing plentifully

around Port Jackson attracted attention on account of the peppermint odour of its leaves. The first eucalyptus oil to be distilled was obtained from its foliage and used as a substitute for peppermint oil by Dr. White, Surgeon-General to the First Settlement (White, "Journal of a Voyage to New South Wales," 1790, 227). The species is now known as *Eucalyptus piperita*, or the Sydney Peppermint. As shown by H. G. Smith in 1900, the peppermint odour of its essential oil is due to a ketone, $\text{C}_{10}\text{H}_{16}\text{O}$, which he named piperitone (*J. Proc. Roy. Soc. N.S. Wales*, 1900, 34, 316). This ketone, which is laevo-rotatory, has since been found in twenty-three species of eucalyptus, growing for the most part in the south-eastern regions of Australia, and characterised by a butterfly-wing leaf-venation. The maximum content is reached in the oil of the Broad-leaved Peppermint (*B. dives*), which furnishes nearly 50% of *l*-piperitone. In 1921, a detailed study of this ketone, which was diagnosed as Δ^4 -menthen-3-one (IV), already synthesised in the *dl*-form by Wallach (*Annalen*, 1908, 362, 272), was begun by Read and Smith and continued in collaboration with Bentivoglio, Hughesdon, and Earl (*Journ. Chem. Soc.*, 1921, 119, 779; 1922, 121, 575, 582, 1863; 1923, 123, 2267, 2916; 1924, 125, 129; 1926, 2072; this J., 1923, 42, 339 r). In the course of these investigations, *d*-piperitone was discovered by Simonsen (*Journ. Chem. Soc.*, 1921, 119, 1644) in the essential oil of a Himalayan grass, *Andropogon Swarancusa*; since the optically active ketone racemises easily, presumably as a result of enolisation, (when heated to 200° or dissolved in alkaline reagents (*Journ. Chem. Soc.*, 1923, 123, 2269), it is readily available in *l*-, *d*-, and *dl*-forms.

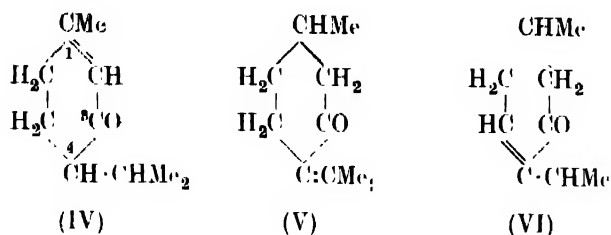
Menthones and isoMenthones.—When catalytically hydrogenated in the presence of colloidal palladium, according to Paal's method, *l*- or *d*-piperitone absorb one molecular proportion of hydrogen, with the formation of ketonic products possessing enhanced but reversed optical rotations, and consisting mainly of *d*- or *l*-isomenthone, respectively (Table A). Since *dl*-piperitone behaves in a similar way, these reactions provide new sources of *d*-, *l*-, and *dl*-isomenthone, and hence also of *l*-, *d*-, and *dl*-menthone.

TABLE A

Unsaturated ketone	$[\alpha]_D^{25}$ of unsaturated ketone	$[\alpha]_D^{25}$ of derived isomenthone
<i>d</i> -Piperitone	+ 62.50°	— 71.41°
<i>l</i> -Piperitone	— 51.90°	+ 69.10°
<i>d</i> -Pulegone	+ 23.00°	+ 33.45°
<i>l</i> - Δ^4 -p-Menthen-3-one	— 78.36°	— 43.24°

A later series of investigations by Read, Robertson, and Cook (*Journ. Chem. Soc.*, 1925, 127, 2782; 1926, 2209, 2223; 1927, 1276) have utilised these new points of departure in extending our knowledge of the chemical and stereochemical relationships of the menthones, the isomenthones, and their more important derivatives. In the hydrogenation of piperitone (IV) at the ordinary temperature by Paal's method, the spatial additive process is conditioned by the asymmetry of carbon atom (4), and the optical rotation of the product corresponds to a mixture of 82% of *d*-isomenthone with 18% of *l*-menthone. Similar experiments with *d*-pulegone (V) and *l*- Δ^4 -p-menthen-3-one (VI), in which carbon atom

(1) is the original asymmetric centre, yielded mixtures containing only 52% and 60%, respectively, of *d*-isomenthone (Table A).

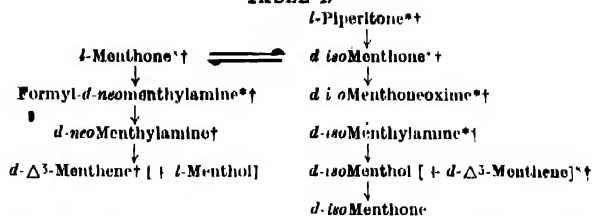


No matter which of the two asymmetric centres (1 or 4) is present in the original molecule, the predominating product is thus isomenthone, or *cis*-menthone (*vide supra*): piperitone, however, affords the highest yields of this ketone, undergoes hydrogenation most easily, and has the additional advantage of ready accessibility in *l*-, *d*-, and *dl*-forms. That the above products do not consist of "partly racemised *d*-menthone," as stated by Skita and Ritter (*Ber.*, 1910, **43**, 3394) in the case of *d*-pulegone, is shown by the magnitude of their optical rotations; moreover, the "inversion" mixtures furnished by them are practically identical with those furnished under similar conditions by *l*-menthone.

The hydrogenation product of *l* piperitone, having the approximate value $[\alpha]_D +70^\circ$, forms a viscid oxime, which upon reduction yields a mixture of menthylamines. Upon fractionally crystallising the mixed hydrochlorides, the main constituent, having $[\alpha]_D +23.6^\circ$ in dilute aqueous solution, is readily obtained pure. From its mode of formation it appears to be the analogue of *l*-menthylamine in the *iso*-series; moreover, like *l*-menthylamine, it yields a crystalline menthol in reaction with nitrous acid. It has therefore been named *d*-isomenthylamine, the corresponding menthol (m.p. 81.5°) being called *d*-isomenthol. The last-named substance, when carefully oxidised with Beckmann's chromic acid mixture, yielded *d*-isomenthone having $[\alpha]_D +91.7^\circ$, and as the "inverting" action of this reagent under the adopted conditions was found to be slight, the preparation was probably contaminated only to a small extent with *l*-menthone. These results bear out the substantial accuracy of Beckmann's earlier observations (*vide supra*). Accepting the above specific rotation for *d*-isomenthone and the maximum value $[\alpha]_D +29.60^\circ$ for *l*-menthone (*Journ. Chem. Soc.*, 1926, 2210), it appears that the "inversion" of *l*-menthone, or *d*-isomenthone, through the agency of alcoholic sodium ethoxide, heat (200°), or cold strong sulphuric acid, gives rise to mixtures containing about 30%, 37%, and 46%, respectively, of *d*-isomenthone.

By using the same series of reactions it is obviously possible to proceed from *d*-piperitone and *dl*-piperitone to pure *l*-isomenthone and *dl*-isomenthone, respectively; all the operations distinguished by means of an asterisk in Table B have actually been conducted with both enantiomorphous forms of the substances concerned, while those in which the externally compensated substances have been used are marked with a dagger.

TABLE B

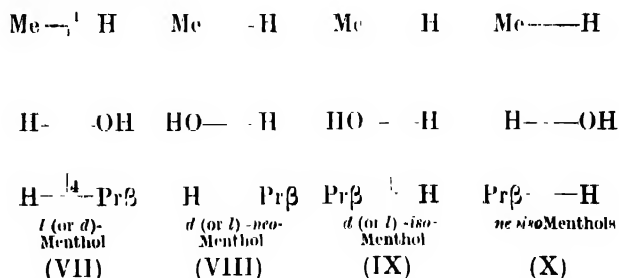


d-isoMenthone is best characterised through the oxime hydrochloride, m.p. 132° , $[\alpha]_D +38.6^\circ$ (chloroform); the pure oxime is a viscid oil. *dl*-Menthoneoxime, which forms well-defined anorthic crystals, m.p. $99-100^\circ$, may be prepared directly from the crude *dl*-isomenthoneoxime obtained in the hydrogenation of *dl*-piperitone by Paal's method, or by the alternative method indicated in Table D. Owing to the occurrence of "inversion," the hydrogenation of *dl*-piperitone at 180° in the presence of finely divided nickel (Smith and Penfold, *J. Proc. Roy. Soc. N.S. Wales*, 1920, **54**, 40) yields a mixture of *dl*-menthone and *dl*-isomenthone in which the former ketone predominates (Read and Robertson, *Journ. Chem. Soc.*, 1926, 2215). In no circumstances has catalytic hydrogenation of a menthenone yielded pure isomenthone, and the pure *d*-, *l*-, and *dl*-forms of this ketone can be obtained only by a careful oxidation of the corresponding isomenthol (Table B). The crude hydrogenation products from *l*-, *d*-, or *dl*-piperitone yield mixtures containing about 70% of *d*-, *l*-, or *dl*-menthone, respectively, when equilibrated with alcoholic sodium ethoxide, and these are the purest preparations of menthone which have been produced by a direct process from piperitone.

Menthols and isoMenthols.—The preparation of *d*-, *l*-, and *dl*-isomenthol from *l*-, *d*-, and *dl*-piperitone, respectively, through the corresponding isomenthylamines, has been outlined above (Table B). Mixtures of *d*- and *l*-isomenthol form a conglomerate (*Journ. Chem. Soc.*, 1927, 1281). Table C summarises certain physical properties of the known menthols (cf. *Journ. Chem. Soc.*, 1912, **101**, 110).

	Menthols			neoMenthols			isoMenthols		
	<i>d</i> -	<i>l</i> -	<i>dl</i> -	<i>d</i> -	<i>l</i> -	<i>dl</i> -	<i>d</i> -	<i>l</i> -	<i>dl</i> -
m.p.	43°	43°	34°	oil	oil	51°	81.5°	80.5°	53°
$[\alpha]_D$	+49°	-49°		+19.6°	-19.6°		+27.0°	-24.1°	
	(in alcohol)			(no solvent)			(in alcohol)		

The evidence adduced below for the menthylamines leads to the following relative molecular configurations for these three series of menthols and the as yet unknown *neoisomenthols* :—



When *l*-, *d*-, or *dl*-piperitone are reduced directly with sodium and alcohol, the resulting mixture of externally

compensated menthols consists largely of *isomenthols* (*Journ. Chem. Soc.*, 1925, 127, 2782), but *dl*-menthol also is present (*Journ. Chem. Soc.*, 1927, 1282). Upon oxidising this crude mixture with chromic acid and reducing the resulting mixture of *dl*-menthone and *dl*-isomenthone with sodium and alcohol, the yield of *dl*-menthol is considerably augmented. An identical result is obviously attained by the alkaline reduction of the mixtures of these ketones produced in the catalytic hydrogenation of *dl*-piperitone in the presence of colloidal palladium or finely divided nickel. By separating and oxidising the resulting crystalline *dl*-menthol it is possible to pass from *dl*-piperitone to pure *dl*-menthone. Some of these operations are summarised in Table D.

TABLE D
(1) *dl*-Piperitone

(Sodium and alcohol)	(Hydrogen and palladium)
(2) <i>dl</i> - <i>iso</i> Menthols [+ <i>dl</i> -Menthol]	
(Chromic acid)	
(3) <i>dl</i> - <i>iso</i> Menthone [+ <i>dl</i> -Menthone]	(6) <i>dl</i> - <i>iso</i> Menthone [+ <i>dl</i> -Menthone]
(Sodium and alcohol)	(Sodium and alcohol)
(4) <i>dl</i> -Menthol [+ <i>dl</i> - <i>iso</i> Menthols]	(7) <i>dl</i> -Menthol [+ <i>dl</i> - <i>iso</i> Menthols]
(Chromic acid)	(Chromic acid)
(5) <i>dl</i> -Menthone	(8) <i>dl</i> -Menthone

The passage from *l*(or *d*)-piperitone to *l*(or *d*)-menthol is possible by carrying out operations (6) and (7) shown in Table D. Although *l*(or *d*)-menthol does not crystallise from the optically active reduction product (7) as readily as *dl*-menthol does from the corresponding inactive mixture, a recent observation indicates that it may be isolated in the form of *l*(or *d*)-menthyl hydrogen phthalate without difficulty.

Menthylamines and isoMenthylamines. *dl*-Menthylamine, prepared by reducing *dl*-menthoneoxime (Table E), was found to be distinct from Wallach's "*i*-menthylamine," mentioned above. The optical resolution of this base presents remarkable difficulty, but a pure specimen of *d*-menthylamine has recently been prepared by this method; all three of the stereoisomeric menthylamines have thus been rendered available. When treated with nitrous acid, *l*-menthylamine yields *l*-menthol as the main product; the accompanying small amount of partly racemised *d*- Δ^3 -menthene appears to be produced as the result of a Walden inversion, leading to the formation of *d*-neomenthol or a related intermediate, which then suffers dehydration (*vide supra*). Configuration (XI) is therefore assigned to *l*(or *d*)-menthylamine.

TABLE E
dl-Piperitone

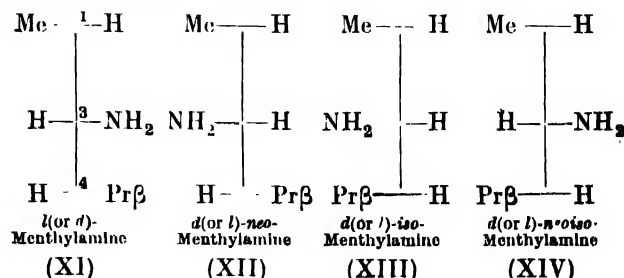
<i>dl</i> - <i>iso</i> Menthone		<i>dl</i> - <i>iso</i> Menthoneoxime
<i>dl</i> -Menthol (Table D)		
<i>dl</i> -Menthone	→	Formyl <i>dl</i> -neomenthylamine
<i>dl</i> -Menthoneoxime		<i>dl</i> - <i>iso</i> Menthylamine
<i>dl</i> -Menthylamine		<i>dl</i> - <i>iso</i> Menthol [+ <i>dl</i> - Δ^3 -Menthene]
<i>dl</i> -Menthol [+ <i>dl</i> - Δ^3 -Menthene]		

Wallach's "*R*-menthylamine" can be prepared, together with *l*-menthylamine, by heating either *l*-menthone or *d*-isomenthone with ammonium formate. In reaction with nitrous acid it yields partly racemised *d*- Δ^3 -menthene, presumably via *d*-neomenthol or a related intermediate, as the main product, but it has recently been found that a small quantity of *l*-menthol is produced simultaneously. "*R*-menthylamine" is therefore to be regarded as a derivative of *l*-menthone; it has been renamed *d*-neo-menthylamine, and configuration (XII) has been assigned to it. The *l*- and *dl*-forms of this base have also been rendered available (Tables B and E). The neomenthylamines differ from the stereoisomeric bases in yielding hydrochlorides which melt below 200° and dissolve in light petroleum; they are also noteworthy by reason of the beauty of their crystalline derivatives. An exceptional relationship is presented by formyl-*d*-neomenthylamine and formyl-*dl*-neomenthylamine, which yield closely related orthorhombic crystals; those of the *d*-compound are holohedral, while solutions of the *dl*-compound deposit right- and left-handed crystals possessing only a faint optical activity in alcohol solution.

d-, *l*-, and *dl*-Menthylamine have been prepared by reducing the corresponding isomenthoneoximes (Tables B and E). *d*-*iso*Menthylamine, which reacts with nitrous acid to give *d*-isomenthol and partly racemised *d*- Δ^3 -menthene, has been assigned configuration (XIII).

Owing to the "inversion" which undoubtedly occurs when *l*-menthone is heated with ammonium formate, it appeared necessary that the product should contain the *iso*-analogues of *l*-menthylamine and *d*-neomenthylamine, and a representative of the remaining group of these stereoisomeric bases has recently been isolated from the mixture of formylated menthylamines furnished by this reaction. The new base, which is feebly dextro-rotatory, has been named *d*-neoisomenthylamine (XIV); but apart from the hydrochloride, its derivatives are mainly laevo-rotatory.* In reaction with nitrous acid it yields partly racemised *d*- Δ^3 -menthene, which is probably associated with a little *d*-isomenthol. Thus, Δ^3 -menthene appears to be invariably produced, in lieu of neomenthol or neoisomenthol, in the interaction of nitrous acid with menthylamines.

It is of interest that the following configurational scheme, which has been evolved for the stereoisomeric menthylamines, leads to the configurations for menthol and neomenthol (VII and VIII) suggested by Zeitschel and Schmidt (*vide supra*):



All four bases, when treated with nitrous acid, yield

* An account of this base and certain of its derivatives will appear shortly in the JOURNAL OF THE CHEMICAL SOCIETY.

varying amounts of *d*- Δ^3 -menthene; in the molecule of this substance carbon atom (1) alone retains its asymmetry, and a proof is thus afforded of the similar spatial disposition of the groups about this atom, as indicated in the above configurational formulæ for the molecules concerned.

The hydrochlorides of the last three of these bases possess almost identical optical rotatory powers in dilute aqueous solution, the respective values of $[\alpha]_D$ for the complete series being -36.6° , $+21.5^\circ$, $+23.6^\circ$, and $+20.9^\circ$; the separation by ordinary methods of these hydrochlorides is impracticable, and a similar difficulty is presented by mixtures of their externally compensated forms (cf. Read and Shannon, *Journ. Chem. Soc.*, 1926, 2232). The acyl derivatives and other substitution products furnished by the optically active bases exhibit widely different values of $[\alpha]_D$ in chloroform solution (Table F).

TABLE F

Values of $(\alpha)_D$ for menthylamine derivatives in chloroform solution

Derivative	<i>l</i> -	<i>d</i> -neo-	<i>d</i> -iso-	<i>d</i> -neois-
Benzylidene	-132.5°	+61.7°	+60.7°	-34.2°
Salicylidene	-119.2°	+30.0°	+77.0°	-17.9°
Formyl	-83.8°	+53.8°	+31.3°	-3.0°
Acetyl	-81.7°	+53.0°	+30.7°	-2.6°
	(XI)	(XII)	(XIII)	(XIV)

A comparison of these values with the above configurational scheme indicates that the reversal of the asymmetry of carbon atom (3), to which is attached the characteristic amino-group, changes the sense of the optical rotation; this remains unaltered, however, when the asymmetry of either carbon atom (1) or (4) is reversed. It is evident also that the menthone derivatives possess higher optical rotatory powers than the analogous isomenthone derivatives. In passing from the benzylidene derivative to the salicylidene derivative of the same base the numerical value of the optical rotatory power decreases, and a similar change accompanies the passage from the formyl derivative to the acetyl derivative. The most interesting numerical relationships are shown by the last-named derivatives. Considering them independently, it is seen that in both instances the sum of the values of $[\alpha]_D$ for configurations (XI) and (XII) is practically identical with the sum for configurations (XIII) and (XIV), the sign being, however, reversed; moreover, configuration (XI) may be coupled with either of the remaining configurations, (XIII) or (XIV), with similar results. These striking coincidences suggest that important information concerning the principle of optical superposition may accrue from a further study of optical rotatory powers in this unique series of stereoisomeric compounds.

CANADIAN INDUSTRIAL NOTES

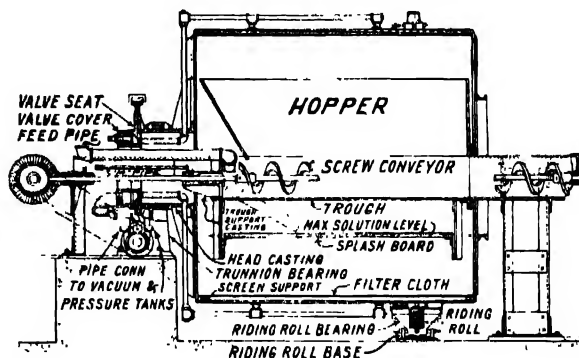
Arrangements have been completed for the establishment of a beet sugar industry in the Fraser Valley, B.C., by a British company. Scottish and English labour will be settled in the valley for the cultivation, and also operation of the sugar refinery.

The Nipigon Corporation, which has been operating a sulphite pulp mill at Nipigon, has arranged to construct a paper mill of 200 tons daily capacity at Port Arthur, Ontario. This will be the first unit of a 400-ton mill. The completed mill will cost \$7,000,000. There are already two large paper mills in Port Arthur.

A NEW TYPE OF CONTINUOUS FILTER

A distinctly novel type of continuous vacuum filter known as the Dorco filter has been recently introduced into chemical and metallurgical practice. Several special features of this filter give it a relatively wider field of application than the usual types.

The machine is a vacuum filter of the rotary drum design containing a filter medium on the inside of the drum, this filter medium being divided into sections or panels making it possible to change the cloth panel by panel if desired. One end of the drum is open for the introduction of the feed, the removal of cake and the inspection of operation, and as the drum itself acts as a container for the pulp being filtered the necessity for a tank with agitating mechanism is entirely eliminated. (See Fig. 1.) Arrangement is made so that in the event



SECTIONAL ELEVATION

FIG. 1

of overfeeding the machine the surplus pulp will pass to a spillage tank.

A trunnion bearing supports the filter at the closed end, while at the open end support is given by a tyre bearing on rollers. The drum is rotated by means of a worm and worm gear drive, and turns in a clockwise direction.

Suction for cake formation, drying and washing and pressure air for cake discharge are applied to the panels through a port valve of the usual type adjacent to the trunnion support. All piping is placed on the outside of the drum, and is readily accessible.

The filter is particularly suitable for pulps containing granular material which settles out rapidly, for the segregating material falls into position on the filter medium. In drum and tank types of machine, segregation hinders the work of the filter as the granular material forms banks on the bottom of the tank and allows the finer material to be drawn on to the cloth first, so tending to cause clogging. In the Dorco filter a natural filter bed is formed. This is of much importance in the filtration of fine coal and many pulps occurring in ore-dressing work.

The cake so formed on the inside of the drum is carried round to a point beyond the top of the machine where the filter cloth is caused to suddenly expand and contract, so that the cake falls readily and freely, leaving the medium clean. The solids drop into a hopper

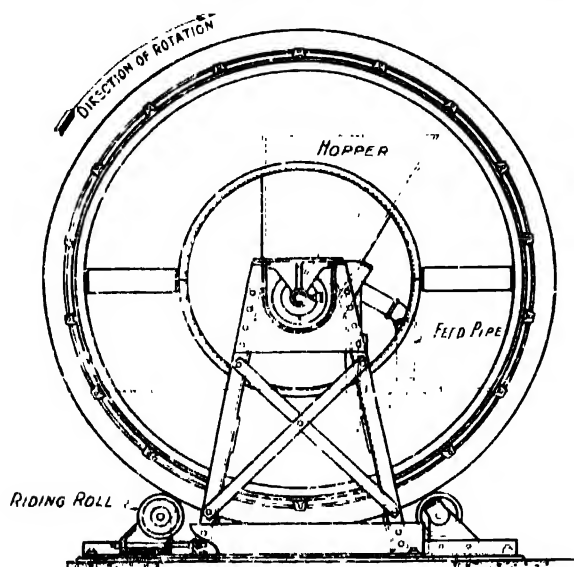


FIG. 2.

situated inside the drum and are removed by a screw conveyor. (See Fig. 2.)

To demonstrate the advantages of this filter careful comparison between a Dorrico filter and a drum and tank type was made at the mill of one of the large copper companies. The machines were operated in parallel, receiving a thickened feed of flotation concentrates from a Dorr thickener. The following figures give the results of a 20 days' test:

General data	Drum and tank filter		Dorrico filter	
	14	14	13 ft. 14 in.	12 ft. 9 in.
No. of panels	24		22	
Area of each panel, sq. ft.	26.2		23.86	
Total blanket area, sq. ft.	605.0		524.9	
Method of cake discharge			Pulsation of medium	
Spacing of binding wire	2½ in.		None used	
Power consumed				
Filter, drive, kw. hr. input			4.45	
Azitation, kw. hr. input	4.12		Nil	
Vacuum pump, kw. hr. input	8.32		10.00	
	14.69		14.45	

Screen analysis of filter feed

Mesh	% cumulative
On 28 mesh	0.2
" 35 "	0.6
" 48 "	1.8
" 65 "	2.1
" 100 "	17.0
" 150 "	31.4
" 200 "	44.0
Through 200 mesh	56.0

Comparative operating data (20 days)

	Tank filter	Dorrico filter
Total tons filtered (1 ton = 2,000 lbs.)	1,201.19	2,402.50
Average tons per day	60.06	120.13
Average per cent. moisture in feed	34.53	34.53
Average per cent. moisture in cake	12.82	12.00
Tons filtered per sq. ft. filter area per day	0.0093	0.229

Comparative costs

	Tank filter	Per ton	Dorrico filter	Per ton
	Per month	\$	Per month	\$
Repairs, labour and supplies, including mill overhead	201.550	0.1110	157.350	0.0435
Power cost	104.700	0.0581	92.174	0.0253
Total cost	306.25		249.524	0.0691

Note: - Operating labour not included.

The mill where these results were obtained operates a gravity-concentrating plant as well as a flotation plant, and although it had always been desirable from the point of view of the smelter to mix and dewater the two types of concentrate together, limitations of the drum and tank filter prevented that being done. The table concentrates had to be dewatered in classifiers provided with suction boxes. After the trial of the Dorrico filter on flotation concentrates, it was decided to send the entire gravity concentrates to the trial filter along with the flotation concentrates. The following excellent result was obtained, enabling a substantial reduction to be made in the cost of handling concentrates.

Filtering gravity and flotation concentrates mixed Screen analysis of feed

Mesh	% cumulative
On 10	0.4
" 14	1.8
" 20	3.4
" 28	7.2
" 35	12.2
" 48	20.8
" 65	30.6
" 100	50.8
" 150	63.0
" 200	67.4
Through 200	32.6
Average tons filtered per day	246.31
Average per cent. moisture in feed	40.0
Average per cent. moisture in cake	10.95
Total cost per month*	\$249.524
Total cost per ton handled*	\$0.0338

* Excluding operating labour. One man attended to all filters and other equipment as well.

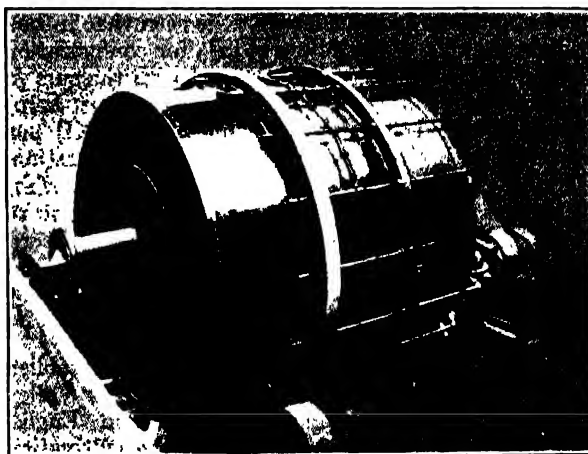


FIG. 3.

The Dorrico filter has been introduced by the Dorr Company of New York, and manufacturing and selling rights have been obtained by the Dorr Company, Ltd., 16, South Street, London, E.C.2.

THE REFUSE OF THE CITY OF SYDNEY AND ITS DISPOSAL*

By ROLLO KEITH NEWMAN, B.Sc., A.A.C.I.

The problems connected with the disposal of refuse have for many years commanded an increasing amount of attention throughout the cities of the world, both on account of the vast quantities of waste materials that have to be disposed of, and also on account of the great costs involved. It is estimated that in the towns and cities of England and Wales alone 10,875,540 tons of refuse have to be collected and disposed of annually at a cost to the ratepayers of £7,500,000. Many efforts have been made to cheapen the costs of collection, and to determine the most economical and efficient means for disposal. Both aspects of the work have interesting features, but it is only with the question of disposal that this paper deals.

In certain American cities, where it is the general practice to collect ashes, rubbish and food waste in separate containers, these three materials are separately disposed of. The ashes, being innocuous, are used for land reclamation or some similar purpose; the rubbish, after removal of saleable constituents, is incinerated; and the garbage or food waste is treated by the reduction process. This process, of which there are several modifications, consists essentially in drying the garbage, extracting the grease for sale, and grinding the degreased residue for sale either as a fertiliser base or stock fodder. In the most modern plants treatment of the garbage is carried out in closed digesters of 3–5½ tons capacity, fitted with a stirring device, steam-jacketed, and connected to a condenser. There is added to the garbage in the digesters a quantity of petroleum naphtha or low-grade kerosene, and the temperature is raised to between 170° F. and 196° F. by means of the steam jacket. The water contained in the garbage and the solvent form a low boiling-point mixture, and distil off. The garbage is thus dehydrated, and after condensation the solvent is separated from the water and used again. When dehydration is practically complete, there remains in the digester with the garbage a certain amount of solvent saturated with grease. This is run off to a settling tank, the contents of the digester are washed with solvent two or three times, and then heated to drive off the last traces of solvent through the condenser. The dry residue is called "tankage," and, after grinding, is sold.

The grease-saturated solvent in the settling tanks is distilled, the solvent recovered, and the grease run into barrels for shipment. This process has been successfully used in some cities for the past twenty years; but, on the other hand, several plants have failed on account of erratic profits and the tendency to cause nuisance from odour.

In England, where refuse is collected in a mixed condition, and consists largely of ashes from domestic fires, either wholesale incineration in destructors, or incineration after the screening out of dust and fine ashes and the salvage of saleable materials, is generally used for disposal. The refuse of Halifax,¹ however, is

now being treated in a modified producer-gas plant, and is said to yield 47,000 cb. ft. of gas per ton. Such gas usually has the composition² CO₂, 3.5%; CO, 23%; O₂, 1.9%; H₂, 13%; CH₄, 2.1%; N, 56.5%; and the calorific value is approximately 130 B.Th.U. per cb. ft. It is suitable for use in gas engines or for boiler firing.

At Bury, Lancashire, and in parts of France, refuse pulverised to a homogeneous mass is sold to farmers for use as fertiliser.

In some of the cities of Italy refuse is converted to innocuous fertiliser by storage for 30–40 days in so-called zymothermic cells, under conditions which are favourable to the aerobic bacteria and inimical to the anaerobic. The fixed nitrogen in the gases liberated by the activity of the micro-organisms is collected in absorption towers situated over the cells.

From Regina, Canada, and from certain districts in America successful alcoholisation of refuse is reported. Such refuse probably contains much fruit waste. Several American cities of considerable size feed all garbage to hogs, and it is claimed that, when practicable, this method is the most advantageous of all from the financial point of view.

It will be seen from these brief descriptions that considerable differences exist between the various disposal methods in use. This diversity is due to the variations in climatic conditions, which exert a great influence on the composition of the refuse, to different methods of collection, to differences in the industrial nature of the localities concerned, and, to a certain extent, to different degrees of fastidiousness of the people.

The information given in this paper was obtained during an investigation conducted in 1925 to determine the nature of the refuse of the city of Sydney, and the most economical and efficient means for its disposal, taking due account of all local conditions.

Quantity and physical composition of City of Sydney refuse

The total amount of refuse disposed of annually in this city (resident population 110,000, excluding suburbs), including street sweepings and uncombustible material, exceeds 80,000 tons, but it is only proposed to deal here with the refuse burnt at the destructors, which amounts to 37,000 tons p.a. This consists of three principal types: household refuse, collected in the residential districts; trade refuse, collected from factories, shops, offices, and warehouses; and a third type, intermediate in composition between the former two, collected in the city at night and in the early morning, and called hereafter, for the sake of convenience, city refuse.

In order to determine the average composition of these types, 141 typical loads, weighing altogether 169,299 lbs. were completely and systematically sorted out. The sorting analyses were spread over a period of nine months to permit seasonal changes to exert their due effect upon the averages. The seasonal changes in the refuse of Sydney were found, however, to be practically negligible. In the cities of colder countries the output of

* Read before the Sydney Section, Australia, on June 9, 1926.

1 "The Cleansing Superintendent," Aug., 1924, p. 318.

2 Chem. and Met. Eng., Aug. 4, 1924, Vol. 31, No. 5, p. 191.

ashes from domestic fires increases greatly in the winter, and this material may constitute 80% of the refuse. In Sydney this is not so, since the average figure for screenings and ashes for 65 loads sorted between March and August was 12.71% and the average figure for 76 loads sorted between September and December was 18.45%. (The difference between these figures (5.74%) is due to an increase in the street sweepings occurring in the latter group of loads.) In Table I, the quantity of each of the three types of refuse disposed of, and the composition, as ascertained by the sorting analyses, is shown:—

TABLE I

Quantity per annum Composition	Quantities and composition of the three chief types of refuse destructors			Quantity of the trade refuse 6601 tons
	Household refuse 23 654 tons	City refuse 6968 tons	Trade refuse 6601 tons	
Garbage	56.54	32.97	22.93	
Paper and cardboard	10.15	36.31	18.27	
Screenings and ashes	17.39	21.21	7.93	
Rags, bags, straw, wood, etc.	3.90	3.15	13.36	
Tins, scrap iron, glass crochery, etc.	6.02	6.03	7.51	
	100.00	100.00	100.00	

Household refuse constitutes 63.54% of the whole, city refuse 18.72%, and trade refuse 17.74%. The composition of the mixed refuse, as burnt at the destructors, is therefore as shown in Table II:

TABLE II

General average composition of mixed refuse

Quantity burnt per annum	37,226 tons
Household refuse	63.54%
City refuse	18.72%
Trade refuse	17.74%
Number of loads sorted	141
Total weight sorted	169,290 lb.
Period	Between March and December, 1925

Average composition

Material	Percentage occurrence	Maximum occurrence in any one load	Minimum occurrence in any one load
Garbage	46.17	71.43	—
Paper and cardboard	25.62	77.69	5.71
Screenings and ashes	16.43	63.67	—
Tins	2.08	6.61	—
Scrap iron	1.34	9.43	—
Rags	1.48	8.04	—
Bags	0.60	5.83	—
Glass	2.04	21.86	—
Crochery etc.	0.72	7.69	—
Wood, straw, etc.	1.78	54.30	—
Other combustible rubbish	1.03	14.00	—
Other incombustible rubbish	0.11	19.15	—

100.00

In Table III, Sydney refuse is compared with that of certain other cities.

TABLE III

Comparison of Sydney refuse with that of certain other cities

	Sydney	Toronto	English Cities ⁴ (average)	Berlin ⁵	Mel- bourne ⁶	U.S.A. Cities ⁷ (average)
Garbage	46.17	52.01	10.70	33.07	14.31	—
Paper and cardboard	25.62	22.12	4.30	4.26	7.36	—
Screenings and ashes	10.43	15.57	78.67	52.97	70.68	—
Tins, scrap iron, etc.	3.42	2.30	0.71	0.78	1.44	—
Rags, bags, etc.	2.08	2.01	0.33	1.15	1.68	—
Glass, crochery, earthen- ware	2.75	3.52	5.07	7.37	2.00	—
Wood, straw, etc.	3.53	2.44	0.22	0.40	2.53	—
	100.00	100.00	100.00	100.00	100.00	100.00

³ Eng. News Record, Feb. 7 1918, p. 250.

⁴ (a) From a paper entitled "The Collection and Disposal of House Refuse in Plymouth," by Jas. Paton, Borough Engineer and Surveyor.
(b) "Collection and Disposal of Municipal Refuse," Hering and Greeley, 1921, p. 79.

(c) J.R. Sanitary Institute, Feb., 1919, p. 114.

⁶ Hering and Greeley, op. cit., p. 75.

⁷ Modern Destructor Practice, Goodrich, p. 165.

⁸ Hering and Greeley, op. cit., pp. 30—31.

There is a marked resemblance between the figures for Sydney and Toronto, the latter representing the result obtained for the sorting analyses of 21,000 lb. of refuse in October, 1914. The figures given for the other cities, however, which represent yearly averages, show a much greater proportion of screenings and ashes, due to the occurrence of ashes from domestic fires, the output of which in the colder climates is enormous.

The chemical examination of refuse materials

A series of chemical examinations of the various constituents of refuse was carried out to determine fuel value, and, in the case of garbage, the grease content and fertiliser value in addition.

To obtain representative samples of garbage, the entire quantity of this material, removed from a typical load, was passed through a mill and pulverised to a more or less homogeneous mass. This was reduced, by the usual quartering method, to a sample of 2—3 cb. ft., which was again passed through the mill, to be further mixed and comminuted, and then reduced by quartering to a quart sample for the laboratory. Two hundred grams of this sample was dried for 18 hrs. at 100° C., and then reduced to a fine powder in a hand grist mill. The analyses were carried out on this powder, and calculated back to the wet basis. A similar method of sampling was employed for paper and certain portions of the combustible rubbish such as bags, and rags.

The screenings and ashes were always in a sufficiently finely divided condition to be sampled directly by the quartering method, and the laboratory sample, after drying, was ground in the hand grist mill to a fine powder.

Samples were taken during a period of nine months to enable the observation of the effects of seasonal changes and rainfall on refuse materials. From the results it appears that the absence of climatic extremes in Sydney, results in a certain uniformity in refuse throughout the year in so far as water content is concerned.

The grease content and fertiliser constituents of garbage were also comparatively unaffected by season, as is shown in Table IV.

TABLE IV

Period	Seasonal changes in fertiliser value and grease content of garbage	
	May—August 35	September—October 25
Number of samples	—	—
Nitrogen	0.70	0.77
K ₂ O	0.11	0.12
P ₂ O ₅	0.77	0.56
Ether extract	2.63	3.08

This result agrees with that obtained in Washington,⁸ U.S.A., where it was found that seasonal changes, or changes in the nature of the people (i.e., rich or poor) from which garbage is collected, alike produce differences small enough to be regarded as unimportant. Such small changes as do occur in Sydney, however, have produced their due effect on the figures given hereafter, which may be regarded as correct yearly averages.

Fuel value of refuse

Following are the averaged results for a series of proximate analyses and determinations of calorific value. Altogether 180 samples, taken between April and December, were examined, and the results are shown in Table VI.

⁸ J. Ind. & Eng. Chem., Jan., 1917, p. 49.

TABLE V
Proximate analyses of refuse materials

	Garbage	Screenings and ashes	Paper	Combustible rubbish
Number of samples ..	81	82	13	4
	%	%	%	%
Water ..	44.71	26.53	24.48	10.94
Volatile combustible ..	18.97	14.95	05.03	77.03
Fixed carbon ..	10.68	6.97		
Ash ..	25.64	51.55	110.49	11.13
Calorific value in B.Th.U. per lb. ..	3007	2223	5336	4518

The calorific values for garbage and paper were determined in a bomb calorimeter, but reliable determinations of the calorific value of screenings and ashes could not be made in that way. It was therefore calculated on the assumption that the combustible in this material had the same value as the combustible in garbage. The calorific value of the combustible rubbish was calculated from the values generally accepted for its constituent materials.

From the results shown in Table V and from the known average composition of mixed refuse (Table II), its proximate composition and calorific value were calculated in the manner shown in Table VI.

TABLE VI
Proximate analyses of mixed refuse

Composition	Water	Combustible	Ash	Calorific value in B.Th.U. per lb.
	%	%	%	
Garbage .. (46.17)	20.61	13.69	11.84	1388
Paper and cardboard (25.62)	6.27	10.66	2.69	1367
Screenings and ashes (16.43)	4.36	3.00	8.47	365
Combustible rubbish (5.49)	0.60	4.28	0.61	218
Incombustible rubbish (6.29)	—	—	6.29	—
(100.00)	31.87	38.23		

In Table VII the fuel value of Sydney refuse is compared with that of certain other cities.

TABLE VII
Fuel value of Sydney refuse compared with that of other cities

City	Water	Combustible	Ash	Calorific value in B.Th.U. per lb.
	%	%	%	
San Francisco ⁹	49.00	22.90	27.20	2410
Borough of Richmond (New York) ¹⁰	30.10	34.90	35.00	4141
West New Brighton (New York) ¹¹	45.10	40.40	14.40	4300
King's Norton (near Birmingham) ¹²	12.12	46.18	41.70	3000
				4300
				4500
				4500
Paris ¹³	—	—	—	—
Copenhagen ¹⁴	28.50	30.00	41.50	—
Hamburg ¹⁵	13.00	23.50	63.50	—
Berlin ¹⁶	22.00	13.10	64.90	1314
				1890
Sydney	33.84	36.71	29.65	3368

The comparison shows that in water content and ash the refuse of Sydney resembles that of the American cities more closely than that of the European cities, but the calorific value obtained for Sydney (3368 B.Th.U.) is almost exactly the mean of all other values quoted (3373 B.Th.U.).

Fertiliser value and grease content of refuse material

In addition to ascertaining fuel values, work was carried on with a view to determining the fertiliser value and grease content of garbage alone, and of household refuse as a whole.

The averaged results for the analyses of 81 samples of garbage sorted out from household refuse between April

⁹ to 16 Collection and disposal of municipal refuse, Hering & Greeley, pp. 18, 58, 61, 71, 72, 73, 75, and 78.

and November were as follows:—water, 44.71%; ash, 25.64%; nitrogen, 0.74%; K_2O , 0.11%; P_2O_5 , 0.63%; and ether extract, 2.84%. The average saponification value of the grease was 170.

The estimations of nitrogen were made by the Kjeldahl method; the potash by the perchlorate method, after the sample had been saturated with concentrated sulphuric acid and ignited at low red heat, and the phosphorus pentoxide by the volumetric molybdate method, after ignition of the sample.

A comparison of Sydney garbage with that of certain American cities shows there is a marked difference between the figures. This is probably due to the fact that the American garbage analysed was collected separately, and not mixed, either in the dustbin or the collecting cart, with rubbish or dirt. It was therefore practically pure food waste. The Sydney garbage analysed was, on the other hand, collected together with paper, rags, rubbish, and street sweepings, and subsequently separated, with the result that a considerable proportion of the water, originally in the garbage, was absorbed by these materials. The admixture of the garbage with street sweepings also resulted in the adherence to the wet food waste of a certain amount of dirt and manure, which was not capable of being completely removed by screening, and remained to increase the ash figure. The grease content was reduced by the contact of the garbage with paper, since dirty paper, sorted from household refuse, contains 2.22% of grease in addition to 36.88% water. It is probable that, in the event of the establishment of a separate collection system in Sydney for garbage alone, the material so collected would closely resemble in analysis the average American garbage, as shown in Table VIII.

TABLE VIII
Average composition of American garbage and probable composition of Sydney garbage if separately collected

	%
Water ..	75.00
Combustible ..	20.80
Ash ..	4.20
Nitrogen ..	0.62
K_2O ..	0.28
P_2O_5 ..	0.33
Ether extract ..	4.08

The average analysis of nine samples of household refuse, obtained by pulverising entire loads without any sorting, except the removal of materials which might have injured the mill, is given in Table IX.

TABLE IX
Average analyses of nine samples from household refuse loads pulverised without sorting

	%
Water ..	40.72
Ash ..	31.13
Nitrogen ..	0.62
K_2O ..	0.09
P_2O_5 ..	0.67
Ether extract ..	2.41

Disposal of Sydney refuse

Space will not permit a recounting of the various reasons for the decision reached regarding the most suitable disposal method for use in Sydney. Suffice it to state that after close enquiry into, and careful consideration of, the various successful disposal methods, the nature of the refuse, the local conditions, costs, health considerations, and all other factors being taken into account, it was decided that the separation-incineration

process, which consists in screening out dust and fine ashes, removing saleable materials, and incinerating the remainder, was most suitable for use in Sydney. This process, which is widely used in Great Britain, operates as follows:

The refuse loads, upon arriving at the plant, are tipped into hoppers, which feed, in some cases automatically, into rotating or vibratory screens, with a mesh of size, determined by experiment, to best permit the escape of dust, cinders, and other practically incombustible material. The screenings are disposed of by use for land reclamation, by punting to sea, or in some cities by use as filler in prepared manures. The refuse held in the screens passes to a moving conveyor belt, usually of rubber composition, and of width, length, and rate of travel designed to suit conditions. This belt travels between pickers who remove certain saleable materials other than paper or metals, and throw them into separate bins, from whence they are removed for baling and selling. At a certain point over the belt an exhaust hood is arranged to suck up paper and other light materials by air draught, and pass them through a screening device which serves to separate straw and dust etc. from the paper. The clean-dusted paper is baled, and sold for re-manufacture.

Near the end of the belt a rotating electro-magnet removes tins and scrap iron, and the refuse remaining on the belt passes to the destructor, which is specially designed to burn wet materials, of comparatively poor calorific value, without smoke or objectionable odour. The heat resulting from the combustion of the refuse is used to generate steam in water-tube boilers, and to prevent the forced draught used to facilitate incineration. The steam generated is always more than sufficient to provide all the power necessary for the operation of the plant, and, in addition, there is generally a large excess of heat available for use in any required manner.

The clinker produced by the incineration of the refuse is used in many places for concrete and ornamental cement work, for making and surfacing roads and foot-paths, and in certain classes of bricks. It has usually the composition: moisture and combustible 4.46%, silicious matter 55-65%, iron oxide and alumina 20%, CaO, P₂O₅, Mn₂O₃, ZnO, K₂O, Na₂O, SO₄, etc., 6-15%, MgO traces.

Results of introduction of separation-incineration method in Sydney

The use of this method in the treatment of Sydney refuse would result in the separation of 6116 tons of screenings and 5317 tons of saleable materials annually, and a consequent reduction in the quantity burnt of 11,433 tons. The refuse remaining to be incinerated would have the composition and fuel value shown in Table X.

Comparison with figures for the unsorted refuse shows that although the water content is increased by separation, the calorific value is unaffected, and the ash reduced. This reduction in ash, together with the reduction in the quantity burnt, means a total reduction of the clinker output from the destructor of 50% of the present figure.

TABLE X
Composition and proximate analyses of refuse after screening and removal of saleable materials

	%	Water %	Combustible %	Ash %	Calorific value B.Th.U. per lb.
Garbage	(69.88)	31.14	20.06	17.86	2095
Dirty paper	(21.77)	8.03	11.25	2.40	964
Combustible rubbish	(7.30)	0.80	5.09	0.81	330
Incombustible rubbish	(1.25)	—	—	1.25	—
	(100.00)	39.99	37.60	22.41	3380
(Cl. before sorting Table VI)		31.87	38.23	20.90	3368

The effect of the new method on costs may be briefly indicated thus:—

A reduction in the total quantity burnt of 33%.

Disposal of the screened and sorted material at an average cost per ton, equivalent to 16% of the present cost per ton of incineration.

Incineration of the remaining material at a rate 60% of the present cost per ton owing to increase of burning efficiency, and decrease of clinker output resulting from screening and sorting.

In concluding this paper, I wish to acknowledge my thanks to Mr. L. Stevenson, the City Cleansing Engineer, and to Mr. W. G. Layton, the Town Clerk, for permission to publish this work. I wish also to acknowledge my thanks to Mr. D. C. Archer, B.Sc., who, as my assistant, carried out a great deal of the analytical work.

City Cleansing Department, Sydney

THE ASSOCIATION OF BRITISH PAINT, COLOUR, AND VARNISH MANUFACTURERS

The laboratories of the Research Association of British Paint, Colour, and Varnish Manufacturers were officially opened at a luncheon held in the Clarence Hotel, Teddington, close to the laboratories, on September 21.

Mr. S. K. Thornley, chairman of the Research Association, presided, and amongst those present were: Sir Joseph Petavel, F.R.S., Sir Robert Robertson, F.R.S., Dr. E. F. Armstrong, F.R.S., Lt.-Col. Sir David Prain, F.R.S., Mr. H. T. Tizard, F.R.S., Mr. F. H. Carr, C.B.E., Mr. W. J. U. Woolcock, C.B.E., Mr. J. W. Bispham, Mr. Chatterton, Mr. C. F. A. Hare, Prof. J. W. Hinchley, Mr. Holmes, Mr. C. A. Klein, Prof. T. M. Lowry, F.R.S., Major C. A. Mander, Dr. S. Miall, Dr. H. H. Morgan, Dr. R. S. Morrell, Mr. Selby Wood, and Dr. Weidlein, and the director of research, Dr. L. A. Jordan.

After the loyal toast, Mr. F. H. Carr, C.B.E., President of the Society of Chemical Industry, proposed the toast of the Research Association. There were clear reasons why the paint and varnish industry, he said, must consider that it was a chemical industry, and he considered it a hopeful sign that the industry had shown their appreciation of that fact by establishing their own Research Association for the study and the application of scientific and chemical knowledge to their needs.

Dr. E. R. Weidlein, director of the Mellon Institute of Industrial Research, who seconded the toast, also emphasised the financial value of research, and, in referring

to his own Institute, said that the industries concerned paid \$700,000 a year in support of its work.

Dr. E. F. Armstrong, F.R.S., who said that, in the unavoidable absence of Sir Harry McGowan, he represented Imperial Chemical Industries, Ltd., supported the toast and referred to the importance of nitrocellulose lacquers and the need for the provision of British solvents at prices competitive with those of American products. As no cheap grain was available here, the solvents required would have to be made by synthetic processes from coal.

Mr. C. A. Klein, president of the Oil and Colour Chemists' Association, then proposed the toast of "The Guests," and Mr. W. J. U. Woolcock, C.B.E., general manager of the Association of British Chemical Manufacturers, replied.

The laboratories are installed in a two-storey brick building standing in grounds covering an acre. The chemical and physical laboratories occupy the upper floor, whilst the offices and rooms for technical work and small-scale plant etc. are below. Exhibits relating to the work of the Association were on view. Investigations on the refining of linseed oil, the blooming of varnish, and the question of weathering tests are amongst those in progress.

At the meeting of the Research Association which followed the luncheon, Mr. S. K. Thornley was elected president, and Mr. C. F. A. Hare and Dr. H. H. Morgan were elected vice-presidents.

CANADIAN INDUSTRIAL NOTES

The Dominion Steel Corporation, one of the main components of the British Empire Steel Co., of Nova Scotia, has been ordered into liquidation by a Nova Scotia court. The liquidation proceedings were most strenuously opposed by the president and officials of the "Besco," as it can be interpreted as the process of winding up the latter company, the largest individual organisation in the Maritime Provinces. An appeal against the judgment will be made. The press of the Dominion is, in many instances, most outspoken in regard to the condition of affairs existing, and state "the record of the Nova Scotia coal and steel development is a rather sorry story. In looking back over the situation, the thought recurs that the failure of the Nova Scotia industry to make good has been due to bad management more than anything else." The consensus of opinion, expressed by those familiar with conditions of affairs for the past 30 years, is in agreement with the above editorial comment of a leading Canadian newspaper.

The new oil, fish meal and fertiliser works of the Pender Island Fish Products Co., Ltd., Shingle Bay, B.C., is operating. The raw material is dog fish and offal from the salmon canneries of the Fraser River.

The Canadian Vegetable Oils, Ltd., Vancouver, B.C., will build an oil extraction works at Port Mann, B.C.

A beet sugar factory may be established in the province of Quebec by British interests. Sir George Courthope recently visited Quebec and interviewed Hon. J. E. Caron, provincial Minister of Agriculture, regarding the possibility of locating the factory in Quebec.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, is now ready.

The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

CHEMICAL SOCIETY'S LIBRARY

Members of the Society of Chemical Industry are reminded that they are entitled to consult the Library of the Chemical Society, Burlington House, Piccadilly, W.1, and to borrow books therefrom.

The Library is open daily from 10 a.m. to 9 p.m. Saturdays from 10 a.m. to 5 p.m. The Library is closed on Bank Holidays, the day following, and on other such occasions as the Council may direct.

ROTHAMSTED LIBRARY

By the courtesy of the Lawes Agricultural Trust, any member of the Society of Chemical Industry, on presenting a card from the General Secretary, shall be allowed access to this Library. The rules of the Library preclude journals and periodicals from being sent out, and these are, therefore, always accessible.

A catalogue of the journals and periodicals is in the Society's Offices at Central House, and may be consulted there by members.

BRISTOL SECTION

The 1927-1928 session of the Bristol Section opens on October 6 with an address by the President of the Society, Mr. F. H. Carr, C.B.E., on "Vitamins in relation to chemistry and medicine." On November 3 Mr. H. H. S. Clotworthy will describe the "Manufacture of viscose artificial silk," and on December 1 Dr. C. H. Lander, the Director of Fuel Research, will address a joint meeting with the Fuel Section on the subject of "Low temperature carbonsation." The subject on January 5, 1928, will be "The catalytic oxidation of aromatic hydrocarbons and their derivatives by means of air," and will be delivered by Dr. E. B. Maxted before a joint meeting with the Chemical Society. On February 2 a paper will be given by Dr. Morris W. Travers, F.R.S., and the session will close with the Annual Meeting on March 1, when Mr. T. Penny will give a paper on "The art of soap manufacture."

CALENDAR OF FORTHCOMING EVENTS

Oct. 3.—SOCIETY OF CHEMICAL INDUSTRY, *London Section. Ordinary Meeting*, at the Royal Society of Arts, John Street, Adelphi, W.C.2, at 8 p.m. "The gas industry, past, present and future," by W. J. A. Butterfield.

Oct. 3.—SOCIETY OF ENGINEERS, *Ordinary Meeting*. Apartments of the Geological Society, Burlington House, Piccadilly, W.1, at 6 p.m. "The lead electric accumulator in practice," by R. C. Hall.

Oct. 4.—INSTITUTE OF METALS, *North-East Coast Local Section*. Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne, at 7.30 p.m. Chairman's address, by H. Dunford Smith.

Oct. 5.—INSTITUTION OF SANITARY ENGINEERS. Opening Sessional Meeting.

Oct. 5.—SOCIETY OF PUBLIC ANALYSTS, Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. (1) "Oil of *Centrophorus granulatus*," by A. Chaston Chapman. (2) "Investigations into the analytical chemistry of tantalum, niobium, and their mineral associates, IX. The separation of titanium from tantalum and niobium," by Dr. W. R. Schoeller and E. C. Deering. (3) "Determination of aldose sugars by means of chloramine-T, with special reference to the analysis of milk products," by C. L. Hinton and T. Macara. Informal dinner at 6.30 p.m., at St. James's Restaurant, 178, Piccadilly, W.

Oct. 6.—SOCIETY OF CHEMICAL INDUSTRY, *Bristol Section*. The University, Woodland Road, Bristol, at 7.30 p.m. "Vitamins in relation to chemistry and medicine," by the President of the Society, Mr. F. H. Carr, C.B.E. Members of the Institute of Chemistry and fellows of the Chemical Society are cordially invited to attend.

Oct. 7.—SOCIETY OF CHEMICAL INDUSTRY, *Manchester Section*. Chairman's address, by C. J. T. Cronshaw.

Oct. 8.—BIOCHEMICAL SOCIETY. Meeting at Cambridge.

Oct. 8.—WESTERN JUNIOR GAS ASSOCIATION. "Some problems of the near future," by Dr. M. W. Travers.

Oct. 10.—INSTITUTE OF BREWING, *London Section*, Engineers' Club, Coventry Street, Piccadilly, W. Discussion on season's malts (made from 1926 barleys).

Oct. 10.—SIR JOHN CASS TECHNICAL INSTITUTE, Jewry Street, Aldgate, E.C.3, at 8 p.m. Inaugural ceremony.

Oct. 10.—INSTITUTE OF METALS, *Scottish Local Section*. 39, Elmbank Crescent, Glasgow, at 7.30 p.m. Chairman's address by S. E. Flack.

Oct. 11.—INSTITUTION OF PETROLEUM TECHNOLOGISTS. General Meeting. House of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m.

Oct. 12.—INSTITUTION OF THE RUBBER INDUSTRY, *London and District Section*, Engineers' Club, Coventry Street, W.1. "Coagulation, structure and plasticity of crude rubber," by Dr. O. de Vries.

Oct. 12.—OIL AND COLOUR CHEMISTS' ASSOCIATION, Rooms of the Royal Society of Arts, 18, John Street, Adelphi, W.C.2, at 8 p.m. Discussion on "Colour standardisation and testing in the paint and colour industry."

Oct. 12.—INSTITUTE OF METALS, *Swansea Local Section*. Thomas' Cafe, High Street, Swansea, at 7.0 p.m. Chairman's address by Capt. L. Taverner.

Oct. 13.—INSTITUTE OF METALS, *London Local Section*. Rooms of the Society of Motor Manufacturers & Traders, Ltd., 83, Pall Mall, S.W.1, at 7.30 p.m. Chairman's address on "Works' economics," by A. H. Munday.

Oct. 13.—INSTITUTION OF THE RUBBER INDUSTRY, *Birmingham and District Section*, Grand Hotel, Birmingham. "Selling," by A. E. Hemsworth.

Oct. 14.—SOCIETY OF CHEMICAL INDUSTRY, *Chemical Engineering Group*, Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "A recent development of spray drying," by J. Arthur Reavell. During the same afternoon a visit will be paid to the Kestner Experimental Works at Camberwell, where a machine of the type to be described in the evening will be seen at work.

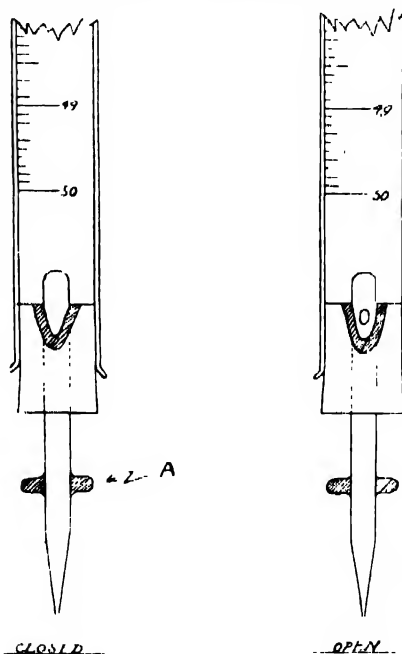
CORRESPONDENCE

UTILISING A BROKEN BURETTE

SIR,—The following application of an old idea has, perhaps, the merit of novelty, and may be of use to teachers and students engaged in volumetric work.

Should the tap of a burette get broken, the burette can be made serviceable again by cutting off the end, flaring it and inserting a rubber stopper cut off at an angle, carrying a jet of the shape shown in the sketch.

The jet should turn fairly easily in the stopper whilst still being watertight (this can be secured by slightly greasing the tube with vaseline and a proper choice of



size of tube), but the stopper itself should be a tight fit in the burette in order not to turn when the jet is turned.

The ring marked A is for convenience in turning, and is made by the usual plan of thickening the glass tube.

The device is within the capacity of elementary students to make and fit, and is more convenient than the usual pinchcock and rubber tube, having the advantage of being rigid to work with and not tending to hold air bubbles; moreover, it is fully as sensitive as a stopcock in delivery.

I am,

Yours faithfully,

Chemistry Department,
Technical College, Huddersfield

A. O. JONES

THE PROFESSION OF CHEMISTRY

SIR,—The Journal of the Institute of Chemistry announces that the revised edition of *The Profession of Chemistry* will be sent to persons enquiring for the Regulations "in order that they may be more fully informed as to the profession which they propose to follow."

For the benefit of these a quotation from the list of appointments recently sent out by the Institute may be of interest:—"Experienced, well-qualified analytical chemist required. Candidates must hold a good degree

and have had at least five years' post-graduate analytical experience in some branch other than food and drugs. They must be under 30 years of age, and will have to pass a doctor. Post subject to three months' probation ———."

Here we see the reward that awaits our professional chemist after years of unremunerative study and post-graduate work. He may go for an interview (at his own expense), and if five years of analytical work have left him with unimpaired strength he may "pass the doctor" and be appointed. Then (when the search for lodgings is ended) he settles down to enjoy the mild delight which his new-found wealth provides, for it should be noted that in view of the exacting conditions, the salary for this appointment is £275 to £325 according to qualifications. (In any profession it would be at least treble.) After three months (when the problem may be solved) our professional chemist (with his family, if he has one) may be precipitated into the cold, hard world. But surely it has been worth while. For a brief period of his life a professional chemist has enjoyed a salary equal to that of a foreman, a joiner, or a very junior commercial traveller.

The Times recently had an advertisement for a man to look after swine—at a salary of £400.

Yours faithfully,

"STILL IN IT"

PATENTS AND TRADE MARKS IN THE IRISH FREE STATE

SIR,—The new Industrial Property Act of the Irish Free State comes into force on October 1, as regards patents, designs, and trade marks. Although a period of six months is allowed for taking steps to register rights under existing British patents, it appears probable that this period of grace applies only to the payment of the first fee, and there are many cases in which a renewal fee for a further year will have become due long before this period expires. In such cases the only safe course is to take steps at once to register the patent rights in Dublin, so that any further steps necessary to maintain the rights can be taken in good time.

Holders of British patents, designs, and trade marks who contemplate protecting their interests in the Irish Free State under the new Act will be well advised to communicate promptly with their patent agents in order to ensure that no necessary precautions are overlooked.

A notice as to the coming into force of the Irish Industrial Property Act appears in this week's "Official Journal of Patents."

Yours faithfully,

H. THOMPSON,
Secretary and Registrar,

The Chartered Institute of Patent Agents
Staple Inn Buildings, W.C.1

PERSONAL AND OTHER ITEMS

H.R.H. the Prince of Wales has graciously consented to give his name as a Patron to the Jubilee celebrations of the Institute of Chemistry, which will be held in London from December 14—16, 1927.

The Prince and Princess Ri of Japan, who are on tour in this country, recently visited the East Hecla works of Messrs. Hadfields, Ltd., where they witnessed demonstrations of the Hadfield special "Resistor" bullet-proof steel and inspected exhibits of "Era" steel, projectiles, trackwork, crushing machinery, and other well-known products of the firm.

Sir Alfred Mond will speak before the London Publicity Club on October 10, his subject being "The general industrial outlook and advertising."

Viscount Leverhulme has left England in the *s.s. Arundel Castle* for Natal.

Prof. J. Kenner, F.R.S., professor of organic chemistry in the University of Sydney since 1924, and a well-known worker in the field of stereochemistry, has been appointed to the chair of technological chemistry in the University of Manchester and the Manchester College of Technology, in succession to Prof. F. L. Pyman, F.R.S., who has been appointed head of the research department of Messrs. Boots, Ltd., Nottingham.

Mr. C. E. Mullin, author of "Acetate silk and its dyes," has been appointed head of the Department of Textile Chemistry and Dyeing at Clemson College, South Carolina, U.S.A. Prof. Mullin extends a cordial invitation to all textile technologists to visit Clemson College during the coming year. The United States Government operates a Cotton Testing Station, under the direction of Dr. H. H. Willis, at the college, and some very interesting data are available upon cotton.

Recent promotions in the French order of the Legion of Honour include the names of Prof. H. Le Chatelier, who becomes a Grand-Officier, and of M. H. Pilon, managing director of the Etabl. Gaiffe-Gallot et Pilon, M. Shur, director of the Cie des Produits Chimiques Alais Froges et Camargue, and M. P. Gounod, vice-president of the Union des Industries Chimiques, who become Chevaliers.

We regret to announce the death, at the age of 80, of Prof. A. Liversidge, F.R.S., the distinguished chemist. He occupied the chair of chemistry and mineralogy in the University of Sydney, New South Wales, from 1872 until 1907, when he retired with the title of Emeritus Professor. An original member of the Society of Chemical Industry, he founded the Sydney Section of the Society in 1902, and served as a vice-president of the Society from 1909 to 1912. He published a great many scientific papers and gave valuable service to science in Australia.

The death is announced of Mr. N. B. Gregg, vice-president of the National Lead Company (U.S.A.) and a prominent figure in the American paint and varnish industry. He took an important part in the development of the manufacture of lead products, titanium oxide and barytes by his company, and had an intimate and wide knowledge of the problems of the industry.

The late Mr. A. G. M. Jack, C.B.E., J.P., lately deputy chairman of Hadfields, Ltd., left £108,540, with net personalty £106,527.

The late Mr. J. Hedley, for many years manager of the Muspratt Works of the United Alkali Co., left £13,007, with net personalty £11,393.

The late Mr. J. J. Wooler, a director of the Bleachers' Association, left £114,503, with net personalty £102,612.

The late Mr. G. Randall, J.P., a director of several leather and tanning companies, left £99,198.

The Gas Industry: Past, Present and Future

The inaugural address, on October 3, by the Chairman of the London Section, Mr. W. J. A. Butterfield, M.A., F.I.C., one of the Gas Referees appointed by the Board of Trade, will direct attention to the following points:—

The relative status of the gas industry among public utility services. Gas supply is fundamentally a chemical industry. The inception, development and present position of the gas industry, and the transition from a photometric to a thermal standard. Latitude given by, and performance under, the Gas Regulation Act. Record of the gas industry through the industrial troubles of 1926. The trend of future developments in gas supply.

Spray Drying

A paper of considerable interest is to be delivered before the Chemical Engineering Group on October 14 by Mr. J. Arthur Reavell, who will describe a recent development of spray drying. In the afternoon preceding the meeting a visit will be paid to the Kestner Experimental Works at Camberwell, where a machine of the type to be described in the evening will be seen at work. As this installation is working in connexion with the Merril oil heating process, the visit will prove of further interest to those not familiar with this form of heating. Members desirous of making this visit are requested to notify Mr. H. J. Pooley, the Hon. Secretary of the Group, not later than October 7 (cf. Forthcoming Events, p. 882).

Fusion of Margarine Companies

It is announced that an important international syndicate has acquired the controlling interest in both the Jurgens and Van den Bergh undertakings in all countries. The full individuality of each concern will be maintained, but they will act in close co-operation. The authorised capital of Jurgens, Ltd., which is the English subsidiary of the Dutch company, Anton Jurgens United Margarine Works, is £10,000,000, of which £5,000,000 is issued. Van den Berghs has an issued capital of £3,575,000.

Shale-Oil Industry in New South Wales

After several years spent in the effort to revive the shale oil industry at Newnes, N.S. Wales, the Commonwealth Oil Corporation has decided to abandon its project and dispose of its assets. Although the Newnes shale yields a high percentage of oil, it has not been possible to find a way of working the deposits economically, despite the expenditure of a million and a half sterling. This failure is attributed partly to foreign competition, partly, it is stated (*Ind. Austr.*, Aug. 11, 1927), to labour and industrial conditions.

Chemical Congress in Paris

The Seventh Congress of Industrial Chemistry will be held in Paris from October 16 to 22, at the Rooms of the Société des Ingénieurs Civils. Two days of the congress will be devoted to organic industries and to agriculture and agricultural industries, respectively, and the meetings will close with visits to works in the neighbourhood of Paris.

Phosphatic Fertilisers in France in 1926

During 1926, Morocco exported 885,720 metric tons (721,228 m.t. in 1925) of phosphates; Tunis, 2,815,000 m.t. (2,562,000 m.t. in 1925); and Algeria, 614,000 m.t. (770,065 m.t. in 1925). Of the total imports of phosphate into France, some 160,000—180,000 m.t. is used directly in agriculture, the rest being used for the manufacture of superphosphate. The output of superphosphates increased from 2,380,000 m.t. in 1925, to 2,430,000 m.t. in 1926, exports rose from 229,000 m.t. to 253,000 m.t., and the home consumption remained at about 2,110,000 m.t., which compares with a world consumption estimated at 13,000,000 m.t. Basic slag was produced to the extent of 1,224,412 m.t., compared with 1,090,000 m.t. in Germany; Belgium, 440,000 m.t.; and the Saar, 298,000 m.t. The French consumption of basic slag was 700,000 m.t., and the export (including exports from the Saar) 819,000 tons in 1926. Altogether, about 130,000 m.t. of phosphoric acid was available for French consumption. Good results are anticipated from the "Office de Répartition des Scories," founded in 1926 to regulate the trade in basic slag and to carry out propaganda for its use.

Chemical Industry in Italy

Synthetic indigotin is now being made in Italy by the Fabbria Coloranti Bonelli, at its Cesano Maderno works, which have an annual capacity of 1.5 million kg. of 20% paste. The Italian consumption of indigo is about 600 metric tons a year.

Synthetic Ammonia in France

The synthetic ammonia plant installed at Toulouse in an old State powder factory is now producing at the rate of 50 metric tons of ammonium sulphate a day. It is hoped that by the end of 1928 the annual output will be 150,000 m.t.

Activated Carbon

According to a report from the U.S. Department of Commerce, an American corporation has contracted with the I. G. Farbenindustrie A.-G., the Metallbank & Metallurgische Gesellschaft, Frankfurt-am-Main, and the Aussiger Verein (Czechoslovakia) to exploit German patents on activated carbon in the United States. The French Société de Charbons Actives Urbain has acquired rights in German patents for exploitation in Europe outside of Germany. The Verein für Chemische Industrie, Frankfurt-am-Main, recently entered into an agreement with the Dutch Algemeene Norit Maatschappij on activated carbon. Extension of the number of products is hoped to offset partially the business lost through the competition encountered from synthetic methanol.

Tung Oil from Florida

In connexion with the experimental plantations of the tung tree, which were established some years ago in Florida, the U.S. Dept. of Commerce (Chemical Division) reports that the first experimental crop of tung (Chinese wood) oil has produced a liquid of clearer and brighter colour than the Chinese oil, and it is considered that domestic planting may result in the production of a superior grade of oil, particularly as the tree seems to thrive in certain climates in the United States.

Acetaldehyde and its Derivatives in American Industry

The Rubber Service Laboratories Co., of Ohio, is making acetaldehyde in bulk from acetylene in presence of a mercury catalyst under patents held by the Chemical Foundation. The polymer paraldehyde is prepared, as is aldol in various grades. From aldol the company produces crotonaldehyde, which is used, like acetaldehyde, in making certain rubber accelerators and dyes, whilst the aldol is used as a foaming agent in the flotation of minerals.

United States Mineral Output in 1926

The mineral output of the United States in 1926 was the largest, measured by value (\$6,262,000,000), recorded since 1920, but as prices have decreased, the output represents a considerable advance, being 10% more than in 1925. There was a new record in the output of petroleum, and though there was only a small increase in the value of the metal output, there was a record production of lead and zinc. Production of mercury, antimony, manganese and other metals decreased, imports rising, but there was little change in the value or quantity of the output of aluminium. Non-metallic minerals showed a slight decline, the decline in clay being compensated by an increase in the output of felspar, small increases being shown in various industrial minerals, fertilisers and so on.

Beryllium in Germany

Much interest has been shown in Germany in the properties of beryllium, and in 1923 a society was founded for the study of the metal with a view to its technical utilisation. At present the electro-chemical section of the Siemens and Halske concern is producing 120 grams of the metal a day in an experimental plant. The price has consequently fallen from 200 marks to 6 marks per gram. Beryllium yields a number of interesting alloys, and is used in Röntgen-ray work and in electrical apparatus, and various technical developments would follow if the metal could be obtained in quantity at a suitable price.

Artificial Silk in Greece

Artificial silk is already made in Greece by one company which utilises the cuprammonium process, and intends to increase its output from 200 to 1000 kg. daily. Another company has now been founded to manufacture cellulose acetate silk.

The Swedish Match Trust

It is reported that the Swedish Match Trust has offered to take over the Estonian match monopoly, guaranteeing the Government a yearly income of 60,000,000 Estonian marks. One third of the world's total trade in matches is estimated, on a conservative basis, to be controlled by the Trust. It controls the International Match Co., which was formed to acquire from the parent and other companies the greater part of the entire capital stocks of concerns owning 90 match-making plants in various European and other countries. The production of the International Match is over ten billion boxes of matches annually. The extent of the Swedish Match Trust participation in other enterprises is shown by the figure \$182,687,858 out of total assets of \$391,593,091.

Third Census of Production (1924)—Starch, Blue and Polishes Trades

Below are given particulars of the output in the above trades during 1907 and 1924. The figures for 1924 relate to Great Britain, while those for 1907 are inclusive of establishments in Ireland. The value of the output of the latter was, however, less than 1% of the aggregate shown for the United Kingdom as a whole:—

Products	1924		1907	
	Quantity Cwts.	Selling Value £	Quantity Cwts.	Selling Value £
Starch	461,100	903,000	Not separately recorded	
Dextrine and Farina and potato flour	39,000	56,000		
Other Farinaceous products (including mustard) ..	457,000	1,717,000		
Total (Farinaceous products)	957,100	2,676,000	1,250,000	1,658,000
Trade and household articles for cleansing and polishing (except soap):—			Not separately recorded	
Leather polishes	485,700	2,005,000		
Stove and other polishes ..	598,200	3,055,000		
Other cleansing and polishing articles	--	1,302,000		
Total (cleansing and polishing articles)		6,362,000		2,441,000
Other products		267,000		210,000
Total value ..		9,305,000		4,309,000

In addition to the output of 1,250,000 cwt. of farinaceous products returned in 1907, there were returned on schedules for other trades 566,000 cwt. of similar products valued at £398,000, and a similar large addition will probably have to be made for 1924. A further output of prepared food for infants and invalids was recorded in 1907, the value being £626,000, and the output of such foods in 1924 will have to be brought under review at a later stage. A heavy decline occurred in the output of farinaceous products, the 1924 quantity being less by over 23% than that shown for 1907. No quantitative comparison is possible in the case of cleansing and polishing articles, but the values shown for the two years suggest that the output in 1924 was substantially in excess of that of the earlier year.

Exports of rice starch and other kinds of starch in 1924 amounted to 28,900 cwt., valued at £67,000, and of dextrine and farina and potato flour to 9800 cwt., valued at £18,000, the quantities exported forming about 6% and 25% respectively of the amounts shown as produced during the year. Net imports of rice and other starch in 1924 were 2,005,600 cwt., valued at £1,683,000, and of dextrine and farina and potato flour 798,100 cwt., valued at £737,000.

Of the total quantity of leather polishes produced in 1924 (486,000 cwt.) 81,700 cwt., or about 17%, was exported, the value of exported leather polishes being £497,000. The quantity of stove and other polishes exported was 108,300 cwt., about 18% of the year's production; exports were valued at £538,000, or about £4 19s. per cwt., the average of all such polishes manufactured being about £5 2s. Net imports of polishes of all kinds during 1924 amounted to only 10,600 cwt.

The net output of the factories and workshops in these trades in 1924 was £4,891,000. The net output per head of persons employed during 1924 was £419;

and in 1907 £174. The average number of persons employed at factories and workshops engaged in the industry was in 1924, 11,663, compared with 11,618 in 1907. The total capacity of engines at the factories in 1924 was shown as 8103 h.p., one third of which was in reserve or idle during the year. The 1907 capacity amounted to 9228 h.p. The capacity of electric motors at factories was not ascertained in 1907, but in 1924 motors aggregating 7117 h.p., driven by purchased electricity, were included in the returns. Nearly 13% of the capacity of these motors was shown as in reserve or idle during the year. The capacity of electric generators at factories was given as 402 kw. in 1924, and 970 kw. in 1907.

Third Census of Production (1924) Fertiliser, Glue, Sheep Dip and Disinfectant Trades

Particulars of production in the years 1924 and 1907 in the above trades are given in the table below:—

Products	1924		1907	
	Quantity Tons	Value £	Quantity Tons	Selling Value £
Manures				
Basic slag	96,000	165,000	203,000	277,000
Superphosphates	196,000	560,000	438,000	924,000
Sulphate of ammonia	5,000	57,000	1,000	13,000
Guano, manufactured and compound manures (including bonemeal and other manufactured fertilisers)	101,000	2,601,000	306,000	1,838,000
Total manures	698,000	3,380,000	1,038,000	3,052,000
Sulphuric acid	113,000 Cwts.	296,000	67,000*	94,000*
Glue and size	513,000	812,000	645,000*	573,000*
Gelatin	34,000	201,000		
Animal fat, not refined				
Tallow	6,000 Tons	201,000	18,000	460,000
Other sorts	19,000	650,000		
Bones for manufacturing putty	11,000	86,000		
Bone by-products not included elsewhere	†	32,000	†	105,000*
Disinfectants, insecticides, weedkillers and sheep and cattle dressings	656,000 Cwts.	1,662,000		503,000
Animal foods --				
Oil seed cake	300 Tons	3,000		
Other feeding stuffs				
Sweetened (i.e., containing molasses)	1,000	15,000		211,000*
Not sweetened	18,000	223,000		
All other products		412,000		275,000
Total value		7,982,000		5,308,000

* In order to avoid the possible disclosure of the business of particular firms, the amounts shown in respect of these items are inclusive of the production of factories and workshops in Ireland. The total value so included was £55,000, and this sum has been excluded from the total value of the output shown for the year 1907.

† Recorded by value only

Added to the quantity shown in the table above, the total make of basic slag manure in 1924 was 357,700 tons, an increase of more than 48% over the 1907 production. The output of sulphate of ammonia shown in the above table represents only a fraction of the entire production in Great Britain. Final figures will not be available until the quantities produced by gas undertakings and other works engaged in the recovery of coal tar by-products have been ascertained. In the cases also of sulphuric acid and animal foods the amounts indicated above form only a small part of the aggregate output in Great Britain.

In the 1907 Census between one seventh and one eighth of the output of superphosphates, over one fifth of the total value of all disinfectants, insecticides,

weedkillers, and sheep and cattle dressings, nearly one half of the aggregate production of bones and bone by-products, one eighth of all glue, size and gelatin, and about one tenth of all compound manures produced were returned on schedules other than those for the trades now under review.

The decline recorded in the production of superphosphates in 1924 amounted to 55% compared with the output in 1907, and the quantity of glue, size and gelatin in 1924 was less by about 15% than in 1907. A decline is also indicated in the bones and bone by-products output, for which no quantitative measurement was obtainable in 1907. The production of compound manures on the other hand shows a slight increase, and the comparative values of disinfectants, insecticides, weedkillers, and sheep and cattle dressings made in the two years also indicate an increased production in 1924.

Exports of the main products of these trades were valued at £2,146,000 in 1924, and imports during the same period at £1,331,000. The net output per head of persons employed during 1924 was £227, and in 1907 £154. The net output of the factories and workshops in these trades in 1924 was £2,340,000. The average number of persons employed during 1924 was 10,323, compared with 11,174 in 1907. The total capacity of engines at the factories in 1924 was shown as 16,180 h.p., a little over 23% of this total being idle or in reserve during the year. The capacity returned in 1907 was 20,141 h.p. The capacity of electric motors at factories was not ascertained in 1907, but in 1924 motors aggregating 19,668 h.p., driven by purchased electricity, were included in the returns. Slightly over 9% of the capacity of these motors was shown as in reserve or idle during the year. The capacity of electric generators at factories for 1924 was 3528 kw., and 870 kw. in 1907.

Acquisition of Finnish Chemical Works

It is announced that the oil and chemical works of Richard Meyer, of Reval, comprising 29 different industrial branches with 80 factories, has been purchased by an international syndicate comprising English, French, and Scandinavian interests.

Swiss Exports of Dyes

During 1926 Switzerland exported 5,936,000 kg. of synthetic dyestuffs, an increase of 21% compared with 1915. Germany took 14% and the United States 12% of the total exports.

Barium Products in the U.S.A.

The U.S. Bureau of Mines reports that in 1926 sales of crude barytes rose by 2% to 232,875 short tons (\$1,743,293). Sales of lithopone, ground barytes, and barium chemicals were 159,931 s.t., 52,964 s.t., and 21,911 s.t., representing increases of 10%, 7%, and 17% in quantity, respectively.

An Enquiry

A correspondent wishes to learn of sources of synthetic bitumen. Replies should be addressed to the Editor, CHEMISTRY & INDUSTRY, Central House, Finsbury Square, London, E.C.2.

We have to thank those correspondents who wrote regarding sources of pectin.

REVIEWS

TROCKENTECHNIK. GRUNDLAGEN, BERECHNUNG, AUSFÜHRUNG UND BETRIEB DER TROCKENEINRICHTUNGEN. By M. HIRSCH. Pp. xiv + 366. Berlin : Julius Springer, 1927. Price 31.80 r.m.

The author of this book in his preface sets out to present the reader with a complete and scientific study of drying apparatus; and it must be admitted that, if he has fallen short of his intention, he has made a bold and useful attempt to fulfil his promise in so far as air-drying plants are concerned.

The first 230 pages are occupied by a patient and logical although somewhat laborious development of the theory of air drying. This portion of the book is worth careful study, as the author does something more than merely attempt to baffle the reader with endless arithmetical calculations, but introduces the factors of heat transfer and the hygroscopic properties of the material under treatment in interesting ways. Diagrams are given which enable problems to be solved graphically, and the most important of these, drawn to a large scale, are provided in a pocket at the end of the book together with special paper protractors which are required.

The fundamental diagram employed is that devised by Mollier (*Z.d.V.d.I.*, Sept. 8, 1923), in which the thermal properties of moist air can be conveniently shown. The diagrams employed hitherto have been perhaps less bewildering, and have chiefly shown heat content of moist air plotted against temperature using rectangular co-ordinates: for example Reyscher's book: "Die Lehre vom Trocknen" was based upon a diagram of this kind originally proposed by O. H. Müller. The Mollier diagram, however, shows heat content plotted against humidity and oblique co-ordinates are used. Practically all the thermal data required can thus be obtained into the charts.

The thermal exchanges between the air and the moist material are discussed at length and the notion of "drying potential" is introduced and methods are given whereby the hygroscopic properties of the material can be taken into account in the calculations. Counter current and parallel flow systems are critically discussed and methods are indicated whereby the essential factors in a drying process can be traced out.

The second part of the book is descriptive in character, being made up chiefly from information supplied by makers of drying machinery. This section contains many illustrations of typical plants. The major portion of this section is classified under the headings of materials treated—a very useful arrangement, but hardly in keeping with the systematic character of the remainder of the book. A short description is also given of the instruments available for the control of drying plants.

The two sections of the book seem to be somewhat independent of each other, and after laboriously wading through the first section one is left with the feeling that the scientific treatment should have been carried through into the second section. It must be admitted, however, that in the present state of knowledge, although it is possible to trace many of the physical transformations

which take place in a drying apparatus, the theoretical study of such plants is at present only of value in so far as it indicates "how things vary" and by reason of the critical power imparted. Before theories can lead to a strictly scientific and quantitative basis for design, it will be necessary to apply them to the analysis of the performances of varying types of existing drying plants. The book contains some numerical examples which are most useful from this point of view.

This book demands very careful study, and by no stretch of the imagination could it be regarded as light reading, but it is a serious contribution to chemical engineering literature and one of the best books on drying which has yet appeared. HUGH GRIFFITHS

DAS KIESELSÄUREGEL UND DIE BLEICHERDEN. By Dr. OSCAR KAUSCH. Pp. 292. Berlin : Julius Springer, 1927. Price 29 r.m.

Those who read card indexes read for a specific purpose rather than for general instruction or enjoyment. Dr. Kausch's book is not for the leisure hours of the general reader. It would be of great value to anyone preparing a case for a patent suit. As a review, or rather a series of extracts from the literature and trade bulletins dealing with silica gel and the refining earths, it is excellent and complete. The author does not claim actual experience of the substances with which he deals, and it is apparent that his interest is mainly a documentary one. It is none the less valuable. The fact that he is a leading official in the German Patent Office explains his view-point, and at the same time guarantees that his documentation is thoroughly done.

Silica gel and the refining earths fuller's earth, Florida earth, Death Valley clay, magnesium hydro-silicate and the rest—are substances of great and increasing industrial importance, whose value lies in their peculiar physical structure rather than in their chemical composition. They are substances of ultra-porosity and extreme surface, properties which make them valuable for the recovery of gases and vapours, the refining of mineral and vegetable oils, for pharmaceutical and medical purposes, and as catalysts or carriers of catalysts. The refining earths are natural products, and have therefore less standardised properties than the artificial silica gel; their use is also confined chiefly to the refining of oils. The possible applications of silica gel seem almost unlimited, but at present their development is in its infancy. English readers will perhaps be most interested in its use for the commercial drying of gases, since the first plant on a large scale for the drying of the air blast to blast-furnaces has recently been put into successful operation in Scotland.

The book is complete and accurate as a record of what has been published and patented under the heading of its title. It would have been of greater value had it been more critical, and have given a juster impression to the general reader had it mentioned the existence and compared the merits of rival processes. However, such was not the plan of the author, and his book will be most useful to those who have or anticipate dealings with these interesting products. E. C. W.

COMPANY NEWS

BRITISH DRUG HOUSES, LTD.

The usual quarterly dividend of $1\frac{1}{4}\%$ has been declared on the preference shares, payable on September 30.

BRITISH CYANIDES, LTD.

The report for fourteen months ended June 30, 1927, states that the scheme for the reduction of capital was duly confirmed by the High Court on March 8 last. The new issue of shares was subsequently offered to shareholders, and 273,989 were subscribed. As this was less than half of the number of shares offered, the underwriters were called upon to take up the full number underwritten, so that a total number of 946,827 new ordinary shares have been subscribed. Up to June 30 last 14,920 preference shares of 2s. each have been converted into ordinary shares at the request of the holders. Colonel J. Josselyn, C.M.G., and Mr. B. Fairfax Comgrave have been appointed directors under agreement with the Rock Investment Co., Ltd. The accounts show a loss to date, after special writings-off on reduction of capital, of £946, compared with a loss on trading for the previous year of £23,833, and a total debit balance at April 30, 1926, of £101,083.

ENGLISH CHINA CLAYS, LTD.

A dividend has been declared on the ordinary shares at $3\frac{1}{2}\%$ per annum for the half-year ended June 30, 1927.

EVANS, SONS, LESCHER AND WEBB, LTD.

A dividend of $6\frac{1}{2}\%$ has been declared on the cumulative preference shares for the period July 31, 1926, to December 31, 1926, less tax, payable on October 6.

GLENBOIG UNION FIRE-CLAY CO., LTD.

A dividend has been recommended of 10% for the year, less tax, compared with $17\frac{1}{2}\%$ for last year.

EASTWOODS CEMENT CO., LTD.

The second ordinary general meeting was held on September 20, the chairman, Mr. Horace Boot, presiding. One kiln with a capacity of 50,000 to 60,000 tons of cement per annum had been working since July on trial tests making cement, and would be officially opened at the end of October. Several thousands of tons of cement had been made of a quality superior to the British standard specification, and a number of sales at market prices had taken place. The effect of the general and coal strikes postponed the date for reaching the production stage by several months. The company had given its contracts for the plant and machinery to only first-class British manufacturers. The profit and loss account showed an excess of income over expenditure of £1602, which with £652 brought forward from last year, made a surplus of £2255. The overhead expenses would always be small owing to the close relationship with Eastwoods, Ltd., which gave them the use of their head office premises and the benefit of the services of their staff. When their works were completed, the company would have some of the finest machinery and plant obtainable, and in spite of this the capital cost per ton of cement output would be one of the lowest, if not the lowest, in the kingdom. All the machinery was driven by electricity generated in the company's own power station. The recent heavy drop in the selling price of

cement would affect their profits, although, with their modern plant, it left a fair margin, which was not so with some of their competitors.

BROKEN HILL PROPRIETARY CO., LTD.

The report for the year ended May 31, 1927, states that the coal strike in existence at the close of the previous year continued for the first few weeks of the current period, the effect, however, being counterbalanced to some extent by the coal strike in England which, for a while, restricted importations of certain materials. The British works had now rapidly overcome their back orders, so much so that they were able to quote for immediate delivery. Lower prices were being quoted, consequent on cheaper coal combined with pressure from low-wage Continental countries. The principal improvement made during the year was the electrification of the 8-in. mill, whilst the construction of an additional furnace in the open hearth department and a second open hearth furnace at the steel foundry was also commenced. The following figures show the output compared with the 1925-1926 figures, which are given in brackets:—*Fig.* iron, 343,801 tons (333,025 tons); steel ingots, 353,682 tons, including foundry open hearth furnace (323,518 tons); coke, 350,865 tons (326,127 tons); sulphate of ammonia, 4962 tons (4883 tons). The output of ore from the Broken Hill mine during 1926-27 amounted to 178,887 tons, the highest since 1917, when the output was 214,198 tons. The net profit for the year under review was £291,577, after allowing a total depreciation of £318,979. The increased output at Broken Hill, with improved metallurgical results, have been a valuable offset to the decline in price of lead and silver as compared with the previous period. Since the close of the year the metals have continued to fall very rapidly, making it increasingly difficult to carry on at present prices.

DOMINION TAR AND CHEMICAL CO., LTD.

An interim dividend has been declared for 1927 of $5\frac{1}{2}\%$ (subject to tax at 2s. 6d.) on the ordinary shares, being the same as for last year.

EASTWOODS, LTD.

The seventh ordinary general meeting was held on September 8, Sir T. Cato Worsfold, Bt., LL.D. (chairman), presiding. In spite of the general strike and the coal strike, the company were again able to report increased turnover and profits. The net profits amounted to £95,905, compared with £92,124 for last year. The sum of £20,000 was placed to general reserve, and £1000 allocated to the staff pensions fund. A final dividend was declared on the ordinary shares of $12\frac{1}{2}\%$, making 20% for the year, compared with $17\frac{1}{2}\%$ for 1926. The turnover had increased by 87% since the reorganisation of the company. The cement works at Barrington were now working, and one kiln was producing the best British Portland cement on the basis of 50,000 to 60,000 tons per annum. When the second kiln operates this will be doubled. A subsidiary company had been formed called Eastwoods Flettons, Ltd. The installation of the Vickers-Petters and Marshall oil engines at Yaxley and Fletton had fully justified expectations in securing economical working.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned. Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS.

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£8 15s. per ton. f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barites.—£3 10s.—£6 15s. per ton, according to quality.
 Calcium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—2s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 10s.—£10 per ton. Good demand. Grey, £14 10s.—£15 per ton. Liquor, 9d per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—7½d.—8½d. per lb. Crude 60's, 2s. 6d.—2s. 7d. per gal.
 Acid Cresylic, 99/100.—2s. 9d.—2s. 10d. per gal. 97/99.—2s. 4d.—2s. 5d. per gal. Pale, 95%, 2s. 2d.—2s. 3d. per gal. Dark, 90%, 1s. 9d.—1s. 10d.; 95%, 2s. 1d.—2s. 2d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9½d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 6d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 4d.—1s. 9d. per gal. Pure, 1s. 6d.—2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 2s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7½d. per gal. ex works. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/100, 9½d.—10d. per gal. Solvent 95/100, 1s. 4d.—1s. 5d. per gal. Solvent 90/100, 9½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals.—£11 10s.—£12 per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—84s.—90s. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb. 100%.
 Benzaldehyde.—2s. 3d. per lb.
 Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—5½d. per lb.
 m-Cresol 98/100%.—2s. 7½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—2s. 3d. per lb.
 Dimethylaniline.—1s. 11d. per lb.
 Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—11d.—1s. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb.
 β-Naphthylamine.—3s. per lb.
 p-Nitraniline.—1s. 8d. per lb.
 m-Nitraniline.—3s. per lb. d/d.
 o-Nitraniline.—5s. 9d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb.
 R. Salt.—2s. 2d. per lb.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb.
 p-Toluidine.—2s. 2d. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£30 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7d.—1s. 8d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 4d. per lb. Technical 1½d.—1s. per lb. Good demand.
 Acid, Tartaric.—1s. 8d.—2s. 10d. per lb.
 Acid, Tannic.—1s. 3½d. per lb. Less 5%.
 Acid, Tannic.—1s. 3½d. per lb. Less 5%.
 Acid, Tannic.—1s. 3½d. per lb. Less 5%.
 Amidol.—1s. 6d.—1s. 8d. per lb. for quantity.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £30 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—9s. 6d. per oz.
 Barbitone.—5s. 9d.—6s. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—9s. 9d.—9s. 10d. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 30 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 2d.—2s. 4d. per lb. Potassium. 1s. 9½d.—2s. per lb. Sodium.—2s.—2s. 2d. per lb.

Granulated ½d. per lb. less. All spot. Large quantities at lower rates.
 Calcium Lactate.—1s. 2d.—1s. 4d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate. 6s. per lb.
 Ethers: S.G. 730, 1s. 1½d.—10½d. drums. Other gravities at proportionate prices.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—4s. 9d.—5s. per lb.
 Hexamine.—2s. 3d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochloride.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols. 2s. 3d. per gal. In carboys: Winchesters, 2s. 11d.—3s. 9d. per gal.; 20 vols., 4s. 3d. per gal.; Winchesters, 5s.—6s. 6d. per gal. Special prices for larger quantities.
 Hydroquinone.—2s. 11d.—3s. 2d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate.—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perochloride.—20s.—22s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £82 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 10d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 5d.—1s. 9d. per lb.
 Methyl Sulphonate.—8s. 9d.—9s. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 1d.—1s. 4d. per lb.
 Phenacetin.—2s. 6d.—2s. 9d. per lb.
 Phenazone.—4s.—4s. 3d. per lb.
 Phenolphthalein.—6s. 6d.—6s. 9d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2½%.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferrioyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic, £15 5s. per ton, d/d. consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 7½d.—1s. 9d. per lb. Crystal, 1s. 8½d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.

Sulphonol.—6s. 9d.—7s. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.

Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.

Aubepine (ex Anethole).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. **Amyl Butyrate.**—5s. 2d. per lb.

Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. **Benzyl Alcohol free from Chlorine.**—2s. per lb.

Benzaldehyde free from Chlorine.—2s. 6d. per lb. **Benzyl**

Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 16s. 3d. per lb.

Coumarin.—9s. 9d. per lb.

Citronellol.—13s. 9d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—6s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—8s. per lb. **Geraniol (Palmarosa).**—18s. 6d. per lb. **Geraniol.**—6s. 6d.—10s. per lb. **Heliotropine.**—

4s. 9d. per lb. **Iso Eugenol.**—13s. 6d. per lb. **Linalol.**—

(ex *Bois de Rose*) 16s. per lb. (ex *Shui Oil*) 10s. 6d. per lb.

Linalyl Acetate.—(ex *Bois de Rose*) 18s. 6d. per lb.—

(ex *Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. **Safrol.**—1s. 6d. per lb. **Terpineol.**

—1s. 8d. per lb. **Vanillin.**—17s. 9d. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. **Anise.**—3s. per lb. **Bergamot.**—28s. per lb. **Bourbon Geranium.**—14s. 6d. per lb.

Camphor.—75s. per cwt. **Cananga, Java.** 18s. per lb.

Cassia, 80/85%.—7s. 6d. per lb. **Cinnamon, Leaf.**—6d.

per oz. **Citronella.**—Java, 1s. 10d. per lb., c.i.f.

U.K. port, for shipment over 1928. 1s. 7½d. prompt

shipment from Java. **Ceylon, Pure.** 1s. 8d. per lb.

Clove, pure.—5s. 6d. per lb.

Eucalyptus, Australian.—2s. 3d. per lb. **Lavender.**—Mont

Blanc 38/40%. 17s. 6d. per lb. **Lemon.**—8s. per lb. **Lemon-**

grass.—4s. 6d. per lb. **Orange, Sweet.**—11s. 3d. per lb.

Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 75s.

per oz. **Palma Rosa.**—10s. 6d. per lb. **Peppermint.**—

Wayne County, 16s. 9d. per lb. **Japanese, 8s.** 3d. per lb.

Petitgrain.—7s. 9d. per lb. **Sandalwood.**—Mysore,

26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Nov. 22nd. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Oct. 6th. Complete Specifications marked are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Adam. Apparatus for treating gases with liquids etc. 24,080. Sept. 13.

Addicks. Disintegrating-machine. 24,000. Sept. 12. **A.-G. Brown, Boveri, et Cie.** Furnaces. 24,010. Sept. 12. (Ger., 10.9.26.)

Bennett. Centrifugal apparatus for spreading etc. liquids etc. 24,486. Sept. 17.

Bossini and Maiuri. Absorption refrigerating-apparatus etc. 24,161. Sept. 14.

Broadbent, and Broadbent & Sons, Ltd. Centrifugal machines. 24,053. Sept. 13. Electrically-driven machines. 24,054. Sept. 13.

Cambridge Instrument Co., Ltd., and Orchard. 24,221. See XI.

Haldenby. Grinding-apparatus. 24,508. Sept. 17.

I.-G. Farbenind. Supports for manufacture of sheets of material soluble in organic solvents. 24,103. Sept. 13. (Ger., 9.4.27.)

Johnson (I.-G. Farbenind.). Apparatus for continuous separation of liquid mixtures. 23,953. Sept. 12. Recovery of volatile organic solvents. 23,961. Sept. 12.

Johnstone and Keith. Apparatus for drying material. 23,097. Sept. 13.

Rutt. Devices for radiation of heat etc. 24,511. Sept. 17. Devices for drying material etc. 24,515. Sept. 17.

Vessels for boiling etc. liquids etc. 24,516. Sept. 17.

Staines. Filter for liquids. 24,084. Sept. 13.

Tupper. Means for mixing liquids. 24,308. Sept. 15.

Wade. Prevention of smoke in furnaces. 23,885. Sept. 12.

I.—Complete Specifications

9582 (1926). **Johnson (I.-G. Farbenind. A.-G.).** Manufacture of finely-divided solid materials. (277,048.)

14,373 (1926). **Wecker.** Separating substances of dissimilar volatilities. (277,085.)

21,716 (1926). **Tintometer, Ltd., Lovibond, and Fawcett.** Colour-estimating apparatus. (277,166.)

25,596 (1926). **Ramsay, and Mayhew, Ramsay & Co., Ltd.** Grinding, milling, and pulverising apparatus. (277,185.)

1544 (1927). **Stattliche Porzellan-Manufaktur.** Suction filters. (264,838.)

7213 (1927). **Allis-Chalmers Manufacturing Co.** Crushers. (269,866.)

23,400 (1927). **Johnson (I.-G. Farbenind. A.-G.).** Manufacture of aqueous solutions or emulsions of solvents or other liquids or solids insoluble in water. (277,277.)

II.—Applications

Arnold (Standard Development Co.). Cracking hydrocarbon oil. 23,974. Sept. 12. Treatment of heavy hydrocarbon oil. 24,210. Sept. 14.

Clayton, Fry, Harper, and Williams. Production of activated carbon. 24,081. Sept. 13.

Ges. für Linde's Eismaschinen A.-G. Separating benzol from gases. 23,991. Sept. 12. (Ger., 13.9.26.)

I.-G. Farbenind. Manufacture of motor fuels. 24,120. Sept. 13.

Johnson (I.-G. Farbenind.). Manufacture of hydrocarbons. 23,955. Sept. 12. Lubricating oils. 23,965. Sept. 12.

Apparatus for catalytic conversion of hydrocarbons. 24,322. Sept. 15. **Hardening paraffins etc.** 24,323. Sept. 15.

Decolorising montan wax. 24,324. Sept. 15. **Carrying out exothermic gas reactions.** 24,326. Sept. 15.

Production of liquid etc. hydrocarbons etc. 24,534. Sept. 17.

King, Morris, Schiff, and Wilder. Separation of gases etc. 24,307. Sept. 15.

King, Lander, and Sinnatt. Treatment of coal etc. 24,518—9. Sept. 17.

Mitchell. Distillation of petroleum etc. 24,214. Sept. 14. **Soc. Anon d'Ougrée-Marhaye.** Treatment of coal etc. 24,416. Sept. 16. (Fr., 9.8.27.)

Steel Bros. & Co., Ltd., and Ward. Distillation of petroleum etc. 24,214. Sept. 14.

Tolman. Treating hydrocarbons. 24,542. Sept. 17.
Trent Process Corp. Dissolving coal. 23,992. Sept. 12.
(U.S., 14.9.26.) Treating coal etc. 23,993. Sept. 12.
(U.S., 14.9.26.)

Wigan Coal & Iron Co., Ltd., and Leek. Treating coal etc. 24,403. Sept. 16.

II.—Complete Specifications

20,472 (1925.) Henshaw, Watson, and Holmes & Co., Ltd. Treatment of gases by the employment of solid catalytic and other reactive agents. (276,736.)

6629 (1926.) Schultz. Preparation and recovery of light oil or motor fuel from crude mineral or shale oil, or tar oils, or from carbonaceous materials. (277,042.)

14,300 (1926.) Low-Temperature Carbonisation, Ltd., and Parker. Retorts for the distillation of coal etc. (277,079.)

15,269 (1926.) Barralet. Manufacture of carbon granules. (277,129.)

15,434 (1926.) Darco Sales Corp. Reactivating decolorising-agents. (269,469.)

19,303 (1926.) Still (Still). Eliminating sulphuretted hydrogen from gases. (271,805.)

25,626 (1926.) Carpmaci (Soc. Ital. per la Metallizzazione). Producing oxyacetylene mixtures for use in spraying metals etc. (277,186.)

31,489 (1926.) Foersterling. Manufacture of air gas. (277,206.)

672 -3 (1927.) Hobson. Distilling solid fuel. (277,214- 5.)

12,642 (1927.) Mathys (Tar & Petroleum Process Co.). Coke ovens (277,256.)

13,855 (1927.) Aktiebolaget Separator. Centrifuges for the purification of oil etc. (271,526.)

19,279 (1927.) I.-G. Farbenind. A.-G. Production of liquid hydrocarbons and derivatives thereof from coal, tar, etc. (277,273.)

*31,832 (1926.) Ateliers Hanrez Soc. Anon., and Modave. Apparatus for the removal of dust from gases. (277,281.)

*10,476 (1927.) Tormin. Manufacture of coke. (277,290.)

*12,919 (1927.) Pistorius and Bunge. Splitting coal into its constituents. (277,293.)

*21,809 (1927.) Aktiebolaget Separator. Recovering oil from fatty solutions of proteins and glues in water. (277,311.)

*23,381 (1927.) Avenarius Gebr. Prevention of knocking of motor fuel. (277,326.)

*23,715 (1927.) Kirschner. See XX.

*23,991 (1927.) Ges. für Linde's Eismaschinen. A.-G. Separating benzol from the gases evolved during the making of coke. (277,378.)

III.—Applications

Brown and Eddington. Tar-removing composition. 24,258. Sept. 14.

Ges. für Linde's Eismaschinen A.-G. 23,991. See II.

III.—Complete Specifications

6629 (1926.) Schultz. See II.

19,279 (1927.) I.-G. Farbenind. A.-G. See II.

*23,991 (1927.) Ges. für Linde's Eismaschinen A.-G. See II.

IV.—Applications

I.-G. Farbenind. Manufacture of pigment dyes. 23,944. Sept. 12. (Ger., 11.9.26.) Manufacture of 1-methyl-2 : 5 : 6-trichloro-3-aminobenzene-4-sulphonic acid. 23,945. Sept. 12. (Ger., 11.9.26.) Manufacture of benzanthrone carboxylic acids. 24,216. Sept. 14. (Ger., 20.9.26.) Manufacture of dyestuffs. 24,442. Sept. 16. (Ger., 23.12.26.)

Johnson (I.-G. Farbenind.). Dyestuffs. 23,956 and 23,958. Sept. 12. Manufacture of chromium stuffs. 24,330. Sept. 15.

IV.—Complete Specifications

14,670 -1 (1926.) I.-G. Farbenind. A.-G., Schmidt, and Berliner. Manufacture of anthraquinone derivatives. (277,109—10.)

14,982 (1926.) Holliday & Co., Ltd., and Shaw. Production of grey to black vat dyestuffs. (277,125.)

15,038 (1926.) I.-G. Farbenind. A.-G. Preparing benzanthrone derivatives. (254,294.)

21,790 (1927.) Johnson (I.-G. Farbenind. A.-G.). Manufacture of finely-divided azo colouring-matter or lakes thereof. (277,275.)

*23,944 (1927.) I.-G. Farbenind. A.-G. Manufacture of pigment dyes. (277,371.)

*23,945 (1927.) I.-G. Farbenind. A.-G. Manufacture of 1-methyl-2 : 5 : 6-trichloro-3-aminobenzene-4-sulphonic acid. (277,372.)

*23,529 (1927.) I.-G. Farbenind. A.-G. Manufacture of benzanthrone and intermediate products. (277,342.)

V.—Applications

British Celanese, Ltd., Ellis, Olpin, and Walker. Treatment of fabrics. 23,923. Sept. 12.

Dreyfus. Manufacture of cellulose derivatives. 24,123—4. Sept. 13.

Gull. Manufacture of artificial silk. 24,237. Sept. 14.

Hercules Powder Co. Treating nitrocellulose. 24,541. Sept. 17. (U.S., 24.5.27.)

I.-G. Farbenind. Treatment of hydrated cellulose. 24,102. Sept. 13. (Ger., 5.10.26.) Manufacture of amino-cellulose derivatives. 24,215. Sept. 14. (Ger., 30.10.26.)

Johnson. 24,329. See XIII.

Quasi Arc Co., Ltd., and Strohmeier. 24,348. See XI.

Soc. pour la Fabr. de la Soie Rhodaneta. Manufacture of artificial silk. 24,242. Sept. 14. (Fr., 14.4.27.)

Teague. Production of plastic products. 24,117. Sept. 13.

Waddell and Watson. Treating fibre-bearing plants. 24,163. Sept. 14. Treating flax for spinning. 24,503. Sept. 17.

V.—Complete Specifications

14,416 (1926.) Silver Springs Bleaching & Dyeing Co., Ltd., and Hall. See VI.

20,939 (1926.) Valet. See XVII.

328 (1927.) Groves (Borne Strymser Co.). Conditioning textile fibres. (277,213.)

4239 (1927.) Soc. Civile des Proc. Masse. Treating green or dry stalks of ramie and other vegetable fibres. (266,344.)

*21,314 (1927.) Wolff & Co., Czappek, and Weingand. Production of foils, films, bands, etc. from viscose. (277,309.)

*22,656 (1927.) I.-G. Farbenind. A.-G. Manufacture of sulphonated cellulose derivatives. (277,317.)

VI.—Applications

British Celanese, Ltd., Ellis, Olpin, and Walker. 23,923. See V.

I.-G. Farbenind. 24,102. See V.

Johnson (I.-G. Farbenind.). Printing on textile fabrics. 24,196. Sept. 14. Production of impregnating compositions. 24,535. Sept. 17.

VI.—Complete Specifications

14,416 (1926.) Silver Springs Bleaching & Dyeing Co., Ltd., and Hall. Rendering cellulose acetate silk and similar products resistant to deterioration. (277,089.)

21,716 (1926.) Tintometer, Ltd., Lovibond, and Fawcett. See I.

25,151 (1926.) Milne. Drying, calendering, and like machines. (277,181.)

*22,790 (1927.) Ratinier. Printing fabrics in several colours. (277,320.)

VII.—Applications

Fairweather (Selden Co.). Catalytically oxidising sulphur dioxide. 24,211. Sept. 14. Preparation of vanadic acid. 24,236. Sept. 14.

Johnson (I.-G. Farbenind.). Production of ammonia from its elements. 24,327. Sept. 15. Production of moulded silica gels. 24,537. Sept. 17.

King, Morris, Schiff, and Wilder. 24,307. *See* II.
 Soc. Chim. des Usines du Rhône. Protection of apparatus against acids. 24,340. Sept. 15. (Ger., 4.2.27.)
 Zelewski. Manufacture of sulphuric acid. 24,121. Sept. 13. (Ger., 13.9.26.)

VII.—Complete Specifications

14,333 (1926). Engol. Base-exchange silicates, and process of making same. (277,082.)
 8741 (1927). Gerlach. Cells with quicksilver cathodes for the decomposition of alkali chlorides. (269,513.)
 *23,311 (1927). Hornsey. Reducing oxides of metals. (277,325.)
 *24,121 (1927). Zelewski. Producing gas-currents for the manufacture of sulphuric acid. (277,382.)

VIII. Complete Specification

69 (1927). Pétrole Synthétique Soc. Anon., and Folliet. *See* X.

IX.—Applications

Fawcett, and Fawcett, Ltd. Manufacture of bricks etc. 24,174. Sept. 14.
 Johnson (I.-G. Farbenind.). Production of plasters etc. 23,959, 23,960, and 23,962. Sept. 12.
 Scottish Dyes, Ltd., Beckett, Thomas, and White. Employment of cement etc. 23,998. Sept. 12.
 Teague. 24,117. *See* V.

X.—Applications

Billington. Copper alloys. 23,996. Sept. 12.
 Coley. Reduction of ores etc. 24,253. Sept. 14.
 Evans and Hamilton. Manufacture of iron etc. alloys. 24,276. Sept. 15.
 Garnett, Holden, and Smith. Magnetic alloys. 24,459. Sept. 16.
 Metallisation Ltd., and Cozens. Coating materials by metal spraying. 24,543. Sept. 17.
 Sulman and Picard. Extraction of tin etc. from ores etc. 24,138. Sept. 13.
 Taylor. Tinning flexible metal strips etc. 24,353. Sept. 15.

X.—Complete Specifications

14,210 (1926). Cozens, and Metallisation, Ltd. Coating of materials by metal-spraying. (277,071.)
 15,188 (1926). Adam. Detinning of tinned iron scrap etc. (277,127.)
 19,286 (1926). Spies. Granulating molten slag. (277,154.)
 22,308 (1926). Kelly. Alloys. (277,170.)
 25,026 (1926). Carpmel (Soc. Ital. per la Metallizzazione). *See* II.

29,499 (1926). Yoshikawa. Lead alloys. (277,199.)
 32,581 (1926). Davies. *See* XI.
 69 (1927). Pétrole Synthétique Soc. Anon., and Folliet. Producing a refractory coating on metallic surfaces. (277,211.)

11,115 (1927). Dowson & Mason Gas Plant Co., Ltd., and Paton. Gas-fired annealing-furnaces. (277,251.)
 12,665 (1927). Michel. Metallurgy of readily-oxidisable metals, e.g., magnesium. (271,088.)

*16,876 (1927). Metals Protection Corp. *See* XI.
 *21,286 (1927). Soc. Anon. des Acieries et Forges de Firminy. Protection of metals in the cementation process. (277,307.)

*21,302 (1927). Vogel. Pickling of iron etc. (277,308.)
 *23,311 (1927). Hornsey. *See* VII.

XI.—Applications

Cambridge Instrument Co., Ltd., and Orchard. Thermoelectric pyrometers. 24,221. Sept. 14.
 Garnett, Holden, and Smith. 24,459. *See* X.
 Lederer. Manufacture of electron-emitting bodies. 23,978. Sept. 12. (Austria, 12.4.27.)
 Matthewson. Production of Röntgen rays etc. 24,300. Sept. 15.

Mond (Berndorfer Metallwarenfabr. A. Krupp A.-G.). Producing galvanic coatings. 24,244. Sept. 14.

N. V. Philips' Gloeilampenfabr. Manufacture of electric incandescence lamps etc. 24,555. Sept. 17. (Fr., 18.9.26.)
 Oldham & Son, Ltd., and Wilde. Galvanic batteries. 24,140. Sept. 13.

Quasi Arc Co., Ltd., and Strohmenger. Fusible electrodes for electric arc welding. 24,348. Sept. 15.

XI.—Complete Specifications

32,581 (1926). Davies. *See* X.
 7724 (1927). Anode Rubber Co., Ltd. *See* XIV.
 8741 (1927). Gerlach. *See* VII.
 *16,876 (1927). Metals Protection Corp. Chromium plating. (277,295.)
 *23,647 (1927). Siemens & Halske A.-G. Induction furnaces or heating-devices. (277,352.)
 *23,784 (1927). Siemens & Halske A.-G. High-frequency induction furnaces. (277,361.)

XII.—Applications

Bailey and Bailey. Soap. 23,995. Sept. 12.
 Hulse. Detergent composition. 24,489. Sept. 17.

XII.—Complete Specification

15,572 (1926). Reebberg Ges. Reducing auto-oxidation of oils and fats. (254,303.)


XIII. Applications

Barash. Manufacture of substance for use as paint etc. 24,504. Sept. 17.
 Carbide & Carbon Chemicals Corp. Paint etc. removers. 24,008. 9. Sept. 12. (U.S., 26.2.27.)
 I.-G. Farbenind. 23,944. *See* IV.
 Johnson (I.-G. Farbenind.). Application of condensation products of aldehydes. 24,199. Sept. 14. Non-inflammable nitrocellulose lacquers. 24,329. Sept. 15.

XIII.—Complete Specifications

14,337 (1926). Gerlach. Manufacture of pigments and impregnating compounds etc. (277,083.)
 30,471 (1926). Wolff & Co., and Schulz. Applying coatings of nitrocellulose lacquers. (262,440.)
 1399 (1927). I.-G. Farbenind. A.-G. Manufacture of condensation products of aldehydes with ketones. (264,830.)
 21,790 (1927). Johnson (I.-G. Farbenind. A.-G.). *See* IV.
 *23,944 (1927). I.-G. Farbenind. A.-G. *See* IV.

XIV.—Applications

Bacr. Process for making an elastic caoutchouc-like body. 24,457. Sept. 16. (Switz., 20.10.26.)
 Head. Rubber solvent. 24,296. Sept. 15.
 Johnson (I.-G. Farbenind.). Manufacture of artificial rubber. 23,963. Sept. 12. Production of raw rubber from latex. 24,328. Sept. 15. 
 K. D. P., Ltd. Drying mixings of latex and filling-materials. 23,968. Sept. 12. (Ger., 10.9.26.) Production of rubber mixings. 23,969. Sept. 12. (Ger., 10.9.26.)

XIV.—Complete Specifications

28,344 (1926). Biddle. Caoutchouc-latex compositions. (277,194.)
 7724 (1927). Anode Rubber Co., Ltd. Manufacture of rubber goods from rubber dispersions by electrophoretic means. (269,505.)
 *23,440 (1927). Goodyear Tire & Rubber Co. *See* XX.
 *23,968 (1927). K. D. P., Ltd. Drying of mixings of latex and filling-materials. (277,373.)
 *23,969 (1927). K. D. P., Ltd. Production of rubber mixings from latex and filling-materials. (277,374.)

XV.—Application

Johnson (I.-G. Farbenind.). Shoe polishes etc. 23,952. Sept. 12.

XV.—Complete Specifications

*21,809 (1927). Aktiebolaget Separator. *See* II.

*23,616 (1927). Maschinenfabr. Turner A.-G. Treating hides, skins, and leathers. (277,319.)

XVI. Applications

Bloxam (Jones) Disinfecting seeds. 24,213. Sept. 11.
Johnson (I. G. Farbennid.) Fertilisers. 23,954. Sept. 12.
24,196. See XIX. Fertilisers. 24,325. Sept. 15.

XVII.—Application

Salerii. 24,462. See XIX.

XVII. Complete Specification

20,939 (1926) Valot. Extracting pulcellu bagasse of sugar cane. (277,163.)

XIX. Applications

Johnson (I. G. Farbennid.). Treatment of vegetable material. 24,194. Sept. 11.

Nyrop. Manufacture of chocolate. 24,222. Sept. 11.

Salerii. Manufacture of sweetmeats. 24,462. Sept. 16.

XX. Applications

Boehringer, and Boehringer Sohn. Extraction of bromine. 23,920. Sept. 12.

I. G. Farbennid. and Henrich. Manufacture of α -amino-alkylammonaphthalene-carboxylic acid. 23,982. Sept. 12.

Johnson (I. G. Farbennid.) Sulphonic acid. 23,964. Sept. 12. Production of sulphonic acids. 24,197. Sept. 11. Production of polyvalent alcohols. 24,198. Sept. 14. Process for vapourising formamide. 24,536. Sept. 17.

Jones and Jones. Remedy for consumption. 23,910. Sept. 12.

XX. Complete Specifications

25,685 (1925) Ayres and Haabestad. Substituting hydroxyl groups for the acid radicals in liquid esters of monoamic acids or for halogens in liquid derivatives of hydrocarbons. (241,889.)

14,477 (1926) Carpuat (I. G. Farbennid. A. G.) Manufacture of new aralkyl-ethers which are aralkylated in the nucleus, and of their sulphonic acids. (277,098.)

14,673 (1926) Carpuat (I. G. Farbennid. A. G.) Converting difficultly soluble or insoluble colloidal carbohydrate ethers into soluble products. (277,111.)

14,211 (1927) Comp. de Béthune. Preparation of ethyl-sulphuric acid. (273,263.)

*708 (1927) Newport Co. Manufacture of 3,4-diamino-benzoylbenzoic acids. (277,285.)

*20,727 (1927) Chem. Fabr. and Actien (vorm. E. Schering). Obtaining germ gland hormones from vegetable organisms. (277,302.)

*23,110 (1927) Goodyear Tire & Rubber Co. Preparing dithioazyl disulphide. (277,338.)

*23,715 (1927) Kirschner. Production of mixtures of mineral oil products and aliphatic alcohols. (277,357.)

XXI. Applications

Colbrook. Treating photographic films. 24,152. Sept. 11.
Johnson (I. G. Farbennid.). Carrying out photochemical reactions. 23,957. Sept. 12.

XXI. Complete Specification

*17,402 (1927) I. G. Farbennid. A. G. Photographic films. (277,297.)

XXII.—Application

Hercules Powder Co. 24,544. See V.

XXII.—Complete Specification

14,333 (1926) Engel. See VII.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods.

British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Paper (B.X. 3816). *British India*: Leather belting, chemicals (237). *Chile*: Soya bean oil, steel sheets (251). *Czechoslovakia*: Chemicals for technical purposes (239). *India Burma and Ceylon*: Druggists' sundries, photographic materials (238). *Italy*: Salt cake, ammonium sulphate, copper sulphate, nickel sulphate, carboic acid crystals, ammonium carbonate, prussiates of soda and potash, shellac (241). *Turkey*: Galvanised sheets (tinplate) (247–248). *United States*: Hollow brass balls (B.X. 3817).

Safeguarding of Key Industries

The Board of Trade give notice that representations have been made to them under Section 10 (5) of the Finance Act, 1926, for the exemption from the duty imposed by the Safeguarding of Industries Act, as amended by the Finance Act, 1926, of the following articles: Bromural (Monobromisovalerylurea), Eukodal (Dihydro-codemone hydrochlorate), Papaverine, R. Potassium permanganate, Resorcine, and Styraeol (Guaiacol cinnamate). Communications relating to the above-mentioned applications should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, before October 21.

News from Advertisements

A technical assistant is required by a chemical engineer (p. vi).

A chemical engineer is required for a large factory in the Midlands (p. vi).

A highly trained chemist requires a junior partnership in a chemical concern (p. vi).

A chemist's business in South London is for sale (p. vi).

Sets of this JOURNAL etc. are for disposal (p. vi).

A mixer is required (p. vi).

A technical assistant is required for the patent department of a large manufacturing firm (p. vi).

A platinum basin is for sale (p. vi).

There are 117 firms represented under various headings in our Buyers' Guide.

PUBLICATIONS RECEIVED

SPECTROSCOPY. By Prof. E. C. C. Baly, C.B.E., M.Sc., F.R.S. Textbooks of Physical Chemistry, edited by Sir William Ramsay, K.C.B., D.Sc., F.R.S., and F. G. Donnan, C.B.E., M.A., D.Sc., Ph.D., F.R.S. Third edition. In four volumes. Vol. III. Pp. vii + 532. London: Longmans, Green & Co., Ltd., 1927. 22s. 6d.

GENERAL CHEMISTRY. THEORETICAL AND DESCRIPTIVE. By T. P. McCutcheon, Ph.D., and H. Seltz, Ph.D. Pp. x+415. London: Chapman & Hall, Ltd., 1927. 16s.

ABRASIVES. PRODUCTS OF CANADA. TECHNOLOGY AND APPLICATION. PART I. SILICEOUS ABRASIVES, SANDSTONES, QUARTZ, TRIPOLI, PUMICE, AND VOLCANIC DUST. By V. L. Eardley-Wilmot. Canada Department of Mines. Mines Branch. Pp. xi + 119. Ottawa: F. A. Acland, 1927. 30 c.

NEWSPRINT. PRELIMINARY EXPERIMENTS ON THE GRINDING OF IMMATURE EUCALYPTS FOR MECHANICAL PULP AND POSSIBILITIES OF MANUFACTURING NEWSPRINT IN AUSTRALIA. By L. R. Benjamin. Commonwealth of Australia. Council for Scientific and Industrial Research. Bulletin No. 31. Pp. 38. Melbourne: H. J. Green, 1927.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

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No. 40

EDITORIAL

International Understandings

ACCORDING to the newspapers there are very important negotiations pending or even completed in which the English, French and German chemical manufacturers are concerned. Whether authentic information about these will be available by the time we go to press we do not know, but we do know that in connexion with certain developments arrangements have been completed, and this shows that there is no insuperable obstacle to such a course of procedure. Historians may look to the past, industrialists must look to the future. There is hardly anything which strengthens friendship so much as community of interest, and we have often in these columns, expressed our belief that the prosperity of Europe will be greatly advanced if industrialists will work together for their common advantage instead of trying to increase their individual productions beyond the needs of the world and in this way increase their overhead charges and decrease their profits as they have done in the past. In some industries it is possible that small units may yet be profitable; in the chemical industry this is hardly so, almost every chemical operation on the large scale implies the manufacture of by-products and the utilisation of these in some other process. Your process must therefore expand horizontally, and to ensure the supply of raw materials the process must often expand vertically. In the particular case a number of us, English, French and German, recently visited several works in France and Germany, and we feel sure that the feeling of the English members of the party, who were guests of our German and French friends, is one of the most cordial gratitude. We were hospitably received, sumptuously entertained, and if anything could be done to interest and please us, it was done. Those who know the country which lies between Frankfurt, Wiesbaden, Coblenz and Cologne may imagine the fascination of visiting works in that district and of having our refreshment in Rudesheim and other places whose products are familiar names. The town of Leverkusen provided, in addition, other features of interest. We have never seen a works of such magnitude as Leverkusen, nor a works in which so many of the triumphs of modern

chemistry and modern engineering could be seen. The greatest and most up to date of our chemical works in this country are not always very easy to see. At Leverkusen we were shown processes and plant which no doubt are a legitimate source of pride to Germany and were the objects of our admiration, and we were able to see everything, not as if we were dangerous competitors, but as colleagues. If this friendly spirit of co-operation is to be a feature of the European chemical manufacturers, if we can pool our knowledge and experience, eliminate waste and inefficient processes, then indeed this great industry will attain to a measure of prosperity and of service to mankind far beyond anything that has yet been achieved. The chemical industry of the future will probably include the fuel industry, metallurgy, the manufacture of artificial silk and of many drugs and foods which are as yet unknown. It is an industry which should dispense with artificial barriers, or at least cut them down to the lowest possible. The three nations we have mentioned have now an opportunity of replacing bitterness by friendship, and of being so busy with the success of industrial developments that they have no time to dwell on the misfortunes of the past. Whether this comes about or not, we are satisfied that the English participants in this visit will long have the most pleasant recollections of the many beautiful places they saw in the valleys of the Seine and the Rhine and of the phenomenal efficiency and scientific achievement of Leverkusen. We do not wish our readers to infer that the co-operation between the manufacturers concerned was confined to motor trips through districts replete with forests and castles and to luncheons and dinners, after which we spoke of our own self-satisfaction and the admiration we had for the others; the co-operation has taken the form of financial participation. Leverkusen begun as a small ultramarine works; it now covers an area of more than a square mile. A visit to it provides opportunity for much thought. From small beginnings great things may grow; when Dr. Duisberg sketched in his mind, about twenty years ago, the possibilities of Leverkusen, he had sufficient imagination and faith to place some of his buildings nearly a mile apart. He and his colleagues have by now pretty well filled the intervening spaces.

The Industrial Chemist

Judging from the letters which have appeared in our columns recently, there are many who think that the chemist produced by our universities is not all that he might be. Some of the critics blame the chemist himself for his shortcomings; others blame the teachers responsible for his university training; whilst an occasional original spirit raises his voice in criticism of the manufacturer and his management. After reading "The Making of a Chemical," by E. I. Lewis and G. King, reviewed elsewhere in our columns, we are not altogether surprised that the average chemist sometimes fails to reach the high level expected from him. There is so much to learn!

No one will deny that the industrial chemist of the dreams of Messrs. Lewis and King would satisfy the critics, but the question arises, "How is the state of excellence to be attained?" It is obvious, in the first place, that salvation cannot come entirely from within, even with the aid of such works as "The Making of a Chemical." Of course, there will always be a few supermen who will rise superior both to teachers and environment, but in most cases the young chemist is but so much plastic raw material, firstly in the hands of his professors and later in those of his industrial teachers—the manufacturer and his management.

We are all familiar with the criticisms levelled at the teachers of chemistry in our universities, namely, the tendency to specialise by concentrating on the theoretical rather than the practical or by emphasising modern ideas and discovery at the expense of the older fundamentals. We do not think that the effect of this is always as serious as is usually supposed, providing that it stimulates inquiry and assists in the development of the student's power of thought and reasoning. A well trained brain is the first thing to be aimed at; as Messrs. Lewis and King point out, with the normal man, the necessary facts have a habit of accumulating of their own accord. Nevertheless, teachers might do more to cultivate in the mind of the student a sense of proportion and perspective. Much might be done in this direction, we think, by a better training in the use of the literature of chemistry. Often as a result of teaching based largely on the selected facts of textbooks, supplemented by disordered reading of modern literature, the student's sense of proportion and perspective is warped. He is inclined to believe that all chemical progress is in the present, whilst most of the great names of our science are to him mere labels attached to some "reaction," "hypothesis," or "principle," rather than those of men who have lived, experimented, erred and triumphed.

Many chemists passing into industry know but little about the original literature, the use of which might be of such great assistance. We realise that it is not always easy to teach the use of the literature during a degree course, but too often the short period of research which follows is frittered away on some more or less unimportant piece of "research" in which the student fills the role of a mere manipulator. The subject and the method of attack are usually suggested by the professor, who also, as often as not, even carries out the preliminary reading. We have often thought that

this period might be made so much more profitable if the student were made to read up and collect data on certain chosen subjects of wide interest and then to plan a number of researches rather than to carry out one small piece of work under the conditions described above. Such a procedure would familiarise him with the journals and works of reference, and would do much to broaden his outlook. To his surprise he would find that many of his problems could be half solved without a single experiment on his part, and a weapon of incalculable value would be added to his armoury.

When we turn to consider those who should be his industrial teachers—the manufacturer and the management—we are on more difficult ground. If we may judge from evidence that has come before us, it seems that few manufacturers realise how much they are responsible for making the industrial chemist what he is. If the chemist is to fulfil his highest functions in industry he must be afforded opportunity of acquiring the necessary knowledge after he leaves college. That he should have access to a good library goes without saying; he should also have the opportunity to use it properly. Too often the manufacturer does not realise that the chemist is working unless he is actively engaged amongst his test tubes and beakers, and looks askance at the chemist who is merely reading. He often forgets that in engaging a chemist he is hiring brains rather than hands.

A university training should have endowed the chemist with a trained mind and a keen brain prepared to tackle almost any problem connected with the running of a chemical works, yet the practice in many organisations is for the individual chemist to be presented with an individual problem and left to it. As to other problems, chemical or otherwise, occupying the minds of the management, he usually knows nothing. Yet a brain that has been trained to deal with chemical problems could often contribute something of value to the solution of those of management, marketing and salesmanship. It is acknowledged that relatively few chemists pass into management. The reason for this is partly, no doubt, their very enthusiasm for their own subject, which cuts them off from the more general problems of industry, where their brains might be equally useful. It seems, however, that managements might do much more to utilise the brains at their disposal. Boards of directors meet frequently to struggle bravely with unfamiliar subjects, under the guidance of managing directors and research directors, but in few works does the management call the chemical staff together to discuss everyone's different problems. In this way the manufacturer is responsible for specialisation, to his own loss, just as much as the academic teachers whom he so often criticises. We are informed that at present in a large number of works the only way in which a chemist can acquire much of the information that Messrs. Lewis and King consider essential for his efficiency is by sheer inquisitiveness, exercised when, in the opinion of the management, he should be amongst his bottles and beakers. Meanwhile, the clerical staff, which is more familiar with the general side of the business, assumes the functions of management which should be in the hands of chemists. What, one wonders, has the manufacturer to say about this?

RECENT DEVELOPMENTS IN THE STUDY OF ACID CATALYSIS*

By Prof. H. M. DAWSON, D.Sc.

The first successful attempt to study the operation of the time factor in chemical change was made in 1850 by Wilhelmy, who showed that the inversion of cane sugar under the catalytic influence of acids proceeds in accordance with a simple law—subsequently recognised as the law of mass action. Since that time the investigation of the many-sided effects which are bound up with the catalysing action of acids has been pursued with uninterrupted vigour. This may be attributed in part to the success which attended the interpretation of the facts in accordance with the general principles which connote the birth of modern physical chemistry, and to the recognition of the technical importance of catalytic phenomena, but more particularly to the circumstance that the acceleration of chemical change has long been accepted as one of the characteristics of that group of substances to which the term acid is applied.

Soon after the advent of the ionic theory, the clearly-marked parallelism between the catalytic power and the electrical conductivity of different acids led to the view that the catalytic effects of acids are attributable to the hydrogen ion, the observed reaction velocity being directly proportional to the concentration of the hydrogen ion. In spite of certain anomalies, *e.g.*, the apparent increase in the catalytic power of the strong acids on the addition of the corresponding salts, for the explanation of which auxiliary hypotheses were introduced, the simple hydron theory of acid catalysis was for many years very generally accepted; this was in large measure justified by the circumstance that the theory served to correlate with a fair degree of precision large groups of experimental observations.

Subsequent and more exact measurements of the speed of acid catalysed reactions gave results which were shown to be incompatible with the simple hydron theory, and at the same time substantial evidence was advanced in support of the view that catalytic activity must be attributed to the un-ionised acids as well as to the hydrogen ion. The facts adduced in support of this dual catalytic action of acids were such as to warrant the belief that the dual theory represented an extension of the simple hydron theory which was essentially correct.

More recently it has been suggested that deviations from the classical hydron theory are due to the circumstance that the catalytic activity of an acid in solution is not determined by the ordinary volume concentration of the hydrogen ion, but by its thermodynamic concentration or "activity." There is, indeed, incontrovertible evidence in support of the view that chemical equilibrium is not directly expressible in terms of the volume concentrations of the substances involved, but that the law of mass action expresses a relation which is only true when the volume concentrations are replaced by the "activities" of the substances concerned.

The connexion between the "activity" a and the volume concentration c is conveniently expressed in

terms of the so-called "activity coefficient" $f = a/c$. The magnitude of this coefficient depends on the environment of the molecules (or ions) concerned, and the connexion between f and c may be derived by various thermodynamic methods.

In so far as the hydrogen ion is concerned, it may be stated quite briefly that its "activity coefficient" in aqueous solution depends very much on its ionic environment, that is to say, on the total number of charged particles (ions) in its vicinity and on the charge which these ions carry. The scope of this paper does not permit of any discussion of the quantitative relations which are involved. It suffices to point out that the introduction of the concept of "activity" and the linking up of this concept with the views of Debye and Hückel relative to interionic effects in solutions of electrolytes are mainly responsible for the most recent attempts to interpret the experimental facts relating to acid catalysis in terms of the "activity" of the hydrogen ion. It may be that the "activity," although introduced as a formal thermodynamic quantity, will ultimately be shown to be connected with the physical condition of the hydrogen ion, in which case there would appear to be very strong grounds for the consideration of the possibility of substituting the volume concentration of the catalytic entity by its "activity" in the analysis of data relating to acid catalysis. Recent developments in the investigation of the phenomena have, however, disclosed facts which would seem to preclude the possibility of any explanation in terms of the hydrogen ion as the only active constituent. On the other hand, these facts suggest very strongly that the catalytic activity of an acid represents an effect in which the hydrogen ion, the acid anion, and the undissociated acid molecule are jointly concerned. The identification of the several catalytically active entities seems, indeed, to be the question of primary importance. Whether the catalytic effects can be more suitably expressed in terms of volume concentrations or the "activities" of these entities is a matter which may ultimately have to be considered, but for the present it has been found more convenient to adopt the former alternative, in support of which, moreover, substantial evidence is afforded by the available experimental data.

In a general way, it may be said that the dominant catalytic entity in aqueous solutions of pure acids is the hydrogen ion. If the corresponding salt is added to a solution of a moderately weak acid, the hydrogen ion concentration is depressed and, under these circumstances, the catalytic effects due to constituents other than the hydrogen ion may be expected to be much more readily observed. It is, indeed, the study of such acid-salt mixtures which has furnished the strongest evidence for the views which are described in this paper. For comparative purposes, such acid-salt mixtures may be grouped in many different ways, but there are two methods of grouping which are of outstanding interest. The first of these methods corresponds with acid-salt mixtures represented by the general formula $cHA + xMA$, in which the concentration of the acid HA is constant, whilst that of the salt MA is varied. Such mixtures may be said to form a constant acid series.

In proceeding to describe experimental results it may

* Based on a paper delivered before Section B.—Chemistry, at the Leeds meeting of the British Association.

be pointed out that the acid catalysed reaction which has been studied in detail by us is the reaction between acetone and iodine. For a given catalyst the velocity of this reaction is proportional to the concentration of the acetone, and is independent of the concentration of the iodine. The latter may, indeed, be regarded as an indicator which serves to measure the rate at which the acetone undergoes some change which is usually considered to be the keto-enol transformation.

The experimental results obtained in the determination of the initial velocity of reaction under the influence of mixtures represented by the formula $0.1 \text{ CH}_3\text{CO}_2\text{H} + x \text{ CH}_3\text{CO}_2\text{Na}$ are shown in Diagram I in which the reaction velocity v is plotted against the salt concentration x . This diagram shows also the

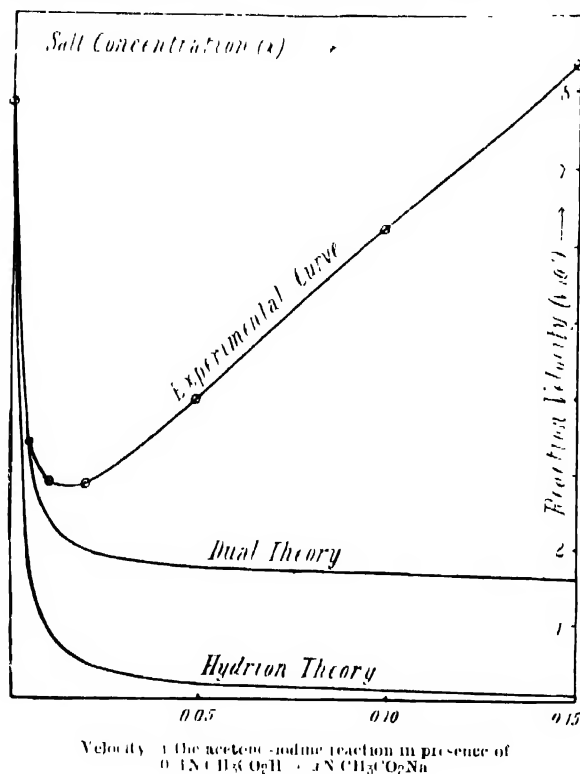


DIAGRAM I.

results which are to be expected on the basis of the classical hydron theory, and of the dual theory. According to the experimental curve, increase in the concentration of the added sodium acetate results at first in a rapid fall in the reaction velocity which, however, reaches a minimum and afterwards increases according to a linear relation which may be expressed by $v = v_m + k_a x$. It may readily be shown that the catalytic effects of the hydrogen ion in solutions for which $x > 0.05$ may be entirely neglected in comparison with the observed velocity of reaction. Since, moreover, the concentration of the undissociated acetic acid is practically constant throughout the series, the linear portion of the $v - x$ curve cannot be explained in terms of the simple hydron theory or in terms of the dual theory.

In accordance with the view that the salt is completely ionised and the fact that the metallic cation has no appreciable catalytic influence, it would seem that the linear portion of the $v - x$ curve is attributable to the catalytic activity of the acetate ion. The slope of this

line by k_a and thus affords a measure

of the velocity coefficient for the acetate ion. If the linear portion of the curve is extrapolated to $x = 0$, it is obvious that the intercept on the ordinate should afford a measure of the velocity which is due to the undissociated acetic acid which is present in constant amount throughout the whole series. This extrapolated velocity $v_m = k_m c = 0.1 k_m$ gives a value for k_m , the velocity coefficient for undissociated acetic acid, which is identical with the value obtained in 1913 by Dawson and Powis (J.C.S., 1913, 103, 2135) in experiments with salt-free solutions of acetic acid of varying concentration. Two independent series of experiments, involving entirely different methods of procedure, thus lead to an identical value for the velocity coefficient of the un-ionised acid.

In accordance with the above interpretation, the observed reaction velocity may be represented as the sum of partial velocities due respectively to the action of the hydrogen ion, the acetate ion and the undissociated acid. In other words

$$v = v_h + v_a + v_m$$

where v_h , v_a and v_m are the respective partial velocities due to the positive ion, the negative ion and the electrically neutral acid molecule.

This equation may be written

$$v = k_h [\text{H}^+] + k_a [\text{A}^-] + k_m [\text{HA}] \quad (1)$$

in which the values of $[\text{H}^+]$, $[\text{A}^-]$ and $[\text{HA}]$ are given by

$$[\text{H}^+] = K(c - [\text{H}^+])/(c + [\text{H}^+]) \quad [\text{A}^-] = x + [\text{H}^+]$$

and $[\text{HA}] = c - [\text{H}^+]$ respectively, K being the ionisation constant of acetic acid $= 1.85 \times 10^{-5}$. The values of the catalytic coefficients at 25°, when referred to an acetone concentration of 20 c.c. per litre, are $k_h = 4.65 \times 10^{-4}$, $k_a = 1.5 \times 10^{-6}$, and $k_m = 1.5 \times 10^{-6}$. The two latter were obtained by the methods already described, and the value of k_h from auto-catalytic experiments in which the observed rate of reaction can be ascribed entirely to the hydrogen ion.

The observed and calculated reaction velocities are compared in Table I (cf. Dawson and Carter, J.C.S., 1926, 2282), the first column of which shows the concentration (c) of the added salt, col. 2 the concentration of the hydrogen ion from which the concentrations of the acetate ion and of the undissociated acetic acid may be derived, cols. 3, 4 and 5 the partial velocities due to the hydrogen ion, the acetate ion and the undissociated acid respectively; col. 6 the total velocity calculated from equation (1); and col. 7 the velocity actually observed.

TABLE I
 Catalyst: 0.1 CH₃CO₂H : 1 CH₃CO₂Na

<i>c</i>	$[\text{H}^+]\cdot 10^3$	$v_h\cdot 10^6$	$v_a\cdot 10^6$	$v_m\cdot 10^6$	$v_{\text{cal}}\cdot 10^6$	$v_{\text{obs}}\cdot 10^6$
0.0	13.5	0.028	0.000	0.118	0.78	0.75
0.001	3.45	0.100	0.024	0.119	0.325	0.36
0.01	1.81	0.081	0.046	0.150	0.28	0.31
0.02	0.92	0.043	0.090	0.150	0.285	0.31
0.025	0.71	0.034	0.113	0.150	0.30	0.32
0.05	0.37	0.017	0.225	0.150	0.39	0.405
0.1	0.18	0.008	0.450	0.150	0.61	0.60
0.2	0.09	0.004	0.900	0.150	1.055	1.04
0.4	0.06	0.003	1.350	0.150	1.50	1.51
0.4	0.05	0.002	1.800	0.150	1.95	1.95
0.5	0.04	0.002	2.250	0.150	2.40	2.45
1.0	0.02	0.001	4.500	0.150	4.6	4.6

Inspection of the table shows that the observed velocities for this constant acid series of acid-salt mixtures are in satisfactory agreement with the calculated values over the entire range extending from the salt-free solution to that which contains ten times as much salt as acid. At low salt concentrations, the chief catalytic agent is the hydrogen ion, but for salt concentrations between 0.01 and 0.25 moles per litre, the largest effect is due to the undissociated acid, and at still higher salt concentrations the dominant catalytic effect is attributable to the acetate ion. Similar results have been obtained for many other constant acid series of acid salt mixtures.

Symmetry of the v - p_{H} curve and dependence of the iso-catalytic data on the concentration of the acid

If the values of $[\text{A}^-]$ and $[\text{HA}]$ given by $[\text{A}^-] = K(c - [\text{H}^+]) / [\text{H}^+]$ and $[\text{HA}] = c - [\text{H}^+]$ are substituted in equation (1) the latter assumes the form

$$v = (k_h + k_m)[\text{H}^+] + k_a K c / [\text{H}^+] + k_m c + k_a K \quad (2)$$

in which the term $k_a K$ represents a quantity which is very small in comparison with the measured velocities, and may therefore be neglected.

By differentiation of equation (2) which expresses the velocity as a function of the hydrogen ion concentration, it may be shown that the velocity passes through a minimum when

$$[\text{H}^+] = [\text{H}] = \sqrt{k_a K c / (k_h + k_m)} \quad \dots \dots \dots (3)$$

$$\text{and } v = v_1 = 2 \sqrt{(k_h + k_m) k_a K c} + k_m c \quad \dots \dots \dots (4)$$

$$= 2k_h[\text{H}] + k_m c \quad \dots \dots \dots (4a)$$

The acid-salt mixture for which the velocity has a minimum value is of particular significance in that it serves as a basis for the co-ordination of the catalytic data for all other mixtures belonging to the same constant acid series. If the reaction velocity, as expressed by equation (2) is plotted against the logarithm of the hydrogen ion concentration, or against $p_{\text{H}} = -\log_{10}[\text{H}^+]$, we obtain, in fact, a symmetrical curve of catenary type (Dawson and Dean, J.C.S., 1926, 1872), the lowest point of which (referred to as the iso-catalytic point) corresponds with the minimum velocity (M.V.) mixture. It follows from this that the p_{H} value of the M.V. mixture is the arithmetic mean of the p_{H} values for any pair of solutions belonging to the same constant acid series for which the reaction velocities are equal. In other words, such pairs of solutions are catalytically equivalent. This may be shown in the following manner. Let v_1

and v_2 be the reaction velocities for any pair of solutions of the same constant acid series, the corresponding hydron concentrations being $[\text{H}]_1$ and $[\text{H}]_2$; then, according to equation (2) we have

$$v_1 = (k_h + k_m)[\text{H}]_1 + k_a K c / [\text{H}]_1 + k_m c$$

$$\text{and } v_2 = (k_h + k_m)[\text{H}]_2 + k_a K c / [\text{H}]_2 + k_m c$$

If $v_1 = v_2$, then

$$(k_h + k_m)[\text{H}]_1 + k_a K c / [\text{H}]_1 = (k_h + k_m)[\text{H}]_2 + k_a K c / [\text{H}]_2$$

and on rearranging the terms, we obtain

$$[\text{H}]_1 + [\text{H}]_2 = k_a K c / (k_h + k_m) + [\text{H}]_1^2 \quad \dots \dots \dots (5)$$

$$\text{or } (p_{\text{H}})_1 + (p_{\text{H}})_2 = 2(p_{\text{H}})_{\text{M.V.}} \quad \dots \dots \dots (5a)$$

When the observed velocities for solutions belonging to the same constant acid series are plotted against p_{H} and horizontal lines are drawn to intersect the curve, the points of intersection give the p_{H} values $(p_{\text{H}})_1$ and $(p_{\text{H}})_2$ for pairs of catalytically equivalent solutions. Table II shows the results obtained in the case of the series 0.05C(CH₃·CO₂H) : 1C(CH₃·CO₂Na). The arithmetic mean of these is shown in the fourth column and thus, as required by the above theory, is quite constant.

 TABLE II
 p_{H} values of catalytically equivalent solutions

<i>c</i> · 10 ²	$(p_{\text{H}})_1$	$(p_{\text{H}})_2$	$\frac{1}{2}[(p_{\text{H}})_1 + (p_{\text{H}})_2]$
50	3.63	4.43	4.03
60	3.46	4.59	4.025
70	3.36	4.50	4.05
80	3.28	4.78	4.03
90	3.22	4.81	4.01
100	3.16	4.90	4.03
110	3.10	4.96	4.03
120	3.04	5.01	4.025

According to equations (3) and (4), the iso-catalytic data $[\text{H}]_1$ and v_1 for a constant acid series of acid-salt mixtures depend on the concentration of the acid which is characteristic of the series. Observations made with different series (cf. Dawson and Hoskins, J.C.S., 1926, 3166) in which the concentration of the acetic acid was varied from 0.01 to 1.0 moles per litre have yielded values of $[\text{H}]_1$ and v_1 which are in close agreement with those calculated from equations (3) and (4). Table III affords a comparison of the observed and calculated values of $(p_{\text{H}})_1$ and Table IV records the corresponding values of the minimum reaction velocity v_1 .

 TABLE III
 $(p_{\text{H}})_1$ values for the mixtures cCH₃·CO₂H : 1C(CH₃·CO₂Na)

<i>c</i>	0.01	0.05	0.10	0.20	0.50	1.00
$(p_{\text{H}})_1$, obs.	4.23	4.01	3.88	3.72	3.50	3.23
$(p_{\text{H}})_1$, cal.	4.37	4.02	3.85	3.72	3.52	3.37

TABLE IV

v_1 values for the mixtures cCH₃·CO₂H : 1C(CH₃·CO₂Na)

<i>c</i>	0.01	0.05	0.10	0.20	0.50	1.00
$v_1 \cdot 10^6$ obs.	0.056	0.164	0.273	0.461	1.020	1.91
$v_1 \cdot 10^6$ cal.	0.054	0.165	0.254	0.457	1.025	1.89

In the case of the series with the highest acid concentration ($c = 1.0$) there is reason to believe that complex ion formation comes into play as a disturbing factor. For all the other series the agreement between the observed and calculated numbers is within the limits of experimental error.

Velocity of reaction for homo-isohydric solutions

Reference may now be made to results (cf. Dawson and Hoskins, *Proc. Leeds Phil. Soc.*, 1926, 1, 108), which have been obtained in the investigation of comparable acid-salt mixtures of the second type referred to, namely those for which the ratio of the acid and salt concentrations has a constant value. Such solutions form a homo-isohydric group in that the same ions are always present whilst the concentration of the hydrogen ion remains fixed.

The experimental results to be described were made with a series of acetate buffers for which the acid/salt ratio is equal to unity. The calculated p_{H} value for this series is 4.73. Since the catalytic coefficient for the hydroxyl ion is about 10,000 times as great as that for the hydrogen ion, the effect of the hydroxyl ion must be taken into account in considering the results for this series of solutions.

The total reaction velocity is therefore given by

$$v = v_h + v_a + v_m + v_{\text{OH}}$$

$$k_h \cdot [\text{H}] + k_a \cdot [\text{A}] + k_m \cdot [\text{HA}] + k_{\text{OH}} \cdot [\text{OH}]$$

Since $[\text{H}]$ and $[\text{OH}]$ are constant throughout the series, the sum of the first and last terms has a fixed value, namely, 0.02×10^{-6} . Denoting by c the concentration of the acid and the salt, the above equation becomes

$$c = (k_a + k_m)c + 0.02 \times 10^{-6} \quad (6.06 + 0.02) \times 10^{-6}$$

The observed and calculated reaction velocities for solutions in which the concentration c varies from 0.005 to 1.0 are compared in Table V.

TABLE V

Reaction velocities for isohydric solutions

c	0.005	0.01	0.02	0.05	0.10	0.20	0.50	1.00
$v \times 10^6$ obs.	0.019	0.078	0.131	0.305	0.50	1.24	3.59	8.05
$v \times 10^6$ cal.	0.0.0	0.080	0.110	0.320	0.620	1.22	3.02	6.05

Excluding the two most concentrated solutions which show clearly the incidence of disturbing factors (complex ion formation) there is very close agreement between the observed and calculated velocities. The velocity for the 0.20 solution is about twenty-five times as great as the velocity for the 0.005 solution and about sixty times that which would be expected on the assumption that the catalytic agents are the hydrogen and hydroxyl ions. The results are therefore vastly different from those which the older views would lead us to anticipate.

A generalised reaction velocity equation

We may now return to the further consideration (cf. Dawson, J.C.S., 1927, 243) of constant acid series of acid-salt mixtures for which the reaction velocity is expressed by equation (2). Since all acid/salt mixtures can be grouped into constant acid series, for each of which the relation between v and p_{H} is represented by a curve of catenary type, it follows that the entire catalytic relations can be expressed by a series of juxtaposed catenaries which give rise to a catenary surface when the reaction velocity, p_{H} value, and acid concentration are unidimensionally co-ordinated (cf. Dawson, J.C.S., 1927, 756).

Within any given constant acid series, the variations in velocity are due entirely to changes produced by the

positive and negative ions, the joint effect of which is expressed by $v = v + k_m c$. The equation for the ionic reaction velocity is therefore

$$v = (k_h + k_m) \cdot [\text{H}] + k_a K c / [\text{H}] \quad \dots \dots (7)$$

according to which the connexion between the ionic velocity and the hydrogen ion concentration is expressed in terms of the catalytic coefficients k_h , k_a , and k_m , the ionisation constant K and the concentration of the acid c , which is also constant for the solutions belonging to a given constant acid series. By a very simple procedure it is possible to eliminate the whole of these constants and to derive a general formula connecting the ionic reaction velocity with the hydrogen ion concentration.

If, namely, the hydron concentration $[\text{H}]$ for any solution is expressed in terms of the hydron concentration

$[\bar{\text{H}}]_0$ of the corresponding M.V. mixture such that

$v = [\text{H}]^n / [\bar{\text{H}}]_0$, then equation (7) may be written

$$v = (k_h + k_m) \cdot n [\bar{\text{H}}]_0 + k_a K c / n [\bar{\text{H}}]_0$$

and since $[\bar{\text{H}}]_0 = \sqrt{k_a K c / (k_h + k_m)}$ cf. equation (3)

we obtain $v = (n + 1/n) \cdot \sqrt{(k_h + k_m) k_a K c} \dots \dots (8)$

If, further, the ionic reaction velocity v is expressed in terms of that for the corresponding M.V. mixture, such that $v = v_0/n$, then since

$$v_0 = 2 \sqrt{(k_h + k_m) k_a K c} \quad \text{cf. equation (4)}$$

we have $v = v_0/n = \frac{1}{2}(n + 1/n) \dots \dots (9)$

Equation (9) expresses in general terms the connexion between the reduced ionic velocity v and the reduced hydrogen ion concentration n .

If $\log_{10} n = \log_{10} [\text{H}] - \log_{10} [\bar{\text{H}}]_0 = (p_{\text{H}}) - (p_{\text{H}})_0$ be denoted by Δp_{H} , then Δp_{H} represents the reduced p_{H} value of the solution in question, and equation (9) may be written in the form

$$v = \frac{1}{2} (10^{\Delta p_{\text{H}}} + 10^{-\Delta p_{\text{H}}}) \dots \dots (9A)$$

This is the equation of a catenary, and, since no specific constants are involved, it expresses quite generally the connexion between the reduced ionic velocity and the reduced p_{H} value. Its applicability would appear to be independent of the nature and concentration of the catalysing acid, of the temperature, of the nature of the solvent, and of the nature of the catalysed reaction. It may also be shown to be valid if the anionic catalytic effect is shared by the anion of a dissolved acid and the hydroxyl ion which, under certain circumstances, comes into play simultaneously when water is the solvent. Equations (9) and (9A) are thus to be regarded as alternative expressions of a general relation which is applicable to all acid catalysed reactions in so far as the velocity of these depends on the joint action of hydrogen ions and catalytically active anions.

In the derivation of this general relation, the procedure followed is analogous to that by which specific gas equations are transformed into constant-free general reduced equations of condition.

The data available for the testing of the generalised reaction velocity formula are necessarily limited, since

the determination of r requires a knowledge of n and n_0 , whilst the evaluation of Δp_H involves the measurement of p_H and p_{H^+} . For the most part the requisite information is only supplied by the experiments which have been made in connexion with the acetone-iodine reaction. Within these limits it has been found that the plot of the experimental values of r and Δp_H conforms closely to the general catalytic catenary (cf. Dawson *loc. cit.*). An alternative method of testing the experimental data is adopted here. This consists in comparing the observed values of Δp_H with those calculated from equation (9A) which may for this purpose be put in the form

$$\Delta p_H = \log_{10} (r + \sqrt{r^2 - 1}) \dots \dots \dots (9B)$$

In Table VI the relevant data are arranged in an order which is determined by the magnitude of r . The first ten have reference to the acetone-iodine reaction at 25°, the eleventh to the hydrolysis of methyl acetate at 85.5°, and the last to the hydrolysis of ethyl acetate at 85.5°. The first column indicates the catalyst used, the second gives the observed value of r , the third gives the experimental value of Δp_H , and the fourth the value of Δp_H calculated from (9B).

TABLE VI
Catalytic effects in relation to the general catenary
Catalyst

Catalyst	r	Δp_H (obs.)	Δp_H (ca.)
1 0.2 CH ₃ CO ₂ H : 0.1 CH ₃ CO ₂ Na	2.9	0.61	0.66
2 0.05 CH ₃ CO ₂ H	1.8	1.02	0.98
3 0.10 CH ₃ CO ₂ H	1.9	1.01	0.99
4 0.20 CH ₃ CO ₂ H	2.2	1.00	1.01
5 0.05 CH ₃ CO ₂ H : 0.16 CH ₃ CO ₂ Na	2.3	1.21	1.16
6 0.1 CH ₃ CO ₂ H : 0.02 CH ₃ ClCO ₂ Na	13.6	1.35	1.42
7 0.1 CH ₃ CO ₂ H : 0.1 CH ₃ CO ₂ Na	14.6	1.45	1.46
8 0.1 CH ₃ CO ₂ H	26.7	1.65	1.73
9 0.2 CH ₃ CO ₂ H : 1.0 CH ₃ CO ₂ Na	27.2	1.71	1.71
10 0.1 CH ₃ CO ₂ H : 1.0 CH ₃ CO ₂ Na	36.2	1.85	1.86
11 Strong acid (85.5°)	38	1.87	1.88
12 Strong acid (85.5°)	65	2.20	2.11

Having regard to the wide variations which are represented by the tabulated data—variations in the nature of the catalysed reaction, the temperature, the nature and concentration of the catalysing acid which is sometimes used in the pure state and at other times admixed with the corresponding salt—the concordance between the experimental data and the corresponding calculated quantities is such as to justify the belief that the reduced catalytic catenary represents a general expression for the effects which result from the joint action of the catalytically active positive and negative ions which are formed by the dissociation of acids.

From the table it is evident that the values of r and Δp_H for pure acetic acid in 0.05, 0.1, and 0.2 molar solution are identical within the limits of error. In other words, the reduced reaction velocity and the reduced hydron concentration depend only on the nature of the acid and not on its concentration. This experimental result is quite in accordance with the general theory, for it may be shown that the reduced hydrogen ion concentration of salt-free solutions of the

pure acids, *i.e.*, $n_0 = [H]_0/[H]_i$ is determined by the relative magnitudes of the catalytic coefficients k_h , k_a , and k_m as expressed by the equation

$$n_0 = \sqrt{k_a/(k_h - k_m)} \dots \dots \dots (10)$$

The reduced ionic velocity for pure acid solutions is then given by

$$r_0 = \frac{1}{2} \{ \sqrt{k_a/(k_h - k_m)} + \sqrt{k_h - k_m}/k_a \} \dots \dots (10A)$$

For a given reaction taking place at a definite temperature in a given solvent medium, the value of n_0 and therefore the position occupied by a particular acid on the reduced catalytic catenary is independent of its concentration. Since for the weaker acids k_m can be neglected in comparison with k_h , it follows that this position is determined by the relative magnitudes of k_h and k_a . If $k_h = k_a$ the pure acid takes its place at the apex of the catenary. According to whether k_h is greater or less than k_a , it falls on the left or on the right branch of the catenary.

The essential difference between the catalytic effects which are produced by the joint action of the hydrogen and hydroxyl ions, derived from the very weak acid H₂O, and those which result from the joint action of the ions from acetic acid, lies in the fact that k_{OH}/k_h for most reactions is much greater than unity, whilst the corresponding ratio k_a/k_h for the acetic and hydrogen ions is much less than unity. There would seem, indeed, to be no satisfactory reason for differentiating between the hydroxyl ion and other acid anions.

Finally, in regard to the general catenary, it may be noted that the movement of an index point along the curve from left to right (in the direction of decreasing acidity) affords not only a representation of the changes in catalytic activity which are produced by the addition of a salt to the corresponding acid, but show clearly the gradation in the catalytic properties of the pure acids as a group, in that the catalytic activity of the acid anion increases as the catenary is traversed from left to right. This increase in the catalytic activity of the anion would seem to run parallel with the diminution in the ionisation constant of the acid and with a decrease in the catalytic activity of the undissociated acid.

From the foregoing account of recent developments it should be clear that a knowledge of iso-catalytic data is of the greatest importance in the study of catalytic effects. From the equations which connect the iso-catalytic data with the catalytic coefficients it is possible to derive the values of catalytic coefficients which cannot be obtained by direct experiment. In this way it has been shown (Dawson, J.C.S., 1927 1146) that the ratio k_{OH}/k_h varies between very wide limits for a series of hydrolytic reactions. For the hydrolysis of benzanide the value of this ratio is approximately unity, whilst for the hydrolysis of ethyl amino-acetate its value is about ten million times as great.

The above equations have also been applied (Dawson, J.C.S., 1927, 1290) to the determination of the dissociation constant of water at different temperatures. The value so obtained is 1.25×10^{-11} at 25° and 34×10^{-14} at 85.5°.

In concluding this brief statement of some of the results which have been obtained in the Physical Chemistry Department of the University of Leeds, we would venture the opinion that the sum total of our observations provides a very strong argument for the general correctness of the views which have been put forward.

SILICA GEL

The use of silica gel as an adsorbent of certain gases has been known for some time. The substance is characterized by the complete reversibility with which it works. As a dehydrating agent it has many possible applications in industry, and it is the object of this short article to describe the results of one such application made in blast-furnace practice.

Blast furnace practice

In this industry the weight of air admitted into the furnace exceeds the total weight of all other materials

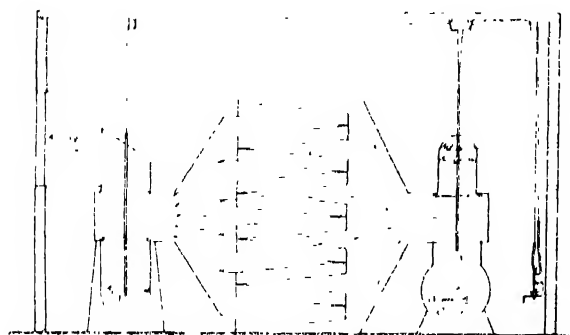


FIG. 1

Silica gel plant. Position of valves during adsorption

charged into the furnace. It is therefore not surprising that much attention has been paid by ironmasters in the past to the condition of the air, and to the effect produced by its most variable constituent, viz., moisture. The important part played by the moisture of the atmosphere is realised when it is pointed out that air containing 5 grains of moisture per cubic foot—which is not excessive

or by chemical adsorption have not been successful in practice.

The silica-gel plant to be described has been installed in the works of the Glasgow Iron and Steel Co. at Wishaw; the data have been furnished by Mr. E. H. Lewis, M.A.,

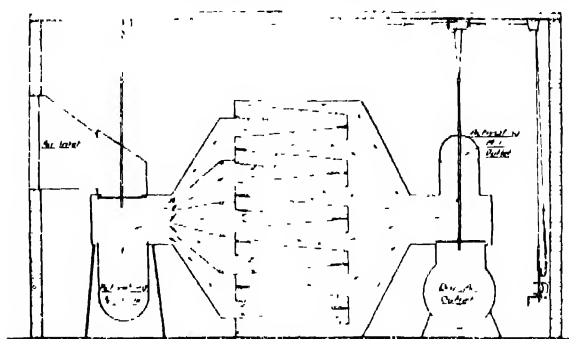


FIG. 2

Silica gel plant. Position of valves during activation

of this firm. The plant is designed to treat 35,000 cu. ft. of air per minute and it has been in operation since April of this year.

It is found that silica gel can adsorb at atmospheric temperature from 30-50% of its weight of water, and that by raising the temperature—done by passing waste blast-furnace gas at 610° F.—this water can be driven off, leaving the reactivated gel ready for another cycle. About 2 lb. of gel is used for each cubic foot of air to be treated per minute.

The plant

The plant consists of a battery of six adsorber units placed side by side and arranged so that the gel in any one

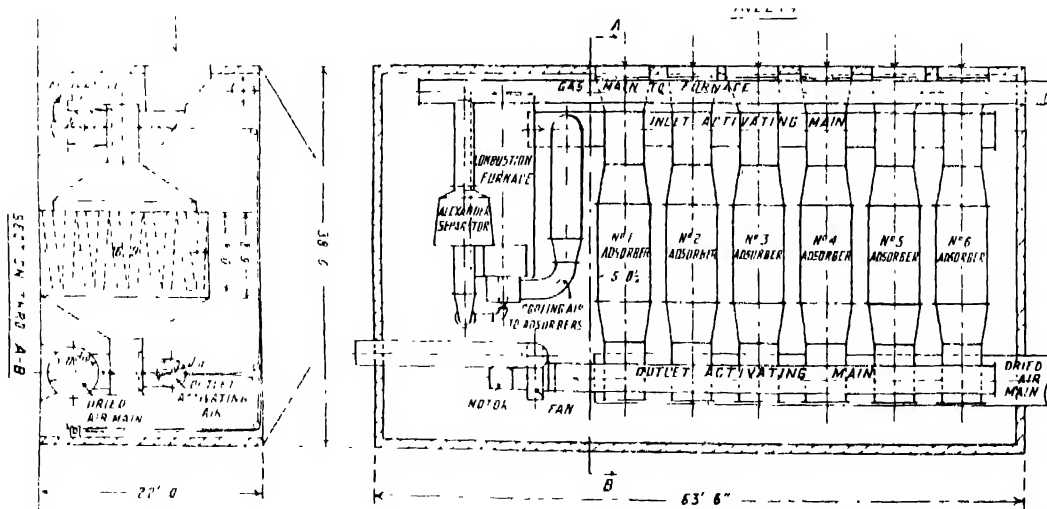


FIG. 3

Arrangement of silica gel plant

atmospheric humidity contributes 100 lb. of water to the furnace per ton of pig iron made. Previous attempts to reduce the moisture of the blast by freezing

element can be activated while the gel in the other five is adsorbing moisture from the atmosphere. Running the whole length of the battery are three ducts or pipes,

one along the front or entry side and two along the back or outlet side. These are connected by branches to each adsorber. The branches from the entry duct are fitted

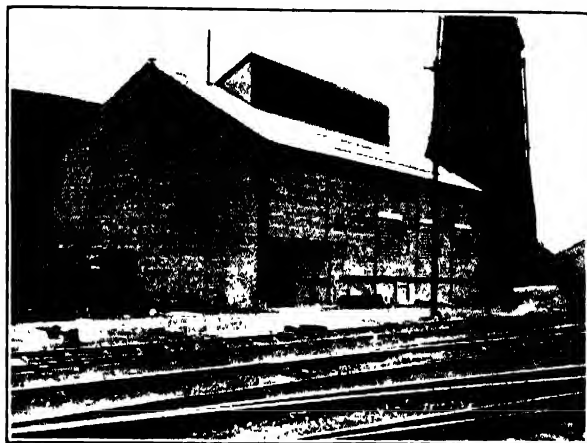


FIG. 4

Silica gel house. Dry air duct on extreme right

with two-way dampers arranged so that five are closed to the hot activating gas and open to the atmosphere,

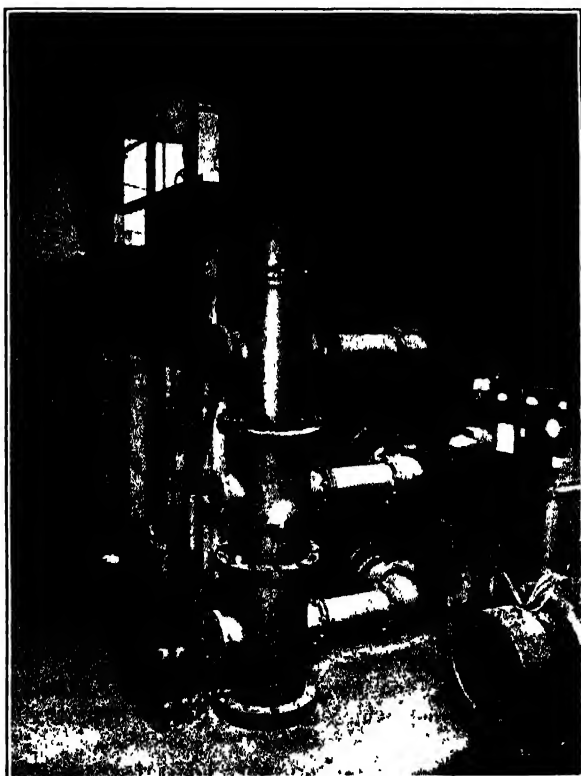


FIG. 5

Activating gas furnace, burner control valves, and instrument board

while the sixth closes one adsorber to the atmosphere and opens it to the entry of hot activating gas. The branches

from the two outlet ducts are fitted with similar two-way dampers mechanically coupled with those on the inlet side of the battery. These dampers connect the one activating adsorber with the wet air duct and the five adsorbing units to the dried air duct. An induction fan draws the hot activating gas through the saturated gel

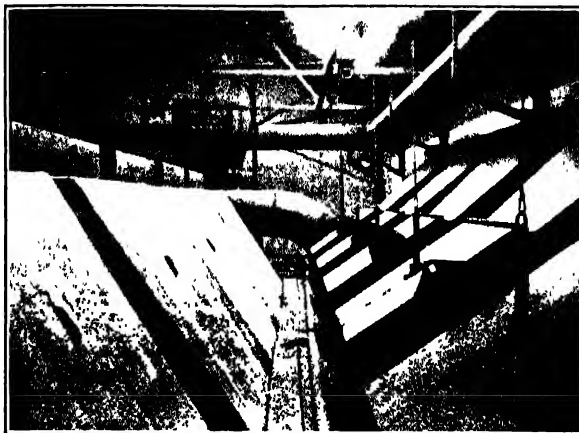


FIG. 6

Top of adsorbers (inlet side), atmospheric inlet duct on right, dust separator and cooling air duct in background

and discharges the moisture through an uptake to the atmosphere.

The adsorber unit

The adsorber unit consists of a steel box about 17 ft. high. It contains 10 mesh-bottomed trays on which rest 6 tons of gel in granular form. These trays are

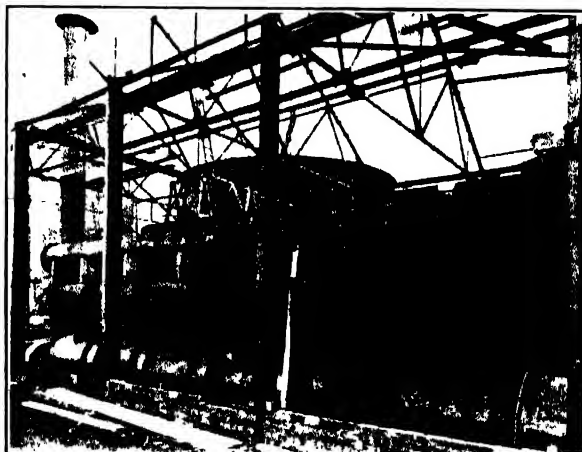


FIG. 7

Plant under construction. Dry air and wet air ducts, with damper valve boxes

suitably inclined to expose the gel efficiently to the flow of the air of the atmosphere, or to the activating gas as the case may be. Filters are placed at the atmospheric inlet to remove dust from the incoming air. The heat for activation is provided by the combustion of blast-furnace gas, which has been cleaned in the process

of recovering the by-products from the raw coal used in the furnaces. The gas is burnt in a small combustion chamber, and an excess of air is admitted to reduce the temperature of the activating gases to about 640° F. (338° C.). The time required to activate one unit is about 1½ hrs., during the latter part of which the gas is turned off and air only is drawn through to cool down the gel to a temperature at which it is able to adsorb moisture.

A constant moisture in the blast of about 1 gram per cubic foot is aimed at. Since in cold weather the plant gives a degree of dryness below this, an adjustable inlet for atmospheric air exists between the dehydrating plant and the blower to dilute the dried air up to the moisture aimed at.

The running cost of the plant is low, consisting mainly of the heat necessary for activation. One man is sufficient to control the plant, and the power required is about 20 h.p. Even to those who use their blast furnaces as gas-producers, the installation of a silica gel plant promises to provide a substantial return on the capital cost.

INSULATING OILS

By CECIL O. HARVEY, B.Sc., A.R.C.S., A.I.C.

Insulating oils for use in electrical transformers are required to have such special properties that they have almost become a subject unto themselves.

The production of a low viscosity oil of low iodine value and high flash point, which does not deposit "paraffins" at temperatures well below the freezing point of water, and which contains a low percentage of matter volatile at 100° C., calls for the use of special "crudes" to which not all oil refiners have access. In addition the oil must have exceptionally good insulating properties, be without action upon any part of the transformer, and must not undergo rapid chemical change when subjected to elevated temperatures and electrical stresses in the presence of atmospheric oxygen.

Such oils must be of the hydrocarbon type, and are therefore essentially highly refined mineral oils of suitable viscosities, which must comply rigidly with the specifications adopted by the various authorities. The British Engineering Standards Association Specification¹ allows for the use of two grades of oil in transformers, designated respectively as "A" and "B" quality oil, the former having a maximum sludge value of 0.1% and the latter a maximum value of 0.8%.

Low insulating power in an otherwise satisfactory oil is invariably due to the presence of moisture, the effect of which is greatly increased if fibrous particles are also present. These objectionable constituents may be removed by centrifugal treatment, and in this connexion it is interesting to note that the quantities of water concerned are of the order of 0.005%.

The most important property of a good transformer oil is undoubtedly its capacity for resisting atmospheric oxidation and freedom from tendency to form sludge.

Rodman² states that three distinct types of sludge are found in transformers, namely, asphaltic, soap, and carbon sludge.

Asphaltic sludge consists largely of oxygenated bodies of high molecular weight, and has good insulating pro-

perties, its detrimental action being due to its low heat conductivity and tendency to increase the viscosity of the oil, with consequent overheating of the transformer windings.

Soap sludge, as its name implies, arises through the development of acidity in the oil, subsequent action upon the metallic parts of the transformer giving rise to salts of organic acids, which have poor insulating properties.

Carbon sludge, caused by "arcing" or "corona discharge," is less common. It has poor insulating properties, but may be removed from the oil by filtration or centrifugal purification.

With regard to the prevention of sludge formation, a good oil should be used, but it must be remembered that even the best oil is capable of undergoing oxidation, and atmospheric oxygen should therefore be eliminated from the transformer as far as possible by using some form of oil conservator. Other features which should be taken into account and avoided as far as possible are (a) conditions giving rise to "silent discharge" and local overheating; (b) contact with substances which will catalytically assist in the oxidation of the oil,* i.e., clean iron, lead, and copper surfaces, and varnishes containing "driers"; (c) the use of materials containing volatile hydrocarbons,² and of synthetic resin products containing excess of phenols or aldehydes. In paper insulating core laminations, the use of papering paste containing excessive quantities of alum, caustic alkalis, or other added mineral matter should be avoided. Calcium carbide should not be used as an air-drying agent in "breathers," as the acetylene generated may form explosive metallic compounds, and will, upon passing into the oil, assist in the formation of sludge.

Precautions having been taken to avoid all objectionable features in the transformer, the quality of the oil remains to be considered.

In carrying out Dr. Michie's sludge test,¹ the oil is maintained at a temperature of 150° C., and is air-blown continuously for 45 hrs., the sludge being weighed after the addition of petroleum ether and standing overnight. The test is very tedious, and is rendered more difficult to carry out by the fact that the quantity of air and the temperature must be very carefully controlled. Furthermore, Stäger⁴ points out that in tests of this nature no account is taken of acids and superoxides formed during the oxidation, which do not necessarily contribute towards the sludge value, but which may nevertheless detract from the insulating properties of the oil, and may exert a very deleterious action upon the copper windings and their cotton or paper insulation, particularly if unvarnished paper insulation is used. Subsequent decomposition of superoxides will give rise to nascent oxygen, which may cause rapid oxidation of the oil.

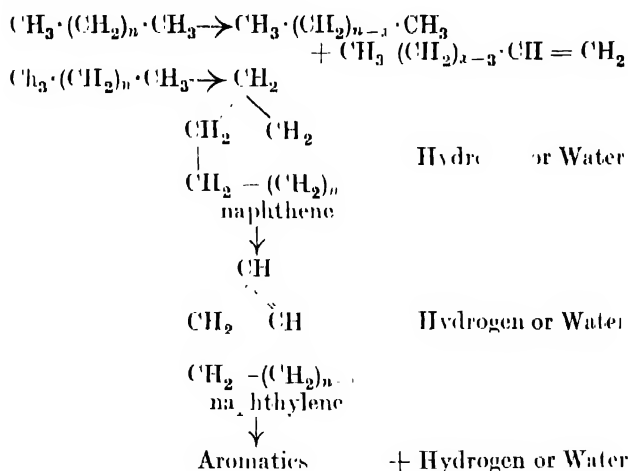
Kissling's tar test,⁵ on the other hand, takes account only of the acidic substances formed during oxidation, and there is, naturally enough, no relationship between the tar number and the sludge value for a given oil.

* Bulkov,³ in attempting to identify the antioxidant agents of petroleum resins, finds that certain substances (α -naphthol, α -naphthylamine, etc.) exert a strong antioxidant action, but it seems probable that the delayed oxidation having commenced, the presence of such substances may assist in the formation of sludge.

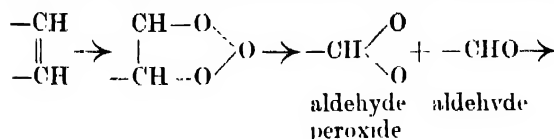
In the Brown Boveri test,⁴ an attempt is made to determine sludge, developed acidity and superoxide development (the last by a Fehling's reduction method on cotton yarn which has been heated in the oil), and this appears to be the most thorough method of testing suggested up to the present.

Stäger maintains that, contrary to general belief, acid formation precedes sludge formation, the unsaturated hydroxy acids formed giving rise to lactones, and polymerisation of these causing deposition of sludge. It is generally agreed that "sludging" is primarily due to oxidation—the changes involved are undoubtedly very complex, but it is interesting to consider relatively simple changes which the various classes of compounds liable to be present in hydrocarbon oils may undergo upon oxidation.

According to Stäger, the temperature employed in the Michie test is too high, fatty acids of low molecular weight (*e.g.*, acetic acid) being formed by decomposition of the oil. Paraffin hydrocarbons are not likely to undergo such drastic changes under normal working conditions, though it is possible that, under the combined influences of oxidation and heat, "cracking" and dehydrogenation may occur, resulting in the formation of paraffins of lower molecular weight, olefins, naphthenes, aromatics, etc.



Olefins, if present in a petroleum distillate, are usually considered to be "cracking" products. In the presence of metallic salts, polymerisation of these compounds may occur, but a greater danger lies in the possibility of ozonide or peroxide formation, with subsequent formation of aldehydes, ketones, and acids, the ability of the oil to take up as much as 15% of its volume of atmospheric oxygen² making the formation of ozone possible.



Brooks¹⁰ has obtained small quantities of butyl aldehyde and acetone by simple atmospheric oxidation of amylene.

Diolefinic substances may undergo similar changes to the olefins, and polymerisation may take place in cases of

conjugation of double bonds, as happens in the preparation of butadiene rubbers. Polymerisation after peroxide formation may also occur.

Naphthenes may be changed by oxidation or "cracking" into naphthylenes etc., and naphthylenes may undergo similar changes to the olefins, or may give rise to asphaltenes. Conjugation of double bonds may possibly cause the formation of rubber-like substances in a manner analogous with the *cyclo-octadienes*.

Aromatic hydrocarbons may undergo direct oxidation to acids, or acid formation may take place via the ozonides.

The effect of sulphur upon caoutchouc, and the influence of accelerators on the rate of vulcanisation suggest that the presence of sulphur- and nitrogen-containing substances in the oil may assist polymerisation, this theory being indirectly supported by the fact that asphaltenes, obtained from natural asphalts, contain combined sulphur.

Phenols, if formed during oxidation of the oil, or derived from bakelite products, may combine with aldehydes and ketones arising from unsaturates and aromatics, forming resinoid bodies (phenol-aldehyde resins). Brooks¹⁰ states that the resins formed during the oxidation of "cracked" gasolines are acidic, not aldehydic, but this does not preclude the possibility of aldehydic condensation occurring in the oil in use in a transformer.

This summary of reactions which may take place in the oil is not put forward as an exhaustive theory accounting for sludge formation. The changes occurring are undoubtedly very complex, but, from a consideration of these simple suggestions, it is obvious that all classes of compounds other than naphthenes and paraffins are liable to give rise to objectionable products, and even naphthenes and paraffins may undergo slow oxidation.

At this point reference must be made to two recent papers bearing on the subject. Becker⁶ states that mineral and fatty oils, subjected to a silent discharge, undergo molecular condensation with loss of hydrogen and an increase in viscosity. It is therefore possible that changes in the properties of an oil may occur in the absence of air. Van der Heyden and Typke⁷ have found that the development of sludge and acidity may occur owing to the action of light, and care should therefore be exercised when storing samples of oil, or discrepancies in the analytical results may arise. This observation accords with Brooks' statement that "cracked" gasolines, exposed to air and sunlight, develop a positive peroxide reaction, and give a "doctor" test closely resembling the true mercaptan reaction.

Obviously no definite relationship between iodine values and sludge values for different samples of oil can exist, as the sludge values may be expected to increase as the molecular weights of the unsaturated compounds increase, whereas the iodine values corresponding with, say, one unsaturated linkage will diminish as molecular weights increase, and, furthermore, some of the substances referred to as being possible potential sources of instability will not contribute towards the iodine value of the oil, *e.g.*, aromatic hydrocarbons. (Note.—A sample of benzene, not specially purified, was found to have a Wijs iodine value of 0.7, this slight

absorption of halogen being probably caused by impurities).

The "formolite number" serves merely as an indication of the proportion of aromatic and naphthylene substances present, and, even if determined by Ratchffe's methylal method,⁸ is difficult to carry out satisfactorily.

Attempts have been made to connect the sludging propensities of oils with their colour intensities. Undoubtedly good transformer oils are practically devoid of colour, but it does not follow that the converse statement can be relied upon, and, according to a report of the British Electrical and Allied Industries Research Association,¹¹ colour tests are of little value as criteria of the sludging characteristics of oils.

As far as the author is aware, the selective absorptions of these oils in the invisible regions of the spectrum have not received any attention. Work in this direction might prove to be of interest.

It appears that a method of examining transformer oils, more rapid and satisfactory than the methods proposed hitherto would be very welcome. Such a method must be free from the limitations from which sludge tests, tar tests, etc. suffer, in that it must be capable of detecting the presence of all objectionable substances, whether they be "sludge formers," "acid formers," or "peroxide formers." All substances capable of undergoing oxidation to form acids or peroxides will not necessarily give rise to sludge, and a method is required which will detect instability in oils having low sludge values, and which will, at the same time, be less tedious than the procedure adopted by Stäger.

Interesting, but only partially successful, experiments carried out by the author during the past twelve months are being continued, and it is hoped that at some future date it may be possible to place on record an entirely new method.

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REPORT OF THE GOVERNMENT CHEMIST*

During the year 469,642 samples were examined at the Government Laboratory and at chemical stations, compared with 445,606 in the preceding year. There was a decrease of 3594 samples examined at the Custom House branch, but the number examined at Clement's Inn showed an increase of 14,716, and at the chemical stations an increase of 12,914. The samples of wine increased from 106,395 to 122,749, and there was a decrease of 4434 samples of tea compared with the previous year. There was an increase of 1297 in the samples of exported tobacco and snuff, indicating that the increase in exports referred to last year has been maintained. The numbers of samples of cocoa goods and of imported and exported spirituous preparations increased, as did the number

of samples examined in connexion with the subsidy on British sugar. Owing to the new duties on silk and artificial silk the examination of over 22,000 samples was necessary during the year, and the work in connexion with the Safeguarding of Industries Act again involved the examination of nearly 10,000 samples. The contracts branch of the Admiralty submitted 47 samples of food on tender for report as to conformity with specification and opinion as to relative merits, and 203 samples were submitted by the technical examining officers at the victualling yards with the object of preventing the issue of canned foods contaminated with metals. Other samples numbered 86, and in addition the determination of the salinity of 1325 samples of sea-water was carried out.

Of the 847 samples of butter examined during the year, three contained more than 16% of water. No samples of milk-blended butter were received: 65 of the samples received were from Scottish ports.

Four of the 341 samples of margarine contained more than 16% of water, but there was no evidence of butter fat in excess of the legal quantity in any of the samples, 53 of which were taken in Scotland and 8 in Northern Ireland.

The proportion of fat in cheese was found to vary from 9.1 to 45.0%, or from 20.5 to 65.6% of the dry matter in the cheese. Some of the cheese had thus been made from skimmed milk, but no exception could be taken, as there are no appropriate regulations to control the marking of skimmed milk cheese.

Twenty-five samples of preserved cream and 80 of unpreserved cream were examined, the unpreserved cream containing from 20 to 33% of fat, with the exception of two samples containing 50% of fat. The preserved cream contained 47 to 52% of fat. These samples were tested not only in relation to the Food and Drugs Acts Regulations, but to ascertain whether they conformed with the Milk and Cream Regulations, issued by the Ministry of Health under the Public Health Acts. Only one sample of tinned sterilised milk was examined. Of the 60 samples of condensed milk examined under the provisions of the Sale of Food and Drugs Acts, 8 of the samples, 3 of which were milk powder and 5 condensed milk, had been prepared from skimmed milk or partially-skimmed milk, but the packages from which the samples had been taken were not marked "Machine-Skimmed Milk," as required by the Act. Three samples imported as milk powder or block milk were found to have been derived from machine-skimmed milk, without anything in the marking to indicate that the fat had been removed before their preparation. In addition, 153 samples were taken under the Public Health (Condensed Milk) Regulations, which came into force on October 1, 1923, and 43 of these were reported against. In five cases the milk was below the minimum standard quality fixed by the Regulations, and in three cases the statement on the label of the quantity of whole milk which the contents of the tin represented was untrue, the amount being overstated. In other cases the offence was connected with the labelling. All the samples were free from chemical preservatives. Of the 21 samples of margarine taken at factories in this country, three contained water

* Report of the Government Chemist upon the work of the Government Laboratory for the year ending March 31, 1927, with appendices. Pp. 42. H.M. Stationery Office, 1927. Price 1s. 3d.

in excess of the legal limit. One sample of butter taken was found to contain vegetable oil.

Samples of sheep dip, numbering 118, were taken during the year, 22 being reported as defective. Thirty-six samples of river water and effluents were also examined. A river receiving effluent from a beet-sugar factory was under systematic survey to collect information on the effect of the effluent upon the river water. The Board of Agriculture for Scotland submitted 15 samples of water in connexion with the water supply of farm settlements, and reports based on chemical and bacteriological examination were made as to the suitability of the water for drinking and other purposes. Sea-water samples were examined in connexion with a scheme of oceanic research carried out by the Fisheries and by the Fishery Board for Scotland, acting in concert with the International Council for the Exploration of the Sea. The salinity of 4385 samples, including 979 samples from the Fishery Board for Scotland, was determined, in addition to those examined for the Admiralty.

Various deficiencies and impurities were found in fertilisers and feeding-stuffs. During the year two fertilisers and eight feeding stuffs were reported upon. The fertilisers consisted of a mangold fertiliser deficient in potash and a blood and bone fertiliser. The feeding-stuffs included barley meals, decorticated cotton seed meal, fattening meal, fish meal, and Sussex ground oats. Three samples of barley meal were found to contain from 33 to 40% of wheat offals, maize meal, or mixed cereal meal, and one sample contained a large proportion of barley offal. The fattening meal was deficient in proteins, the fish meal contained an excess of oil and a deficiency of proteins, and the Sussex ground oats contained 20% of tapioca meal and 15% of wheat and barley.

The Committee of Chemists, called together by the Government Chemist at the request of the Ministry of Agriculture to formulate a method of estimating fibre in feeding stuffs which could be prescribed for use under the Fertilisers and Feeding Stuffs Act, 1926, has forwarded a report on the suggested method to the Ministry.

The total number of samples of beer examined for the year for assessment of duty was 56,725, or an increase of 1198 samples. Out of the 484 samples of brewing materials examined, 233 were malt, corn, brewing sugars, or exhausted grain, and 251 yeast foods and miscellaneous substances used, or proposed to be used, in the preparation of beer. Fifty-three samples were found to contain arsenic in slight excess of the limit laid down by the Royal Commission on Arsenical Poisoning. Many duty-free spirits, including methylated spirits, specially denatured spirits, and other manufacturing spirits, were examined and 718 samples of wood naphtha and mineral naphtha, and 148 samples of pyridine were examined for fitness for methylating. All these samples were approved. Of 75 samples of methyl alcohol, 15 were found liable to duty on the ground of potability. Thirty-two samples of fusel oil from British distilleries were examined, and out of these two were found to contain more than 15% of proof spirit.

The Merchant Shipping Act provides that every foreign-going ship shall carry a supply of lime or lemon juice, and that one ounce per day shall be served out to

every member of the crew after the ship has been at sea for 10 days. Two hundred and thirty-three samples of raw lime and lemon juice were submitted for approval, of which none was found to conflict with the existing regulations. Of fortified juice sent for examination before being bottled, or for re-approval, 93 samples were received, two of which proved to be unsuitable for use. The quantity of juice approved was 28,326 gals. In the early days of the use of fruit juice as a preventive or curative agent for scurvy, the juice of lemons alone was employed, but for some time the juice of limes has been recognised as equally suitable for the purpose. The work carried out during recent years upon accessory food factors (vitamins) has, however, shown that lime juice is not a satisfactory antiscorbutic agent. On the other hand, orange juice and lemon juice possess valuable antiscorbutic properties, and their activity is retained for considerable periods if the juice is suitably preserved and stored. An Order in Council has now been issued (The Merchant Shipping (Antiscorbutics) Order in Council, 1927) making provision for the use, if desired, of concentrated orange juice. The Order gives the specification for the juice, and, *inter alia*, it is required that it shall be so prepared and stored that there is no material loss of vitamin potency.

Of imported colours, lakes and other goods, nine samples were examined to ascertain whether they involved liability to Customs duty, and whether they contained synthetic organic dyes, of which the importation is prohibited.

Examination was made of numerous samples of sugar (including 3994 samples of beet pulp, beet juice, molasses and refined sugar), glucose and saccharin; also of table waters, tea, tobacco, wines, and of 778 samples for the Air Ministry, which included silicon and one sample of petrol containing lead tetraethyl.

ONTARIO WINE INDUSTRY

Under prohibition, in Ontario, alcoholic beverages were not permitted to be sold for consumption, except native wines, which could be purchased direct from the vintner and consumed in private dwellings. This provision greatly assisted in developing a market for these wines, which the winery proprietors early recognised. The services of the chemist were requisitioned, and to-day the wineries are producing Canadian champagnes, burgundies, tokays, ports, clarets, sauternes, and sherries which have proved highly satisfactory. While the production of wine in 1923 was only about one million gals., it is estimated this year it will exceed three million gals. In the past the grape growing industry has been almost wholly confined to the Niagara peninsula district. Owing to the devastation caused by the corn-borer in Essex and adjacent counties, the farmers of these districts have turned their attention to other agricultural products, and have discovered that an acre of grapes brings eight times the profit of an acre of corn, so many of the farmers of South-west Ontario have planted vineyards. To provide a market for the grapes within the district, a winery has been established at Walkerville, Ontario, under the management of a French expert, and the plant of a former large U.S. winery has been transferred to the Ontario establishment.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, is now ready.

The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

CHEMICAL SOCIETY'S LIBRARY

Members of the Society of Chemical Industry are reminded that they are entitled to consult the Library of the Chemical Society, Burlington House, Piccadilly, W.1, and to borrow books therefrom.

The Library is open daily from 10 a.m. to 9 p.m. Saturdays from 10 a.m. to 5 p.m. The Library is closed on Bank Holidays, the day following, and on other such occasions as the Council may direct.

ROTHAMSTED LIBRARY

By the courtesy of the Lawes Agricultural Trust, any member of the Society of Chemical Industry, on presenting a card from the General Secretary, shall be allowed access to this Library. The rules of the Library preclude journals and periodicals from being sent out, and these are, therefore, always accessible.

A catalogue of the journals and periodicals is in the Society's Offices at Central House, and may be consulted there by members.

GLASGOW SECTION

The 1927-28 session of the Glasgow Section opens on October 19 with a joint meeting with the Chemical Engineering Group, in the Ca'doro Restaurant, to hear a paper on "The desiccation (De Vecchus) process of beet sugar manufacture," by C. Scott Garrett, M.B.E., D.Sc., and G. W. Riley, M.I.Chem.E. On November 9 a joint meeting held in the Institute of Chemistry will be addressed by C. M. Keyworth, M.Sc., on "Research in the textile industry." On December 7 Dr. D. F. Twiss will speak on "Rubber," followed by C. Chapman, A.I.C., A.M.I.Chem.E., on "Naphthas, and their uses"; this meeting will be a joint one with the Edinburgh Section and the Institution of the Rubber Industry, and will take place in the Ca'doro Restaurant. The 1927 meetings end on December 14, when the Ramsay Chemical Dinner will be held. In 1928 Dr. C. H. Lander will speak on "The fuel problem" on January 17, and on February 22, at a joint meeting with the Institute of Chemistry, Mr. J. W. Hawley, B.Sc., will speak on "Some aspects of toxicology." The annual business meeting will take place on March 23, followed by a joint smoker with the Institute of Chemistry, and on May 25 a meeting will be held at St. Andrews, when Principal Sir J. C. Irvine will speak; the meeting will be followed by a dinner. The closing meeting will be held on May 26 jointly with the Edinburgh Section, when golf will be the order of the day.

LONDON SECTION

The opening meeting of the Session was held at the Society of Arts, on October 3, when the Chairman, Mr. W. J. A. Butterfield, M.A., F.I.C., who is one of the Gas Referees, gave an address on "The gas industry: past, present, and future." During the delivery of the address the chair was taken by Dr. Charles Carpenter, C.B.E., D.Sc., President of the South Metropolitan Gas Company and a Past President of the Society.

In introducing Mr. Butterfield, the Chairman said he knew of nobody better fitted to deal with the subject of the lecture than Mr. Butterfield, because his knowledge of the industry dated back very many years, and he had been associated with it in different positions and had seen the developments, which had been particularly striking, during the past 20 years. From his official position, too, Mr. Butterfield had been able to envisage the workings of the industry, its development, and its progress more impartially probably than anyone else.

Among public utility services, said Mr. Butterfield, the gas industry, which started in London in 1812, is older than the railways and electricity supply. It operates with less outstanding capital than either of them, yet its receipts are considerably greater than those of electricity undertakings and more than half as much as those of the railways. It is the only public utility service which is fundamentally a chemical industry, and the only one which was not interrupted, more or less generally, by the general strike and the miners' stoppage of last year. It achieved this distinction through its preparedness in the matter of stocks of coal and oil, and the prevalence of co-partnership schemes among its employees.

Official testings were made throughout the troubles of 1926 on over 70% of the gas supplied in Great Britain, and as regards 70% of that gas, its average heating value was found to be as high as it should have been in normal times, whilst as regards a further 20%, the deficiency in heating value in any quarter did not average as much as 5%. Having regard to the cessation of the customary supplies of coal for many months, the gas industry achieved a remarkable record of public service in 1926.

Reproductions of record-sheets of continuously operating calorimeters, and summarised results of other official testings (thrown upon the screen), indicated that the "therm" system of charging for gas supplied has tended to reduce the proportion of non-heating constituents in the gas and to promote regularity in its heating value.

Gas from coke-ovens should be more extensively utilised for public gas supplies, but the coke-ovens concerned should be taken over by the gas undertakings, in order that they may not be involved in colliery labour disputes, and the public service thereby placed in jeopardy.

Gas is being used increasingly for industrial heating—for example, two contiguous works belonging to a single firm, and in reality constituting one premises, consumed over 89 million cubic feet of town's gas in 1926. The service-pipe to one consumer's premises is no less than 14 inches in diameter.

For street-lighting, the self-diffusing effect of the gas mantle gives it a great superiority over unobscured electric lamps, the high point-like intensity of which causes them to arrest the attention of drivers, who are then apt to overlook objects in the roadway. The growth of electric street lighting in certain areas may be associated with the fact that the Public Lighting Authority is usually the local authority, and that seven elevenths of the electricity sold in the country is supplied by local authorities, who supply only four elevenths of the gas. In such circumstances, and especially when the Borough Electrical Engineer is given the position of Public Lighting Engineer, gas does not obtain, as it should on merits, a virtual monopoly of street lighting.

Gas supply should be extended more rapidly to rural districts, and electricity generated locally from it where required, or from oil, instead of being carried by overhead high-tension transmission lines, which are a menace to airmen and others. There is irrefutable evidence of a more insistent and general demand for gas than for electricity supply. In Great Britain, $8\frac{1}{2}$ million premises have gas supplies, and reckoned on the heat, or potential energy, basis, the increase in the consumption of gas in the years 1922-1925 was $2\frac{1}{2}$ times the increase in the consumption of electricity.

The gas industry, besides being itself one of the oldest and largest chemical industries of the country, is the fountain-head from which other chemical industries originate.

The Chairman, in proposing a vote of thanks to Mr. Butterfield, referred to the advantages of co-partnership, as exemplified during the general strike of last year, when, he said, the employees of an electricity works all marched out whilst the men at an adjacent gas works remained at their posts. He then emphasised the point made by the lecturer as regards the importance of chemistry to the gas industry. This was being realised to-day far more than it had been in the past, and people who had set their minds at one time against such a recognition were now realising that it was impossible to carry on a gas undertaking without a scientific foundation of that kind. In the past the gas industry had been very largely run by gas engineers with only a partial assistance from the chemist, but that attitude was being entirely changed, and one of the reasons for the developments to which Mr. Butterfield had drawn attention was due to this fact. These developments, however, had been delayed in the past because of this want of recognition of the necessity for the chemist in the industry. So far as the electricity industry was concerned, it was evident from the address that this industry required a great deal of nursing; further, it was a pity that it should have been decided to put up two large generating stations in residential areas of London, having regard to the difficulties encountered from smoke and other troubles where the combustion of large quantities of coal was concerned. Referring to another aspect of the competition between electricity and gas, the chairman drew attention to the manner in which some local authorities who own electricity undertakings are endeavouring to compel the tenants on their housing estates to use only electricity, or at any rate to use no gas for lighting. The public should have a free choice in this matter.

Mr. C. S. Garland, seconding the vote of thanks, said it was a courageous thing for a man to get up in any scientific gathering and take a definite line and state a definite case. Mr. Butterfield had made out a perfectly good case for gas because, judging by the amount of noise made by the two industries, one would have thought it was the gas industry which was not making progress, whereas the curves and figures given by Mr. Butterfield, showed clearly that the gas industry was making the more rapid progress of the two. When an industry had to go to the extent of prohibiting the use of a competing commodity it must have a very poor case. At the same time, he was inclined to think the gas industry had itself to blame for some of the progress which electricity was making. It was often said that the gas industry did not worry about the lighting load and only wanted the heating, but his view was that every endeavour should be made to prevent electricity being used for lighting because once it got into the houses for lighting it was soon used for other purposes also. The gas industry was a striking example of an industry which had had its whole course entirely changed by scientific research work. The development of the gas mantle altered the whole position of the gas industry at a time when it was in a critical state, and but for the invention of the gas mantle in the early 90's or late in the 80's, the position of the gas industry might have been very different. By an extension of that scientific research work, he hoped to see the gas industry in the future supplying not only gas and smokeless fuel, but those liquid fuels which are essential to civilisation. The synthesis of alcohols and the hydrogenation of oil itself both would ultimately, he believed, depend upon the gas industry.

Mr. H. C. Honey, late Director of Gas Administration at the Board of Trade, spoke of the collaboration between himself and Mr. Butterfield in the inception and administration of the Gas Regulation Act of 1920, and expressed satisfaction that the Act should have resulted in such an increase in the technical efficiency of the industry as had taken place.

Mr. Butterfield, replying to the vote of thanks, said the address had been something of a departure from the usual subjects brought before the Section, but the chairman was entitled to a little licence on such an occasion and he admitted he had taken advantage of it. He expressed the hope that more members of the gas industry would become members of the Society of Chemical Industry, and that members of the gas industry would contribute papers to the Society dealing with scientific progress in the gas industry.

The Chairman, acknowledging a vote of thanks to himself, emphasised the remark made by Mr. Butterfield as to the accession of new members to the Society from the gas industry. No engineer engaged in the supply of gas could afford to be outside the Society and no chemist engaged in the gas industry was outside the Society.

CALENDAR OF FORTHCOMING EVENTS

Oct. 7.—Society of Chemical Industry, Manchester Section. 17, Albert Square, Manchester, at 7 p.m. Chairman's Address, by C. J. T. Cronsshaw, on "The seven lamps of chemical enterprise."

Oct. 8.—Biochemical Society, Biochemical Laboratory, Cambridge, at 3 p.m. (1) "The scission of gelatin into constituent proteins," by S. B. Schryver and K. V. Thimann. (2) "The interferometer method for the diagnosis of pregnancy and malignant growths," by G. S. Haynes and C. G. L. Wolf. (3) "The isolation of a second sterol from yeast fat," by I. S. MacLean. (4) "On the original of etheral sulphates," by T. S. Hele. (5) "The osmotic pressure of iso-electric egg albumin," by J. R. Marrack and L. F. Hewitt. (6) "Adsorption of phthalein dyes by proteins," by L. F. Hewitt. (7) "On a cell-free dehydrogenase obtained from bacteria," by M. Stephenson.

Oct. 10.—Institute of Metals, Scottish Local Section. 39, Elmbank Crescent, Glasgow, at 7.30 p.m. Chairman's address by S. E. Flack.

Oct. 11.—Institution of Petroleum Technologists. General Meeting. House of the Royal Society of Arts, John Street, Adelphi, W.C.2. at 5.30 p.m.

Oct. 12.—Institution of the Rubber Industry, London and District Section. Engineers' Club, Coventry Street, W.1. "Coagulation, structure and plasticity of crude rubber," by Dr. O. de Vries.

Oct. 12.—Institute of Metals, Swansea Local Section. Thomas' Café, High Street, Swansea, at 7.0 p.m. Chairman's address by Capt. L. Taverner.

Oct. 13.—Institution of the Rubber Industry, Birmingham and District Section. Grand Hotel, Birmingham. "Selling," by A. E. Hemsworth.

Oct. 13.—Institute of Metals, London Local Section. Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W.1, at 7.30 p.m. Chairman's address by A. H. Mundy, on "Works' economics."

Oct. 14.—Society of Chemical Industry, Chemical Engineering Group. Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "A recent development of spray drying," by J. Arthur Reavell. During the same afternoon a visit will be paid to the Kestner Experimental Works at Camberwell, where a machine of the type to be described in the evening will be seen at work.

Oct. 14.—University of London, University College, Gower Street, W.C.1, at 5 p.m. "Hydrogen ion concentration," by Dr. Phyllis M. Kerridge. (Also on October 21 and 28.)

Oct. 14.—Institute of Metals, Sheffield Local Section. The University, Sheffield, at 7.30 p.m. Chairman's address by J. H. G. Monypenny, on "Science and industry."

Oct. 19.—Society of Chemical Industry, Glasgow Section. Jointly with the Chemical Engineering Group. Ca'doro Restaurant. "The desiccation (De Vecchis) process of beet sugar manufacture," by C. Scott Garrett and G. W. Riley.

Oct. 20.—Chemical Society. Ordinary Scientific Meeting. Burlington House, Piccadilly, W.1, at 8 p.m.

Oct. 27.—Society of Chemical Industry and Institute of Chemistry, Edinburgh and East of Scotland Sections. Joint Meeting. The North British Station Hotel, Edinburgh, at 7.30 p.m. Inaugural address by J. Adam Watson.

Oct. 28.—Society of Chemical Industry, Liverpool Section. The University, Liverpool, at 6 p.m. "Merseyside and chemical industries," by Dr. A. Holt.

INSTITUTION OF CHEMICAL ENGINEERS

The Institution of Chemical Engineers is opening its session for 1927—28 with an important lecture, to be delivered by Sir William Bragg, K.B.E., F.R.S. The subject will be "Crystallisation," and the meeting will be held in the Institution of Civil Engineers, Westminster, on Friday, October 28, 1927, the President, Sir Alexander Gibb, taking the Chair at 6.30 p.m. There will be no charge for admission, but tickets (to admit two) can be obtained on application to the Honorary Secretary, Institution of Chemical Engineers, Abbey House, Westminster.

Dr. E. R. Weidlein, the President of the American Institute of Chemical Engineers, who is also the Director of the Mellon Institute of Industrial Research, has just visited England. The President of the Institution, Sir Alexander Gibb, entertained him to dinner to meet the Council of the Institution on September 21. Mr. F. H. Carr, C.B.E., member of the Institution and President of the Society of Chemical Industry, and Mr. W. J. U. Woolcock, C.B.E., the first Honorary Member of the Institution, were also among the guests.

Dr. Weidlein gave an interesting account of the history of the Mellon Institute, and stated that since 1920 it had been entirely self-supporting, the necessary funds being obtained by industrial firms, desirous of making use of its services, buying a yearly fellowship. So successful has the scheme proved that there is now a waiting list of firms desirous of purchasing these fellowships. Other outstanding features of the Institute are that any discoveries and any patents which are taken out in connexion therewith are the property of the firm holding the fellowship in that particular research. An unwritten rule of the Institute is that the firms should reward the actual research worker for any successful exploitation of his work. The form of reward is at the discretion of the firm concerned, but so successful has been the system that permanent research workers of the Institute are often in receipt of yearly incomes from such firms which are larger than the salaries paid to them by the Institute. Cases have even been known in which the Institute has had to restrain the over-generosity of some firms. The Institute does not fear the ultimate setting-up of research laboratories by the firms themselves, for experience has shown that even if such laboratories are started, the firms are not only willing but anxious to continue their fellowships, since they realise that the workers in the Institute, not being so vitally concerned with the problems of a particular industry, are able to take wider views of such problems than a firm's own workers. At present 61 different investigations, covering an extremely wide field, are in progress, and the Institute is making large developments in the near future, so that it may be able to undertake fundamental scientific research as well as industrial research.

From Dr. J. V. N. Dorr, a Vice-President of the American Institute of Chemical Engineers and Chairman of the Committee charged with making the arrangements for the visit of the Institution to the United States of America next year, we learn that these are now nearly complete. It is hoped shortly to be able to announce details of the itinerary and of the cost.

The Annual Meeting for 1928 of the Society of Chemical Industry is to be held in New York, and endeavours are being made for the two gatherings to be so synchronised that members of both the British organisations can attend both meetings without being too long absent from this country.

The Annual President's Reception will be held on November 2, at Prince's Galleries, London, W.1. This will be Sir Alexander Gibb's first opportunity of meeting members since assuming office. Invitations will shortly be sent out.

PERSONAL AND OTHER ITEMS

On October 20 the Prime Minister will formally open the new biology block of the University of Birmingham. The new block will house the Departments of Biochemistry and Brewing, Botany and Zoology.

Josiah Wedgwood & Sons, Ltd., the famous potters of Etruria, England, have presented to the Priestley Memorial Museum, Northumberland, Pennsylvania, a Wedgwood blue medallion of Priestley made from the original mould. Priestley was a close friend of Josiah Wedgwood, the founder of the firm.

The following have joined the Board of British Celanese, Ltd.:—Brig.-General Sir William Alexander, M.P., managing director of Charles Tennant & Co., and a director of the Celanese Corporation of America and of Canadian Celanese; Mr. A. Chester Beatty, the American engineer; Mr. R. A. Murray, C.A., a director of the Clydesdale Bank, Burnah Oil Co., and the Scottish Western Investment Co.; and Mr. G. Whigham, chairman of the Celanese Corporation of America and Canadian Celanese, and a director of the Celluloid Corporation (New York). Dr. M. Soller, works manager, and Mr. G. H. Spilman, manager of the sales department, have also been appointed directors.

Mr. C. S. Garland, B.Sc., has been elected vice-chairman of the London Section.

Sir William Bragg, K.B.E., F.R.S., will deliver a public lecture before the Institution of Chemical Engineers on October 28 on the subject of "Crystallisation."

Mr. W. Macnab represented the Institution of Chemical Engineers at the Third Conference of Scientific Management, which was held recently in Rome.

Through ill-health, Mr. A. R. Warnes has been obliged to resign his seat on the Council of the Institution of Chemical Engineers. Mr. F. A. Greene has been co-opted in his place.

On the occasion of the opening of H. H. Wills Physics Laboratory at Bristol University by Sir Ernest Rutherford, on October 21, the honorary degree of D.Sc. will be conferred upon Prof. M. Born, Sir William Bragg, Prof. A. S. Eddington, Prof. A. Fowler, Prof. P. Langevin, and Sir Ernest Rutherford.

Miss Dorothy Jordan Lloyd, D.Sc., has been appointed to succeed Dr. R. H. Pickard, F.R.S., as director of research to the British Leather Manufacturers' Research Association. Dr. Lloyd has been a member of the staff of the British Leather Manufacturers' Research Association since its inception, and is the author of a book on

"The Chemistry of the Proteins and its Economic Applications."

Prof. Dr. Emil Heuser, Manager of the Research Laboratories of the Riordom Pulp and Paper Co., a subsidiary of the International Paper Co. of Canada, Hawkesbury, Ontario, is on a three months' leave of absence, visiting Darmstadt and other parts of Germany.

We regret to announce the death, at the age of 68, of Prof. Svante Arrhenius, whose name is linked with those of van't Hoff and Ostwald as the founders of physical chemistry. His work on the theory of electrolytic dissociation is classic, and for it he was awarded the Nobel prize for physics in 1903. He was a Davy medallist of the Royal Society and an honorary member of the Chemical Society and many other learned societies. In addition to his scientific work he was the author of several books of a popular nature, in which his graceful style and vivid pen were turned to the service of the dissemination of scientific culture.

The death is announced of Prof. W. Einthoven, one of the most famous of modern physiologists and the inventor of a number of beautiful physical instruments, amongst which the "string galvanometer" is prominent.

The death is announced of Sir W. D. Cramp, I.S.O., who was Deputy Chief Inspector of Factories from 1902 until his retirement in 1907. He was secretary to the Home Office Committee on Potteries in 1893, chairman of the Home Office Committees on Lucifer Match and Chemical Works, 1893, and on Brass Casting, 1894, and a member of the Factory Accidents Committee, 1900.

Mr. George H. Bostock, Chief Chemist of Ontario Factory Inspection, recently died in Toronto. He was born and educated in England, and went to Canada about 25 years ago. He was a member of the Society of Chemical Industry.

The deaths are announced from Germany of: Dr. O. Reinhardt, for 23 years in the service of the I.G. Farbenindustrie A.-G.; Dr. C. Scheuer, aged 83.

The late Mr. G. W. Pettit, managing director of Pettit & Sons, Ltd., chrome tanners, Northampton, left £21,436.

The late Mr. S. Colquhoun, of Paisley, analytical chemist, left £5699.

Conference on Methods of Coal Analysis

The British Engineering Standards Association announces the calling of a conference resulting from a request of the Committee of the Privy Council on Scientific and Industrial Research that British National Standard methods of coal analysis should be adopted. It is suggested that Report No. 7, "Methods of analysis of coal," as drawn up by the Fuel Research Board, should be used as a basis for the preparation of a British Standard Specification for national use. The conference above referred to is being called for the purpose of ascertaining if there is a consensus of opinion in favour of setting up a B.E.S.A. Committee to deal with the subject, and delegates have been invited from all interested bodies to attend.

The Committee of the Privy Council states that the question of methods of analysis is one of increasing

importance, owing to the growing tendency to purchase coal to specification, and this is especially so with foreign purchasers. They consider that the national adoption of standard methods of analysis would be of considerable advantage, both to the producers and the users of coal.

World Power Conference—Fuel Conference, 1928

A meeting of the International Executive Council of the World Power Conference was held at Cernobbio, North Italy, from September 5–10, 1927. The following countries were represented:—Australian Commonwealth, Belgium, Dominion of Canada, Denmark, Dutch East Indies, France, Germany, Gold Coast, Great Britain, Japan, Greece, Holland, Hungary, Ireland, Italy, Luxembourg, Dominion of New Zealand, Norway, Poland, Roumania, Russia, Spain, Sweden, Switzerland, United States of America.

There were present representing Great Britain Mr. D. N. Dunlop, chairman of the International Executive Council and chairman of the British National Committee; Mr. L. B. Atkinson, member of the British National Committee; Mr. R. T. Smith, member of the British National Committee and of the Technical Committee, Fuel Conference, 1928; Dr. E. W. Smith and Mr. E. J. Fottrell, Joint Technical Secretaries of the Fuel Conference, 1928; Mr. M. W. Burt, Secretary of the International Executive Council and Joint General Secretary of the Fuel Conference, 1928.

A number of most interesting conversations took place between the British and foreign representatives regarding the technical programme for the Fuel Conference, 1928. It was evident from these conversations that the technical programme had been very favourably received, and that the Fuel Conference had already aroused widespread international interest.

Dr. E. W. Smith, Joint Technical Secretary, in addressing a special meeting on September 10, said that, speaking on behalf of the British Committee, the technical programme was only to be regarded as indicating the scope of the Conference, and was not the programme of papers. The British Committee does not wish to dictate regarding individual contributions, but it is hoped as the result of the conversations with international representatives that it will be possible to decide what contributions should be made by each country. If each country were to attempt to cover the whole programme, the Conference would be far too large. Germany, for instance, is interested in most fuel problems, but it is suggested that she should concentrate on questions on which she is specialising, such as gas distribution, utilisation of lignite, carbonisation under static means, etc. France might specialise, for instance, on the production of alcohol. Spain is anxious to become independent of other countries for her fuel supplies, and it would be most interesting to hear how she proposes to do this. Each country has its own problems and its own specialist subjects, and it is hoped that each country will make its own essentially national contribution, with the object of pooling knowledge and experience internationally. Each country was invited to submit to the British Committee a skeleton of each paper they proposed to present for a preliminary exchange of views regarding the subject-matter. The paper itself would probably have to be written by an individual, but should receive the careful

scrutiny of the representative body under whose authority it was to be issued, to the exclusion of all proprietary and specialised individual opinions. The desire of the British Committee to receive suggestions from all interested countries was emphasised, but as in some cases these may be of a conflicting character, it will be necessary for the British Committee to sift these suggestions before deciding, in consultation with other countries, what line of action should be adopted. The Conference is not to be a theoretical Conference, but it is hoped that it will be of a thoroughly practical nature, based on sound technical lines directly related to practical economics.

The Volta Solemn Commemoration was held on Sunday, September 11, and a telegram was sent to H.M. The King of Italy, and to the Prime Minister, H.E. Benito Mussolini, couched in the following terms:—“The International Executive Council of the World Power Conference, representing forty-five countries, assembled at Cernobbio, send greetings and desire to pay homage to Volta, the great Italian, whose name is for ever associated with the birth of the electrical age, and whose discoveries and high ideals have so largely contributed to the progress of mankind. Long may Italy produce such benefactors. Dunlop, Chairman.”

University Students at the B.D.C.

Last week a number of chemical students from different British universities terminated a month spent in the Blackley works and laboratories of the British Dyestuffs Corporation, Ltd. According to the *Manchester Guardian*, one of them said, in an interview: “It has been a valuable experience which none of us would desire to have missed, and we could wish that other large firms with chemical interests would follow the example of the British Dyestuffs Corporation. We have had practical experience in the workshop as well as the laboratory, which will be immensely helpful to us in our future studies.”

Active Carbon

A company has recently been registered in London under the name of “British Carbo-Union, Limited,” to take over and develop in the British Empire (excluding Canada) the patents and processes of the following firms, for the manufacture and use of active carbon:—The I.G. Farbenindustrie Aktiengesellschaft, Leverkusen; the Metallbank und Metallurgische Gesellschaft Aktiengesellschaft, Frankfurt, a.M.; the Urbain Corporation, New York, U.S.A., and Paris; and the Verein für Chemische und Metallurgische Produktion, Karlsbad. This company will be principally engaged in developing the use of active carbon for the recovery of solvents in air and gas mixtures, considerable commercial experience in which has already been gained on the Continent, where a number of plants operating under the Bayer and Urbain processes are at work. It is also proposed later to erect plant for the manufacture of active carbon for absorption and decolorising purposes. The address of the company in London is Astor House, Aldwych, W.C.2.

Sources of Vitamins A and D and Margarine Manufacture

In a letter published in *Nature*, Messrs. O. Rosenheim and T. A. Webster discuss sources of supply of vitamins A and D, and point out that the liver fats of

sheep, calf and ox contain on an average as much as 10 times the amount of vitamin A as a good Newfoundland cod-liver oil. These fats may be said to contain from 200 to 1000 times more vitamin A than butter, and not only are they free from the flavour of fish oils, but they are easily incorporated into other fats such as margarine. Vitamin A, being fat-soluble, can be extracted from the tissue by a neutral oil, though isolation might not be necessary in large-scale manufacture. The body fats of certain fishes, free from vitamin A, were found to be a good source of vitamin D, but the authors observe that there is no need to search for natural sources of vitamin D, as it can now be produced by irradiation of ergosterol. Irradiated ergosterol is extraordinarily potent, so that the amount to be incorporated into margarine would be extremely small. By a study of the best conditions for its formation in yeast, a practically unlimited supply of ergosterol should be available. The authors conclude by pointing out that margarine manufacturers have means at their disposal which should make it possible not only to supply a perfect biological substitute for butter, but a product of constant vitamin content, superior in this respect to natural butter.

Presentations by the Washington Chemical Co., Ltd.

On September 24 last five employees of the above company whose total service amounted to 190 years, an average of 38 years each, were presented with gold watches and chains in recognition of their long service. Since these members of the company had first commenced work in it many changes had occurred. The output of magnesia had increased 150-fold, and during the whole period of their service they had had constant employment in one branch or another of the company's works. Among the new industries that had come within the company's scope was cork insulation, of which the company made several thousand tons a year, insulating bricks, carbonic acid gas in a liquid form for refrigeration and magnesia insulation for high temperature surfaces, all products which the company was now supplying.

Subsidence at Ontario Nickel Mine

A subsidence has occurred at the Worthington mine of the Mond Nickel Company in Ontario, a cavity 400 ft. square and some hundred feet in depth having been formed. The power plant and various buildings are reported to have been engulfed.

State-aided Research in Australia

The Australian Budget, which shows a surplus of £2,635,000, includes the sum of £250,000 for research in science and industry and £100,000 for the purchase of radium.

The Austrian Chemical Industry

A report contributed by Herr Josef Brunner to the "Oesterreichische Chemikerzeitung" gives a fair idea of the state of the Austrian chemical industry in 1926.

In Austria the heavy chemical industry is much more fit for expansion than the fine chemical industry. The latter depended, before the war, upon the Bohemian heavy chemical industry, a connexion which is difficult now. After the war the various Succession States tried

to establish chemical industries of their own. In Austria, too, chemical factories have been erected. As some of the larger factories fell to Succession States with only poorly-developed industry, they were forced to work for export trade. This is the reason why the following goods are imported into Austria:—Methyl alcohol, caustic soda, etc. (from Yugoslavia, Rumania); ammonium sulphate from Poland; aluminium oxide from Yugoslavia; superphosphate from Yugoslavia, Poland, etc.

On the whole, importation of chemicals has decreased and exportation has increased.

Thus imports of concentrated hydrochloric and sulphuric acids fell by 50% since 1924. There are practically no imports of acetic acid, but considerable exports. Imports of aluminium sulphate in 1926 were reduced to 5% of that imported in 1924 (200 truckloads), and for potassium nitrate the imports were one tenth that of 1924. Imports of ammonium carbonate were very small, but exports were large.

In the hydrogen peroxide industry, Austria has had a leading position for many years: the export in 1926 exceeded that of the preceding year. Ammonium sulphate exports were more than double those of the preceding year. Artificial resins and horn were largely exported; the import is very small.

Although the relation of the export and import trade is mostly favourable to Austria, the position of the Austrian chemical industry is difficult, owing to competition for the world's markets. Austrian trade in chemicals is suffering from the fact that there are now more dealers in these goods than there were in the whole Austro-Hungarian Monarchy before the war, although only a quarter are now remaining of the 200 firms which were active in the time of the monetary inflation.

Austrian Aluminium Industry

The Lend (Salzburg) branch of the Neuhausener Aluminium-Industrie A.-G. (Switzerland) has been annexed to the European Aluminium Trust, and the second Austrian aluminium factory, Stern & Hafferl A.-G., at Steeg, is reported to be negotiating about joining the trust. The annual production of these factories (chiefly Lend) amounts to 3000 metric tons.

As far as calcined aluminium oxide is concerned, Lend depends on foreign countries. Stern & Hafferl owns a bauxite deposit and a calcination plant. The bauxite found in Austria is of inferior quality, and the industry is affected by the fact that Istrian export has recently been closed by the Italian Government.

Austrian Magnesite Industry

The Austro-American Magnesite Company Ges.m.b.H. in Radenthein (Carinthia) has been amalgamated with the Allgemeine Automobil A.-G., in Vienna, which is closely connected with the Wiener Bankverein. The Company has been converted into a limited company.

The Austrian magnesite industry includes the following works:—(1) The Radenthein works own quarries in the Millstatt Alps. The works are situated in Radenthein. The "Heraklit" factory is in Ferndorf (Drau Valley). Altogether, these employ 800—1000 workmen; a colliery attached, producing 20,000 tons a year, employs 150 men. The works manufacture sintered magnesite to be used for smelting works, magnesite stones, caustic magnesite for

xylolith flooring, "Heraklit" plates, and building plates. The production nearly equals that of the Veitsch Magnesite Works. (2) The Veitscher Magnesitwerke A.-G. owns the Veitsch, Trieben, Breitenstein and Eichberg works; they mostly produce sintered magnesite. (3) The Steirische Magnesit-Industrie A.-G. have their works in Neuberg, Oberdorf and Kraubath. They are partially closed down.

90% of Austrian sintered magnesite is exported. In 1925 the export amounted to 80,000 metric tons, *i.e.*, two thirds of the pre war export. As Austrian magnesite is especially suitable—it is said to be the best—for metallurgical purposes, neither the high import duties of the U.S.A. nor the new deposits found in that country have been able to hinder the Austrian export. In fact, the magnesite industry is the most important exporting industry of Austria.

An Enquiry

A correspondent wishes to obtain a protective coating for zinc sheet which will stand immersion in petrol for three months or more; no heat can be used when applying it. Replies should be addressed to the Editor, CHEMISTRY AND INDUSTRY, Central House, Finsbury Square, London, E.C.2

REVIEW

THE MAKING OF A CHEMICAL. By E. I. LEWIS, M.A., B.Sc., and G. KING, M.Sc., F.I.C. Pp 288. London: Ernest Benn, Ltd., 1927. Price 12s 6d.

This excellent book should be in the hands of every young chemist, and in view of its moderate price there is no reason why it should not find a place even on the most modest bookshelf.

The aim of the authors, as stated in the introduction, is to give an insight into works practice and works conditions. The book has been primarily written for young chemists, but it might with advantage be read by those engaged in a technical capacity in almost any scientific industry, whilst there is also a message for the non-technical, particularly the many who as proprietors or directors are engaged in management.

The chemist who is already in industry will find much to interest him. He will probably disagree often with the authors on points of detail. Thus, he may consider the experimental mechanical workshop described quite outside the requirements of the average works, however necessary it may be in a large, highly organised concern with abundant resources corresponding to its numerous activities.

In the opening chapters, entitled "Preparation," the authors give some useful advice of a kind that is rarely offered to young chemists, at least in such a concentrated and attractive form. He is told what knowledge other than chemical he ought to possess. For example, he must be conversant with a fair amount of physics and mathematics. He should also acquire certain laboratory accomplishments, which, it is implied, should not be allowed to degenerate into mere hobbies (there is a shrewd dig at the gifted amateur glass blower who "finds occasion"). Further, not only should he be acquainted with some modern foreign languages, but he should also strive to maintain a high standard as regards his own

English composition. This latter piece of advice is refreshing in a book which, quite rightly, lays considerable stress on the "cold dollar" aspect. It is, as a matter of fact, characteristic of the general attitude of the authors, who have successfully endeavoured to emphasise the dignity and romance of a profession which, on their own showing, must inevitably be influenced mainly by monetary considerations.

The main part of the book is divided into two portions: Part 1, A chemical; its manufacture and cost; and Part 2, Power and plant. In Part 1 the research involved in the general development of a manufacturing process and the factors governing the market price of the product are examined. Emphasis is laid on the need of an adequate study of the literature prior to experiment, and on analytical control. Absence of these two important precautions almost invariably leads to high hopes and subsequent disillusionment, as we all learn at some time or another. Accurate sampling, which the authors feel to be rather a neglected art, is referred to in some detail.

The investigation proper is first treated from the point of view of its development in the laboratory. The beginner is warned against developing methods on the small scale, in glass apparatus and with simple methods of control, that are impracticable on the large scale where a large bulk of material reacts out of sight in metal pans accompanied by difficulties as regards corrosion, agitation, and temperature control. These are features of manufacture where experience alone is the only real teacher, but the authors in pointing out to the young chemist the kind of difficulties which are to be anticipated will probably succeed in inoculating him with that healthy scepticism which is essential in our profession.

After showing how the probable cost of a substance may be estimated as the result of laboratory and small-scale work, and the principles on which materials, labour and power are charged against the product, the authors pass to a consideration of the actual manufacturing process. This chapter can only deal with generalities, but although some old and experienced investigators may profess to find many trite sayings therein, there is much that will be new and informative to the beginner.

The chapters on the final selling cost of the finished article will prove useful to most young chemists. The facts involved are mainly ones which directly concern the "management" alone, but a proper appreciation of them by chemists is of the greatest utility. To some extent this appreciation may be the only difference between a good chemist and a good industrial chemist. Amongst other things it will explain to him (although it may not console him to know) how the cost of a product, including his own days of labour and nights of thought, may be (say) 4d. per pound when it leaves his hands, and 2s., or more, when it at length reaches the public, including about 9d. for package and handling, 3d. as profits for the wholesaler and 6d. for the retailer. It will not be surprising if many an aspirant to the chemical profession transfers his affections to the retail trade after reaching this point in the book.

Part 2, Power and Plant, contains a great deal of interesting information which we have not previously seen brought together within the covers of one book in

such a satisfactory form. There are chapters on the transport and measurement of materials and energy. Materials are also considered from the point of view of their resistance to strain and chemical action: their ultimate value as "scrap" is even touched upon. Distilling, condensing, evaporating, crystallising, filtration, drying, furnacing, grinding, and mixing are all dealt with in the latter sections. In these chapters the various items of plant are explained by simple diagrammatic treatment, which is much more instructive to the beginner than the scale drawings or photographs from a manufacturer's catalogue, usually considered adequate by authors who treat of these matters.

The book closes with an interesting glossary wherein are to be found brief notes on such varied subjects as first-aid, gaskets, glands, standard wire gauge, steam traps, and butt-welding.

It is obvious from what has been said above that the authors have managed to condense a great deal of matter within the boundaries of this little book; for readers who desire a more exhaustive treatment of the various subjects dealt with there are many references to more detailed sources.

This book will undoubtedly be read with interest and enjoyment by most chemists, while, to the young worker just entering chemical industry, it cannot be too highly recommended.

J. E. G. HARRIS

COMPANY NEWS

BRITISH PORTLAND CEMENT MANUFACTURERS, LTD.

An interim dividend has been declared on the ordinary shares of 5% actual, less tax, being the same as for last year.

HARBEN'S (VISCOSE SILK MANUFACTURERS), LTD.

The annual general meeting was held on September 29. Sir Charles Mandelberg, chairman, presided, and said that the company definitely emerged from its development stage during the year ended April 30 last, and not only confirmed its position amongst manufacturers of artificial silk yarn of the highest quality, but began production on a scale commensurate with the full capacity of its plant and machinery. Rather more than 9 tons of yarn was being produced per week. The technical, engineering, selling and commercial staff was highly efficient, and had been built up with a view to an increased output of 18 tons per week. The artificial silk yarn produced by the company was recognised as being equal in quality to the best makes, and the fact that it was so much stronger and had greater elongation was a further advantage. The demand for the company's "Matrix" yarn continued to increase. The technical and research departments were maintaining an alert and progressive policy. So well was the company's product already regarded on the market that practically the whole of the year's output had been sold, and large contracts had been entered into for delivery well into next year. The company should be in a position to pay off some of the preference dividend arrears before the end of 1927. (For the accounts, cf. CHEM. & IND., September 23, 1927, p. 862.)

ASSOCIATED DYERS AND CLEANERS, LTD.

An interim dividend of 8d. per share, less tax, has been declared on the ordinary shares.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS.

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s. £27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations; 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS.

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson. 1s. 4d.—1s. 6d. per lb. according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide. 2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark --5½d.—6½d. per lb.
Lump Black. —£35 per ton, barrels free.
Lead Hyposulphite. — 9d. per lb.
Lithopone, 30% £22 10s. per ton.
Mineral Rubber "Rubpron" £13 12s. 6d. per ton. L.O.R.
London.

Sulphur. — £9 - £11 per ton, according to quantity. Sulphur
Precip. B.P. — £47 10s. £50 per ton, according to
quantity.

Sulphur Chloride. — 4d. 7d. per lb., carboys extra.
Thiocarbamide. 2s. 6d. 2s. 9d. per lb., carriage paid.
Thiocarbamilide. 2s. 1d. 2s. 3d. per lb., according to
quantity.

Vermilion, pale or deep. — 6s. — 6s. 3d. per lb.

Zinc Sulphide. — 1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime. Brown, £9 10s. £10 per ton. Good demand.

Grey, £14 10s. — £15 per ton. Liquor, 9d. per gal.

Charcoal — £6 — £9 per ton, according to grade and locality.

Foreign competition severe.

Iron Liquor. — 1s. 3d. per gal. 32° Tw. : 1s. per gal. 24° Tw.

Red Liquor. — 9d. — 10d.

Wood Creosote. — 1s. 9d. per gal., unrefined.

Wood Naphtha. Miscible, 3s. 11d. 4s. 3d. per gal. Solvent,
4s. 3d. per gal.

Wood Tar. — £4 — £5 per ton.

Brown Sugar of Lead. — £40 15s. per ton.

TAR PRODUCTS

Acid Carbolie. — Crystals, 7½d. 8½d. per lb. Crude 60's,
2s. 4d. 2s. 5d. per gal.

Acid Cresylic. 99, 100. — 2s. 11d. — 3s. per gal. 97, 99.

2s. 4d. 2s. 5d. per gal. Pale, 95%, 2s. 2d. 2s. 3d. per gal.

Dark, 90%, 1s. 9d. 1s. 10d.; 95%, 2s. 1d. 2s. 2d. per gal.

Anthracene Paste. — A quality, 2½d. per unit. 40% — £5 per
ton; Anthracene Oil. Strained, 8d. 8½d. per gal.
Unstrained, 7½d. 8d. per gal.

Benzole. Crude 65's, 9½d. — 9½d. per gal., ex works in
tank wagons; Standard motor, 1s. 1½d. — 1s. 2½d. per gal.,
ex works in tank wagons; Pure, 1s. 5d. — 1s. 6d. per gal.,
ex works in tank wagons.

Toluole. 90%, 1s. 4d. 1s. 8d. per gal. Pure, 1s. 6d. —
2s. per gal.

Xylole. 1s. 3d. 1s. 10d. per gal. Pure, 2s. 5d. per gal.

Creosote. — Cresylic 20 24%, 10d. — 11d. per gal. Middle
Oil, 8d. — 9d. per gal. Heavy, 8½d. — 9d. per gal. Standard
specification, 7½d. — 7½d. per gal. ex works. Salty, 7d.
per gal., less 1½%.

Naphtha. Crude, 9d. — 10d. per gal. Solvent 90 160, 9½d.
10d. per gal. Solvent 95/160, 1s. 3d. — 1s. 4d. per
gal. Solvent 90 190, 9½d. 1s. 3d. per gal.

Naphthalene Crude. Drained Creosote Salts, £5 per ton.
Whizzed or hot pressed, £8 per ton.

Naphthalene. Crystals, £11 10s. £13 10s. per ton. Flaked,
£12 10s. £13 per ton.

Pitch, medium soft. — 84s. — 90s. per ton, f.o.b. according
to district. Market firm.

Pyridine. — 90/140. — 5s. 9d. — 6s. 6d. per gal. 90/180. 4s. 6d. —
5s. per gal. Heavy. — 4s. — 4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices
include packages except where otherwise stated.

Acid Gumma. — 4s. 9d. per lb.

Acid Amidonaphthol disulpho (1.8.2.4.) 10s. 9d. per lb.

Acid H. — 3s. per lb.

Acid Naphthionic. — 1s. 6d. per lb.

Acid Neville and Winther. — 4s. 9d. per lb.

Acid Sulphanilic. — 8½d. per lb.

Aniline Oil. — 7½d. per lb., naked at works.

Aniline Salts. — 7½d. per lb., naked at works.

Anthranilic Acid. — 6s. per lb., 100%.

Benzaldehyde. — 2s. 3d. per lb.

Benzidine Base. — 3s. 3d. per lb. 100% basis d/d.

Benzoic Acid. — 1s. 8½d. per lb.

o-Cresol 29/31° C. — 5½d. per lb.

m-Cresol 98/100%. — 2s. 7½d. per lb.

p-Cresol 32/34° C. — 2s. 8½d. per lb.

Dichloraniline. — 2s. 3d. per lb.

Dimethylaniline. — 1s. 11d. per lb.

Dinitrobenzene. — 9d. per lb., naked at works. £75 per ton.

Dinitrochlorobenzene. — £84 per ton d/d.

Dinitrotoluene. — 48/50° C. — 8d. per lb., naked at works.

Dinitrotoluene. — 66/68° C. — 9d. per lb., naked at works.

Diphenylamine. — 2s. 10d. per lb. d/d.

α-Naphthol. — 2s. per lb. d/d.

β-Naphthol. — 11d. — 1s. per lb. d/d.

α-Naphthylamine. — 1s. 3d. per lb.

β-Naphthylamine. — 3s. per lb.

p-Nitraniline. — 1s. 8d. per lb.

m-Nitraniline. — 3s. per lb. d/d.

o-Nitraniline. — 5s. 9d. per lb.

Nitrobenzene. — 6d. per lb., naked at works.

Nitronaphthalene. — 1s. 3d. per lb.

R. Salt. — 2s. 2d. per lb.

Sodium Naphthionate. — 1s. 8½d. per lb. 100% basis d/d.

o-Toluidine. — 7½d. per lb.

p-Toluidine. — 2s. 2d. per lb., ex works, naked.

m-Xylidine Acetate. — 2s. 6d. per lb. 100%.

N.W. Acid. — 4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80% — £39 per ton, ex wharf London, in
glass containers.

Acid, Acetyl Salicylic. — 2s. 3½d. 2s. 5d. per lb.

Acid, Benzoic B.P. — 2s. — 2s. 3d. per lb. for synthetic product,
according to quantity. Solely ex Gum — 1s. — 1s. 3d. per
oz., according to quantity.

Acid, Boric B.P. — Cryst. 40s. 43s. per cwt. Powder
44s. — 47s. per cwt., according to quantity. Carriage
paid any station in Great Britain in ton lots.

Acid, Camphoric. — 19s. — 21s. per lb.

Acid, Citric. — 1s. 6½d. — 1s. 7d. per lb. Less 5%.

Acid, Gallic. — 2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallie, Cryst. — 7s. 3d. per lb. Resublimed. — 8s. 3d.
per lb.

Acid, Salicylic. — B.P. pulv. 1s. 2½d. — 1s. 3½d. per lb. Technical
11½d. — 1s. per lb. Good demand.

Acid, Tannic B.P. — 2s. 8d. — 2s. 10d. per lb.

Acid, Tartaric. — 1s. 3½d. per lb. Less 5%.

Anidol. — 9s. per lb. d/d.

Acetanilide. — 1s. 6d. — 1s. 8d. per lb. for quantity.

Amidopyrin. — 8s. 6d. per lb.

Ammon. Benzoate. — 3s. 3d. — 3s. 6d. per lb., according to
quantity.

Ammon. Carbonate B.P. — Lump £37 per ton, Powder £39
per ton, in 5-cwt. casks. Resublimed. — 1s. per lb.

Atropine Sulphate. — 9s. 6d. per oz.

Barbitone. — 5s. 9d. — 6s. per lb.

Benzonaphthol. — 3s. 3d. per lb.

Bismuth Carbonate. — 9s. 9d. — 9s. 10d. per lb. Bismuth
Citrate. — 9s. 6d. — 9s. 9d. per lb. Bismuth Salicylate. —
8s. 9d. — 9s. per lb. Bismuth Subnitrate. — 7s. 9d. —
8s. per lb. Bismuth Nitrate. — 5s. 9d. — 6s. per lb.
Bismuth Oxide. — 13s. 9d. — 14s. per lb. Bismuth Sub-
chloride. — 11s. 9d. — 12s. per lb. Bismuth Subgallate. —
7s. 9d. — 8s. per lb. Extra and reduced prices for
smaller and larger quantities respectively; Liquor
Bismuthi B.P. in W. Qts. — 1s. 1d. per lb.; 12 W. Qts.
— 1s. per lb.; 36 W. Qts. — 11½d. per lb.

Borax B.P. — Crystal 24s. — 27s. per cwt. Powder 20s. — 20s.
per cwt., according to quantity, carr. paid any station in
Great Britain in ton lots.

Bromides. — Ammonium. — 2s. 2d. — 2s. 3d. per lb. Potassium,
1s. 9½d. — 1s. 10½d. per lb. Sodium. — 2s. — 2s. 1d. per lb.

Granulated $\frac{1}{2}$ d. per lb. less. All spot. Large quantities at lower rates.

Calcium Lactate.—1s. $2\frac{1}{2}$ d.—1s. $4\frac{1}{2}$ d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.

Chloroform.—2s. 3d.—2s. $7\frac{1}{2}$ d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ethers: S.G. 730, 10 $\frac{1}{2}$ d.—1s. $1\frac{1}{2}$ d. drums. Other gravities at proportionate prices.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—4s. 9d.—5s. per lb.

Hexamine.—2s. 3d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal. in carboys; Winchesters, 2s. 11d. per gal.; 20 vols., 4s. 3d. per gal. in carboys; Winchesters, 5s. per gal.

Hydroquinone.—2s. 11d.—3s. 2d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate.—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perochloride.—20s.—22s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2 $\frac{1}{2}$ %. Heavy Commercial £21 per ton, less 2 $\frac{1}{2}$ %; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol—A.B.R. recryst., B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb.; Levig., 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb.; Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.

Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonat.—8s. 9d.—9s. per lb.

Metal.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—2s. 6d.—2s. 9d. per lb.

Phenazone.—4s.—4s. 3d. per lb.

Phenolphthalein.—6s. 6d.—6s. 9d. per lb.

Potass. Bitartrate, 99/100% (Cream of Tartar) 98s. per cwt., less 2 $\frac{1}{2}$ %.

Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included, F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.

Resorcin.—3s. 9d.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. $7\frac{1}{2}$ d.—1s. 9d. per lb. Crystal, 1s. $8\frac{1}{2}$ d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.

Sulphonat.—6s. 9d.—7s. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.

Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.

Aubepine (*ex Anethole*).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 16s. 3d. per lb.

Coumarin.—9s. 9d. per lb.

Citronellol.—13s. 9d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—6s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—8s. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. 6d. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 8d. per lb. Vanillin.—17s. 9d. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—2s. 10d. per lb. Bergamot.—28s. per lb. Bourbon Geranium.—14s. 6d. per lb.

Camphor.—75s. per cwt. Cananga, Java, 18s. per lb. Cassia, 80/85%—7s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java, 1s. 10d. per lb., e.i.f. U.K. port, for shipment over 1928. 1s. $7\frac{1}{2}$ d. prompt shipment from Java. Ceylon, Pure, 1s. 8d. per lb. Clove, pure 5s. 6d. per lb.

Eucalyptus, Australian 2s. 3d. per lb. Lavender, Mont Blanc, 28/40%, 17s. 6d. per lb. Lemon.—7s. 6d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—9s. 3d. per lb. Peppermint—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 6d. per lb. Sandalwood—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Nov. 29th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Oct. 13th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Alexander. Filters. 24,563. Sept. 19.
Blamey. Centrifugal extraction of slimes etc. 24,572. Sept. 19.

Bohme A.-G. Increasing wetting etc. capacity of liquids. 24,778. Sept. 20. (Ger., 27.5.27.)

Burch, and Metropolitan-Vickers Electrical Co. Vacuum distillation. 24,893. Sept. 21.

Gunka. Furnaces. 24,889. Sept. 21.

Heasman. Centrifugal separators. 25,095. Sept. 23.

Imray (I.-G. Farbenind.). Manufacture of metal catalysts. 24,636. Sept. 19.

Jambon. Furnaces. 24,837. Sept. 21. (Fr., 31.5.27.)

Johnson (I.-G. Farbenind.). Carrying out exothermic gas reactions. 25,110. Sept. 23.

Pay. Lubricant. 24,755. Sept. 20.

Stewart & Co. (Mauss). Cake washing means for rotary drum filters. 25,243. Sept. 24.

I. Complete Specifications

7330 (1926). Ljungstrom. Furnaces. (277,396.)

12,720 (1926). Dessauer. Apparatus for analysing substances by means of Röntgen or cathode rays. (253,090.)

23,461 (1926). Southall. Separation of solids from liquids. (277,500.)

2206 (1927). Levy. Granules for the absorption of gases. (277,540.)

2921 (1927). Vallez. Filters. (277,546.)

6699 (1927). I.-G. Farbenind. Manufacture of emulsions. (267,534.)

14,527 (1927). Schendt. Bag filter. (272,209.)

*22,403 (1927). Vereinigte Schweizerische Rheinsalinen. Salt or evaporating pans. (277,639.)

*22,782 (1927). Allgem. Elektrizitäts-Ges. Potentiometric devices. (277,645.)

*23,993 (1927). Trent Process Corp. Treating materials. (277,660.)

II. Applications

Anglo Persian Oil Co., Ltd. (Jameson). Treatment of hydrocarbon gases. 24,739. Sept. 20.

Arnold (Standard Development Co.). Conversion of hydrocarbon oils into lighter oils. 25,055. Sept. 22.

Asiatic Petroleum Co., Ltd., and Barton. Motor fuels. 24,906. Sept. 21.

Broué and Stevens. Hydrogenation of shales etc. 24,921. Sept. 21.

Carbide & Carbon Chemicals Corp. Making absorptive carbon etc. 25,130. Sept. 23. (U.S., 25.5.27.)

Daniels. Production and activation of carbon. 25,045. Sept. 22. (U.S., 22.9.26.)

France. Plants for washing coal etc. 24,896—7. Sept. 21. (Belg., 24.2.27 and 4.3.27.)

Ges. für Teerverwertung, Spilker, and Zerbe. Splitting hydrocarbons etc. 24,861, 24,915—6. Sept. 21. (Ger., 23.9.26, 18.10.26, and 20.10.26.)

Johnson (I.-G. Farbenind.). Low-temperature carbonisation of fuels. 24,644. Sept. 19. Production of oils of high viscosity etc. 24,647. Sept. 19. Bleaching montan wax. 25,003. Sept. 22.

Lucas, and V.L. Processes, Ltd. Cracking of liquid hydrocarbons. 24,974. Sept. 22.

Patent Aktiebolaget Grondal-Ramén. Dry distillation of shales. 25,271. Sept. 24. (Sweden, 7.10.26.)

Perehis. Treatment of mineral oils by heat. 25,033. Sept. 22. (U.S., 23.9.26.)

III.—Complete Specifications

14,468 (1926). Bianchi and Guardabassi. Apparatus for cracking, catalysing, and hydrogenating carbonaceous materials. (277,404.)

15,085 and 19,821 (1926). Lamplough and Hodgson. Treating oil and coal and the production of liquid hydrocarbons. (277,419.)

3903 (1927). I.-G. Farbenind. Decomposition of gaseous or vaporous hydrocarbons by means of water vapour. (265,989.)

6809 (1927). Bamag-Mequin A.-G., and Heller. Low-temperature distillation. (268,745.)

11,657 (1927). I.-G. Farbenind. Pulverulent fuels for internal-combustion engines. (270,703.)

*252 (1927). Gasifier Co. Gasifying liquid fuels. (277,604.)

*23,992 (1927). Trent Process Corp. Dissolving coal. (277,659.)

III.—Complete Specifications

15,048 (1926). Wittek. Extracting neutral oils from tar, tar-oil, or pitch. (256,933.)

15,085 (1926). Lamplough and Hodgson. See II.

*13,122 (1927). Still. Recovering sulphuric acid from acid-tar of benzol purification. (277,619.)

IV.—Applications

Carmael (I.-G. Farbenind.). Reduction of organic nitro compounds of the anthracene series. 25,049. Sept. 22. Manufacture of azo-dyestuffs. 25,050. Sept. 22.

IV.—Complete Specifications

7328 (1926). Bucherer. Production or development of azo-dyes. (249,526.)

9433, 10,632, 10,739 (1926) and 746 (1927). Wylam, Harris, Drescher, Thomas, and Scottish Dyes, Ltd. Dyes and dyeing. (277,398.)

17,655 (1926). Soc. Chem. Ind. in Basle. Manufacture of a dyestuff. (256,205.)

25,954 (1926). I.-G. Farbenind. Manufacture of stable preparations of vat-dyestuffs. (259,999.)

28,782 (1926). I.-G. Farbenind. Manufacture of anthraquinone nitriles. (261,422.)

29,276 (1926). I.-G. Farbenind. Manufacture of pyrazolone-azo-dyestuffs. (261,770.)

11,728 (1927). Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. (270,348.)

*24,216 (1927). I. G. Farbenind. Manufacture of benzanthrone-carboxylic acids. (277,670.)

V.—Applications

Carmael (I.-G. Farbenind.). Manufacture of copper oxide ammonia cellulose solutions. 24,903. Sept. 21.

Donagemma. Manufacture of cellulose threads etc. 24,672 and 24,948. Sept. 19 and 22.

Duke. Treatment of fibres for manufacture of paper etc. 25,165. Sept. 23.

Mourlaque. Manufacture of paper. 25,193. Sept. 24.

Stabner. Manufacture of coloured cellulose etc. 25,063. Sept. 22. (U.S., 23.9.26.)

Weingand, and Wolff & Co. Production of cellulose. 24,776. Sept. 20. (Ger., 19.4.27.)

V.—Complete Specifications

*20,012 (1926). Clavel. Treatment of artificial silks. (277,602.)

*18,255 (1927). Rheinische Gummi- und Celluloid-Fabrik. Treating celluloid scrap. (277,626.)

*23,383 (1927). Zimmerli. Lubricants for textile fibres or threads. (277,649.)

VI.—Applications

Balut. Dyeing hair of a pelt. 25,124. Sept. 23.

Hill. Production of finishing effects on textile fibres etc. 24,846 and 24,945. Sept. 21 and 22.

VI.—Complete Specifications

6720 (1926). Johnson (I.-G. Farbenind.). Increasing wetting and cleaning power of liquids for treating fibrous materials. (277,391.)

7328 (1926). Bucherer. See IV.

9433 (1926). Wylam, Harris, Drescher, Thomas, and Scottish Dyes, Ltd. See IV.

22,985 (1926). I.-G. Farbenind. Dyeing cellulose esters and ethers. (258,611.)

VII.—Applications

Alcock, Weber, and Laporte, Ltd. Manufacture of phosphoric acid etc. 25,022. Sept. 22.

Brégeat. Manufacture of potassium carbonate etc. 25,062. Sept. 22.

Coulter and Goldschmidt. Production of nitrogenised metallic compounds. 24,789—90. Sept. 20. (Belg., 20.9.26.)

Fischer. Radioactive material. 24,881 and 25,042. Sept. 21—22. (Austria, 29.9.26 and 19.2.27.)

Johnson (I.-G. Farbenind.). Production of solid calcium cyanide etc. 24,645. Sept. 19. Production of formates. 24,646. Sept. 19.

Laporte, Ltd. (Schlaugk Ges.). Manufacture of sodium sulphide. 24,910. Sept. 21.

Scailles. Manufacture of alumina. 24,637. Sept. 19. (Fr., 18.9.26.)

VII. — Complete Specifications

1601 (1927). Soc. Chim. Usines du Rhône. Treating acetic-acid liquor. (266,684.)

6477 (1927). Kyber. Simultaneous manufacture of iron phosphide and fused cement. (267,518.)

*13,122 (1927). Still. *See* III.

*18,623 (1927). Oesterr. Chem. Werke. Manufacture of stable solutions of peroxides, persalts, and peracids. (277,628.)

*22,403 (1927). Vereinigte Schweizerische Rheinsalinen. *See* I.

*23,650 (1927). Siemens & Halske A.-G. Production of ozone. (277,651.)

*24,637 (1927). Scailles. Manufacture of alumina. (277,697.)

*24,789—90 (1927). Goldschmidt and Coulter. Production of nitrogenised metallic compounds. (277,714—5.)

VIII.—Application

Lang. Abrasive. 25,014. Sept. 22.

IX.—Applications

Ackermann. Manufacture of bricks. 25,074. Sept. 23. (Ger., 31.12.26.)

International Copperclad Co. Building-material etc. 25,067. Sept. 22. (U.S., 5.10.26.)

IX.—Complete Specification

6477 (1927). Kyber. *See* VII.

X.—Applications

Ashcroft. Metallurgy of ores etc. containing tin. 24,649. Sept. 19.

Coles. Sherardising. 24,566. Sept. 19. Protection of metallic surfaces from corrosion. 24,567. Sept. 19.

Coulter and Goldschmidt. 24,789—90. *See* VII.

Gruber, Rohn, Weber, and Vacuumsmelze Ges. Metallurgical process. 24,994. Sept. 22.

Ott. Manufacture of steel. 25,168. Sept. 23.

Schorn. Aluminium alloys. 24,661—2. Sept. 19. (Ger., 18.9.26.)

Zimmer. Manufacture of gold leaf. 25,117. Sept. 23.

X.—Complete Specifications

14,959 (1926). Speichert. Treating lead-tin alloys derived from waste material from lead-smelting works. (253,908.)

15,037 (1926). Cumberland. Prevention of corrosion. (277,417.)

18,752 (1926). Jessup. Electrolytic manufacture of magnesium and alkaline-earth metals. (256,241.)

25,863 (1926). Siemens & Halske A.-G. Apparatus for galvanic processes, particularly for chrome-plating. (276,610.)

709 (1927). Browne. Producing high-grade silicon iron. (277,537.)

2224 (1927). Schubert and Pletsch. Tunnel annealing-furnace. (277,541.)

*22,496 (1927). Metallbank u. Metallurgische Ges. Production of aluminium or its alloys. (277,640.)

*24,661—2 (1927). Schorn. Aluminium alloys. (277,701—2.)

*24,789—90 (1927). Goldschmidt and Coulter. *See* VII.

XI.—Applications

D.P. Battery Co., and Waddell. Negative secondary-battery plates. 24,877. Sept. 21.

British Bead Printers, Ltd., Heynert, and Vredenburg. Electric-insulating compositions. 24,669. Sept. 19.

Hall. Electric accumulator. 24,794. Sept. 21.

XI.—Complete Specifications

18,752 (1926). Jessup. *See* X.

22,346 (1926). British Thomson-Houston Co., Ltd. Electric furnaces. (258,276.)

25,863 (1926). Siemens & Halske A.-G. *See* X.

11,353 (1927). Zimmermann. Production of insulating materials. (277,577.)

XII.—Applications

Canals. Treatment of oils and fats. 24,867. Sept. 21.

Nelles. Soap-making. 24,876. Sept. 21.

Pickersgill and Postnikoff. Margarine-making machines etc. 24,720—1. Sept. 20.

XII.—Complete Specification

6699 (1927). I.-G. Farbenind. *See* I.

XIII.—Applications

Higgins, and United Water Softeners, Ltd. Manufacture of mineral pigments. 24,765. Sept. 20.

Johnson (I.-G. Farbenind.). Manufacture of plastic compositions, lacquers, etc. 25,004. Sept. 22. Production of coloured compounds etc. 25,007. Sept. 22.

Wright. Luminous paint etc. 24,590. Sept. 19.

XIV.—Application

Goodyear Tire & Rubber Co. Accelerator of vulcanisation. 24,625. Sept. 19. (U.S., 8.10.26.)

XV.—Applications

Balut. 25,124. *See* VI.

Pawlowitsch. Tanning. 24,780. Sept. 20.

Röhm & Haas A.-G. Emulsions for tanning. 25,066. Sept. 22. (Ger., 13.11.26.)

XVI.—Complete Specification

9731 (1927). Prep. Indust. des Combustibles, and Hoffmann. Manufacture of phosphatic fertilisers. (269,199.)

XVII.—Application

Cuker and Komers. Increasing purity coefficient of diffusion etc. juices. 24,927. Sept. 21.

XVII.—Complete Specifications

10,236 (1926). Dehn (Penick & Ford, Ltd.). Manufacture of starch. (277,400.)

9736 (1927). Marks (Corn Products Refining Co.). Manufacturing starch. (277,572.)

XVIII.—Application

Sak. Production of compressed yeast. 24,751. Sept. 20.

XVIII.—Complete Specifications

20,875 (1926). International Yeast Co., Ltd. (Fleischmann Co.). Yeast manufacture. (277,476.)

*22,769 (1927). Henkel & Cie. Manufacture of a dry urease preparation. (277,644.)

XIX.—Applications

Pickersgill and Postnikoff. 24,720—1. *See* XII.

XIX.—Complete Specification

27,514 (1926). Douglas Pectin Corp. Pectin preparations and manufacture of preserves and jellies. (262,736.)

XX.—Applications

Delco-Light Co. Methyl ether. 25,182. Sept. 23. (U.S., 28.9.26.)

Germain. Distillation of organic calcium salts. 24,882. Sept. 21. (Fr., 23.9.26.)

I.-G. Farbenind. Making dihydroxyacetone. 24,909. Sept. 21. (Ger., 18,12,26.)

Johnson (I.-G. Farbenind.). Manufacture of methyl alcohol. 24,642. Sept. 19. Production of aldehyde sulphonylates. 24,643. Sept. 19. Production of aldol. 24,648. Sept. 19. Preparation of formaldehyde solutions. 25,002. Sept. 22. Recovery of products from oxidation products of hydrocarbons. 25,005. Sept. 22. Production of esters. 25,006. Sept. 22.

Merck. Production of a scopalamine preparation. 25,249. Sept. 21. (Austria, 11,10,26.)

Stephens (Wulffing) Manufacture of 2-phenylquinoline-4-carboxylic acid. 25,158. Sept. 23.

XX.—Complete Specifications

7051 (1926). Johnson (I.-G. Farbenind.). Manufacture of organic compounds. (277,394.)

17,561 (1926). Glucksmann. Manufacture of aqueous medicinal emulsions of paraffin. (255,456.)

15,197 (1927). Etabl. Poulenc Frères, and Pournau. Manufacture of a formyl derivative of 2 oxy-4-amino-phenyl-arsenic acid and salts thereof. (277,586.)

XXI.—Application

Ott. Composition for coating kinematograph films etc. 25,170. Sept. 23.

XXI.—Complete Specification

20,169 (1926). I.-G. Farbenind. Manufacture of photographic silver halide emulsions. (259,926.)

XXIII.—Applications

Hick, Hargreaves, & Co., Ltd. Means for deaerating water. 24,879. Sept. 21.

Higgins, and United Water Softeners, Ltd. Treatment of water by precipitation process. 25,093. Sept. 23.

I.-G. Farbenind. Preparations for repelling gnats etc. 24,762. Sept. 20. (Ger., 20,9,26.)

Johnson (I.-G. Farbenind.). Process for destroying pests. 24,865. Sept. 21.

XXIII.—Complete Specifications

15,200 (1926). Boehringer. Production of disinfecting agents. (253,918.)

*24,752 (1927). I.-G. Farbenind. Preparations for repelling gnats etc. (277,710.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Glass cloth (253); Water turbines and alternators (B.X. 3829). *Austria*: Soaps, india-rubber articles (261). *British India*: Optical goods, glassware, stationery, soaps (254); Steel, air lift pumps, oil engine driven compressor, receiver, oil tanks, well tubes, tools, steel sleepers and steel keys, disinfectors, boilers, steel crank axles for locomotives, paper, chrome steel crossings (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *British West Indies*: Cement, galvanised sheets, iron hoops (255). *Italy*: Sugar (269). *Japan*: Manganese metal, ferro tungsten, ferro titanium, manganese copper, phosphor copper (A.X. 5243). *New Zealand*: Soaps, stationery, rubber goods (258). *South Africa*: Internal combustion Diesel crude oil locomotives (A.X. 5229); Tallow (B.X. 3844); Disinfectant powder (B.X. 3846); Stone-crushing plant, including conveyor belt, endless

rope haulage, electric motors, etc. (A.X. 5263). *Switzerland*: Engineering metals (272). *Yugoslavia*: Tin (A.X. 5261).

Bisulphide of Carbon (Conveyance in Tank Wagons) Regulations, 1927

In pursuance of Section 9 of the Third Schedule of the Petroleum Act, 1926, the following regulations have been made amending the Bisulphide of Carbon (Conveyance) Regulations, 1927. (b):—(1) Bisulphide of carbon may be conveyed in tank wagons, subject to the provisions of these regulations. (2) The Bisulphide of Carbon Regulations, 1927, shall apply with the exception of Regulations 1, 2, 3, 4, 5, 12, and 14. (3) This section regulates the construction of such tank wagons. (4) The capacity of a tank wagon shall not exceed 1000 gals., this limitation being construed so as to permit the tank to contain the amount specified under varying conditions of temperature. Trailers shall not be employed with tank wagons. (5) During the filling or emptying of a tank wagon the following precautions shall be observed: (a) If the wagon is mechanically driven the engine shall be stopped the whole time the filling or emptying is proceeding, and shall not be run until all tanks have been securely closed. (b) If the wagon is horse-drawn, the horses shall be removed and the wheels securely scotched before filling or emptying is begun. (c) Adequate provision shall be made to prevent the accumulation of a dangerous static charge of electricity. (6) Bisulphide of carbon in cans or other packages shall not be conveyed on any tank wagon used for the conveyance of bisulphide of carbon. (7) This regulation lays down conditions to be observed if electric lighting is employed on any tank wagon conveying bisulphide of carbon. (8) The tank of any tank wagon conveying bisulphide of carbon shall be legibly marked with the words "Bisulphide of Carbon, Highly Inflammable." (9) These regulations may be referred to as the Bisulphide of Carbon (Conveyance in Tank Wagons) Regulations, 1927.

News from Advertisements

The following posts are vacant: (1) Inspector under the Alkali Works Regulation Act. (2) Chair of Organic Chemistry in the University of Sydney, New South Wales. (3) Junior assistant chemist under the Northern Coke Research Committee, Armstrong College, Newcastle-upon-Tyne. (4) Chemical engineer for Midland factory. (5) Junior assistant chemist for an Engineering Works Laboratory (p. vi).

Three vacant posts in the Industrial and Commercial Property Registration Office as examiners of applications for patents for mechanical engineering, electrical engineering, and chemical inventions, are announced by the Civil Service Commission, Dublin (p. vi).

Sets of the JOURNAL are for sale (p. vi).

There are now 118 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

THERMODYNAMICS APPLIED TO ENGINEERING. By A. F. Macconochie, B.Sc. Pp. xiii + 260. London: Longmans, Green & Co., 1927. 12s. 6d.

MODERN CEREAL CHEMISTRY. Revised and enlarged edition. By D. W. Kent-Jones, Ph.D., B.Sc. Pp. vii + 446. Liverpool: The Northern Publishing Co., Ltd, 1927. 25s.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

VOL. 46 NEW SERIES

LONDON, OCTOBER 14, 1927

No. 41

EDITORIAL

Calorifer on Bone

WE have the best reasons for believing that CALORIFER, who has successfully concealed his identity by adopting a *nom de guerre*, has a profound admiration for the work done by Bone and Townend and for the book they have published on Flame and Combustion in Gases. The fact is that in our editorial capacity we naturally have been in communication with CALORIFER, and know who he is, though we shall duly respect his desire to remain anonymous. We cannot imagine him writing ten columns, filled with learning, jests, arguments, sarcasm, satire, poetry, verse and so on, revolving the matter round in his fertile and highly-charged brain, and entering into the lists prepared for any sort of mortal combat, unless he thought the book which has stirred him up was really a valuable contribution to knowledge. It is true that his admiration is tempered by keen criticism; on the other hand, his vigorous onslaught has the sting taken out of it by the airy touches of fancy which enable us to realise that when he describes a chemist, who may easily be identified, as a thrice-unhung villain, he really has a great respect for the worthy man. These modifications must be borne in mind and allowed for. Somebody said once, not of CALORIFER, "He was the mildest-mannered man that ever scuttled ship or cut a throat." Someone else wrote, "Perhaps you were right to dissemble your love, but why did you kick me downstairs?" CALORIFER is a stickler for precision in words, and recommends, as we do ourselves, the sparing use of such words as end in *osity* and *ate*. Quite right! but what about "epipedonic?" Why drag this in? The irreverent chemist called Henry would have dealt with him severely for such an innovation. We are glad that CALORIFER objects to "activate." We have an affection for Latin and Greek, but in their proper places: if a Latin or a Greek word will express a meaning more accurately and more concisely than an English one, and if it will be as accurately understood, let us have it by all means. There are, however, foreign, specially Greek words, used in science which are used to explain briefly that the writer is not clear in his mind what he does mean, and hopes that the reader will not detect this. On the use of the word "theory" we should like further enlightenment. CALORIFER tells us that "A theory is a complete doctrine, into which all the facts may be fitted." The only theory known to us in chemistry is "The atomic theory." We do not know why the word theory should have in chemistry a narrower meaning than it has in the writings of many careful men during

many years. The word is, we suppose, derived from the Greek, through the French. It originally meant a view, contemplation, speculation, spectacle. It corresponded closely in several of its senses with the word "view." It was not usually distinguished from opinion or hypothesis. An erroneous speculation was nevertheless a theory. Grote uses the word theory to describe what he calls elsewhere a hypothesis. Lyell, in his Principles of Geology, speaks of "visionary and fantastical theories" and the "theory" of Pythagoras concerning the destruction and renovation of the earth. Faraday, in commenting on M. Biot's opinion as to the cause of electro-chemical decomposition, says, "This theory implies that decomposition takes place at both poles upon distinct portions of fluid, and not at all in the intervening parts", on pages 76 and 77 of that very edition that CALORIFER advocates he will find an account of Faraday's "theory," M. de la Rive's "theory," and some other theories. So Darwin wrote of the theory of natural selection at a time when it was hardly more than an opinion. Rouse Ball writes of Maxwell's and "the other electric theories." We think, if we spent another half hour, we could find a profuse crop of examples taken from authors who wrote well and carefully. It is possibly a mistake to go back to the Greek meaning of Greek words when there may so easily be found the chemical meaning of the Greek. We must go cautiously and with sure steps and slow; this is, we suppose, what is meant by epipedonic progress. We remember the lines "Oh why did I learn mathematics or give my attention to Greek? That's the reason I'm lodging in attics and living on nothing a week." If we use the word "theory" as it has been used by the learned for two thousand years, it will include "view," or even "impression." There is something divine about a theory, probably theory and thionic have the first syllable in common, but there is nothing about it which need command our respect; the old theorist was probably merely the man who enjoyed the spectacle of the sacred games, the equivalent of the man who now watches a football match. CALORIFER almost tempts us to write something about flame; if we could spend an afternoon with him and another with the authors of the book he has praised, we might, perhaps, write two short notes, one for publication, the other to be handed round to those frivolous chemists who frequent the Savage Club. The lines we have quoted about mathematics and Greek will appeal to those chemists who write to us complaining of inadequate remuneration; if ten thousand men and women attained a reasonably high standard in mathematics, the pay of a mathematician would be very

low, unless the knowledge was supplemented by exceptional qualifications of another sort.

The New Stereochemistry

We have often tried to read up the stereochemistry of the simple carbon compounds, but have been foiled, partly by the lack of the necessary text-books and partly by a mixture of diffidence and laziness which has prevented us from taking due advantage of the information that has been published. We have frequently invited our readers to enlighten our darkness; we thought that a few of the four or five thousand of our readers who have this subject at their fingers' ends might very gladly give some elementary instruction to the four or five hundred who never knew this subject very well and have now forgotten most of what they once knew. We were disappointed that so few responded to our invitations; our disappointment has vanished, it has been replaced by a grim satisfaction that we have not worn out our feeble brain in an effort to understand both organic chemistry and solid geometry and then had to revise or correct a good deal of the result. For here comes Prof. Victor Henri, of Zurich, whom we have met and who appears to be a man with knowledge on such matters, and he tells us that we must abandon the axioms and postulates of stereochemistry and work out new theorems. He has duly pondered on the experimental evidence, concerning the structure of methane and methane derivatives, furnished by observations on the scattering of light, the absorption spectra, the structure of crystals as determined by X-rays, the potential energy of molecules and the emission spectra of atoms and molecules. He has experimented on about fifty different compounds in his own laboratory, and has compared his results with the work of Cabannes, Raman, Guillemin and Mark, almost all of which has been published in the last three or four years. His conclusions are that the molecule of methane is rectangular pyramidal in form and not tetrahedral, that the dichloro-derivatives of methane are tetrahedral, but the molecule of tetraphenylmethane is pyramidal. The component atoms of the water molecule are shown to be arranged at the corners of a triangle. Not content with shaking the foundations of organic chemistry in this way, Prof. Henri makes our flesh creep by arguing that the four valencies of carbon are not equivalent but consist of two different types, and that the molecule of methane is labile and capable of changing its form in its derivatives. We have an imperfect recollection that in the 'eighties and 'nineties we were taught to bind our molecules with chains and our atoms with links of iron, and that subsequent workers have calculated the stress on bending the links, their hardness and breaking point, and finally their tensile strength, and that you may find tables of the naperian logarithms of the cosines of the angles of distortion of these massive connecting rods. Prof. Henri will have none of this; he considers that the molecule is a mobile system of atoms in which the stability of the structure is determined by the minimum value of the potential energy. We can see the makings of a pretty quarrel between the physical chemists and the organic chemists. Have at ye, and God defend the right! We will not yet destroy our beliefs for so slight a cause; it is like burning down the house to kill the

beetles; but we do intend to postpone our projected course of study until we know whether we should enlist in the army of Prof. Henri or his opponents. We may say that a full account of his beliefs and his reasons in support will be found in the current number of *Chemical Reviews*, obtained from Messrs. Baillière, Tindall and Cox, the London agents of the American Chemical Society.

Greed and Egoism

We confess that when, frequently, we read the *Evening News*, we seldom fail to acquire much and varied information respecting social life of to-day, and not a few definite views on the political situation. Recently, however, we read something which rather upset us. We were called upon to admit that Science is as greedy as it is egotistical, that Science, up-to-date, has fortunately been more bombastic than successful, and that if we seriously annoy Nature by destroying insect and other pests, she will retaliate by wiping out man. After so scathing an indictment, we are relieved to think that we have always humbly protested when addressed as a "scientist," but we must nevertheless set to work immediately and re-examine our position. It is clearly a case of Nature *versus* Science, and we are safer on the side of the bigger battalions. Let us start with Newton's apple. Item, All this insistence on an universal law of gravitation is pure arrogance. The facts are simple enough; the apple just fell down, as all other things do when you drop them. Item, The maggot of the codling moth (if any) which was the immediate cause of so natural a phenomenon had as much right to that apple as Newton. Conclusions: Science may be tolerated so long as it does not conflict with nature, but greedy gravitation must not presume to try and make things full upwards; moreover, the morality of insecticides is in question. "Man," we learn, "gets 80% of the world's available supply of food, a far greater share than his own unaided efforts produce." This is only too true. Equity demands—and secures a proper agreement with *Bacillus nitrificans* and his friends. Rabbits and rats may not earn their daily bread—unless rabbit pie may be regarded as service rendered but that is no reason why they should be deprived of a suitable livelihood for themselves and their families. No. We must refuse to be "egged on by our scientific war-lords" to a class-war against the lower orders of the animal kingdom. "Nature can be won by kindness." Let our agricultural chemists turn over a new leaf. Let us prohibit insecticides, and spray our potatoes with molecules which will melt in the mouth of the potato bug; give the boll-weevil our hemstitched handkerchiefs to chew; see that our rats get plenty of irradiated ergosterol, and then, perhaps, losing their taste for the things man requires for his own use, they will live their lives in synthetic contentment, if they do not die of laughing. The *Evening News* doubtless intended to amuse rather than to instruct. We sincerely hope that its leading article will not mislead the thoughtless into the attitude which regards Science as the enemy, rather than the expression, of Nature, and that it will do nothing to encourage any neglect of the duty of controlling, even to the point of extermination by "shock troops and battalions of scientific death," the menace of insect pests and vermin.

THE LABOUR POLICY OF IMPERIAL CHEMICAL INDUSTRIES, LTD.

Sir Alfred Mond, M.P., chairman of Imperial Chemical Industries, Ltd., has explained, in a statement made at a Press Conference, the programme of the company in regard to workers in its employ. The reorganisation and the revival of British industry, said Sir Alfred, had been seriously retarded by industrial disputes, but gradually there had been growing in all directions the view, which would soon become a settled conviction, that the best interests of all concerned were best served by agreement and conciliation. The history of most of the industries now amalgamated in Imperial Chemical Industries, Ltd., had been a happy and peaceful one, and almost entirely free from industrial disputes. The relationship between the companies and its workers in the chemical industry had always been cordial. Those conducting it in the past had always regarded all those working with them in any capacity as fellow-workers in a common cause. In his first official announcement on the formation of the new company, he stated that "The formation of the new combination will not be allowed to alter that close personal contact which has happily existed for more than one generation between the chiefs of the industry and those employed with them. The good-will of all those engaged in the industry is one of the most valuable of invisible assets, and this is fully recognised by those who will control the future destiny of the British Chemical Industry."

In a subsequent official statement in December, 1926, Sir Alfred Mond said he endeavoured to define the labour policy of Imperial Chemical Industries, Ltd., in the following passage:—

"There has been a certain agitation or tendency to suggest that one of the objects of the merger is to depress wages and worsen the conditions of those employed in the respective companies. I want to give a most emphatic contradiction to that. Nothing could be more untrue. Quite the reverse is in the minds of those directing this enterprise. In fact, at an early date a careful study will be made of the various welfare and profit-sharing and bonus, or other schemes already existing in the constituent companies, with a view to ensuring that the future shall, if anything, be better than the past, and that those engaged in any rank in any of the works of this great Imperial enterprise shall obtain the greatest possible consideration and sympathetic treatment. In fact, the happy relations which have existed for so many years in the chemical industry, almost unique in the industries of this country, will, we confidently anticipate, not merely be maintained, but improved, and every endeavour will be made that contact will not be lost, by the mere size of the organisation, between those who are at the head and those who are giving their daily work in its many manufactories in whatever sphere."

No time had been lost in implementing this promise to introduce an Imperial Chemical Industries' Workers' Programme. Considerable investigations had been made and a great deal of time and thought had already been given by the Board to the formulation of this programme. To-day he was happy to be able to announce the details of the first instalment of the company workers' programme. In commencing a huge concern like this

there were many problems to think about, particularly in the earlier stages, and one they had to think about was the importance of the organisation of the labour position. For they had something like 40,000 workmen and workwomen spread through a large number of factories of different sizes throughout the length and breadth of the country.

During the last few weeks the movement towards industrial peace had received a great impetus. There was not only a new spirit, but there was also a new task in industry. The influences made themselves felt at the last sessions of the Trades Union Congress. He trusted that the concrete proposals which Imperial Chemical Industries, Ltd., had put forward would prove a lead to other companies and other industries.

To give effect to the purpose of having a common labour policy throughout all the works of Imperial Chemical Industries, a central labour department had been established. The Board attached the greatest importance to the unification of all labour matters, and that department and all labour questions would be under the personal direction of Mr. Henry Mond, who was an executive director of the combine. Mr. Mond would be assisted by Mr. R. Lloyd Roberts, the company's Chief Labour Adviser, who had for long been Secretary of the Chemical Employers' Federation. The department would be administered by specialists, and would have the assistance of an advisory committee to secure the necessary interchange of views between those who framed the policy and those who executed it. One of the problems that had occupied his mind in the reorganisation of the chemical industry was how it would be possible to maintain personal contact between those directing the industry and those employed.

Works councils would be set up in all the works of the combine, to provide a direct link with the Board of Chemical Industries. These works councils would be of three forms, and they would all be representative equally of the management and the workers. In the first place, there would be the Local Works Council, which would deal with all local matters affecting the workers. In the second place, there would be the General Works Council, appointed from and by the various Local Works Councils of all works under each group of companies. Its functions were similar to those of the Local Works Councils, but matters dealt with would be of a wider scope and of general interest to the workers of the whole group. Lastly, there was the Central Works Council, appointed from and by the General Works Councils, which would meet regularly in London. Over this body he himself would preside. He would thus be able to maintain that constant and close personal contact with the interests and operations of all the workers of the combine, and would be able to consult and discuss with them on all questions affecting their general well-being.

Another problem which affected all industrial relations was that of the status and security of the worker. By the system of works councils and by the inauguration of a staff grade of workers, any ground for complaint would be removed. All men of five years' service and over would be eligible for promotion to the staff, and those promoted would be paid a weekly wage instead of an hourly rate. To give greater security to their

employment, they would be entitled to receive a month's notice of termination of employment; they would be paid wages for bank holidays, whether worked or not; for all certified sick absence up to six months in any year they would be paid full wages, less National Health Insurance benefit. This staff grade might even consist of 50 per cent. of all workers of five years' service and over.

The co-partnership plans which had functioned in various of the companies were being unified in a Workers' Shareholding Scheme, which was designed to encourage all ranks of workers to obtain a direct financial interest in the company. Any employee might purchase ordinary shares in Imperial Chemical Industries, Ltd., at 2s. 6d. below the mean market price. All workers receiving wages of £200 a year or less would receive one free share for every four shares purchased. Workers receiving higher wages or salaries would receive a smaller proportion of free shares to those purchased. The maximum individual allotment would be such number of shares as could be purchased by an expenditure of a sum not exceeding 20 per cent. of the annual wages or salary of the employee. To this 20 per cent. might be added an additional 1 per cent. for each year of service above five. An employee with 20 years' service therefore might spend 25 per cent. of his wages or salary. If the worker should die before completing his payments, which might be by instalment, the company would take over his obligations and hand the shares, fully paid, to his next-of-kin. The shares were just such as the public could purchase in open market, and could be sold in the market like other shares.

The workers' shareholding scheme was intended as an investment scheme, and while no absolute restriction was placed on the workers, they would not be expected to speculate with their shares. The directors reserved the right to refuse to allot further shares to a worker who did not enter into the right spirit of the proposal.

Further, a monthly magazine would be established to keep their workers all in close touch and make them feel they were all working with the board and management for the prosperity of their industry.

These points were but the first instalment of the workers' programme of Imperial Chemical Industries. The keynotes were personal contact, improved status and security, co-partnership, and information. He did not consider this complete, but other proposals now being investigated and considered would be decided on the same broad lines.

Industrial peace would be created only by those responsible for industry and those responsible for labour accepting the position and working out schemes which would be of use to both parties and would give benefits to industry as a whole. The achievement of industrial peace could not be hastened by the desires of enthusiastic amateurs or disillusioned politicians. It could be secured only by the competence of those in whose hands was placed the responsibility for industrial reorganisation. There was a new spirit and a new science required in the management of industry. That they had endeavoured to apply to the chemical industry. That was the broad avenue to industrial prosperity and to industrial peace.

[Further details of the Labour Programme of Imperial Chemical Industries, Ltd., will be given in our next issue.]

SYNTHETIC DRUGS AND PHARMACOLOGY

At the opening of the thirty-sixth session of the School of Pharmacy of the Pharmaceutical Society, the Hanbury Medal was presented to Dr. T. A. Henry, F.R.S., director of the Wellcome Chemical Research Laboratories. In his address, Dr. Henry discussed the contribution of the Pharmaceutical Society to education and research. He welcomed the opening of a pharmacological laboratory by the Society. There was a consensus of opinion among pharmacists, manufacturers, and medical men that this country had not yet reached the position it ought to occupy as a producer of synthetic drugs. We had made great progress since the critical year 1914, both in the manufacture of synthetic drugs of established reputation as therapeutic agents and in the introduction of new products of this kind, but far too many of the new additions were of foreign origin. This was not a creditable state of things. We were as an Empire responsible for the well-being of an enormous tropical population, yet most of the important new drugs for the treatment of tropical diseases still came from abroad. This was probably due, in part at least, to the fact that as a nation we were naturally and primarily interested in the preventive rather than the curative side of medicine. This was as it should be, but it was no reason why we should not take our share in investigations which would produce new materials for dealing with disease. In practice there were many factors which weighed heavily against British activities in this direction, but one of the most important had been the lack of facilities for conducting pharmacological tests and therapeutical trials of new drugs. Scarcely a number of the *Journal of the Chemical Society* appeared which did not contain descriptions of new substances whose pharmacological action ought to be investigated.

Further, the number of chemists who were beginning to take an interest in the possible therapeutic value of substances they prepared was steadily increasing, but the number of centres at which the necessary pharmacological work could be done in Great Britain was lamentably small. Apart from this demand there were the requirements of the pharmaceutical branches of the fine chemical industry. We had had it clearly impressed upon us that an investigation leading eventually to the production of such a drug as "Salvarsan" implied the preparation of a large number of substances, and therefore the employment of many organic elements, but it did not seem to be as clearly realised that all this work required to be carried on under pharmacological control.

It was the same with much of the biochemical work which was now leading to the use in medicine of materials such as insulin. All this meant an increased demand for pharmacological work in the future in this country. Anyone who realised these needs must welcome the action of the Pharmaceutical Society in opening the new laboratory, not only for the immediate help it could give in connexion with the testing products of which came within the scope of the Therapeutic Substances Act, but for the fact that it was a new centre for training in experimental pharmacology, and that as it developed it might be able to give material assistance in some of the directions just mentioned.

A RECENT DEVELOPMENT OF SPRAY DRYING*

By J. ARTHUR REAVELL, M.I.Mech.E., M.I.Chem.E.

In all chemical works, and, to a large extent, in the manufacture of food products, the removal of water from various solutions and substances forms an intermediate step in most manufacturing processes. Very often this can be done by evaporation in evaporators of various kinds, but in many cases the use of any type of tubular evaporator, or of drum driers, is not feasible.

The problem now to be discussed, therefore, is another form of evaporation. In a previous paper† the author defined evaporation as "the use of heat to bring about the separation of a volatile liquid, generally water, from solids in solution." In the form of evaporation described in this paper air is used as the medium whereby the heat is conveyed to the liquid to be evaporated.

The production of chemical products, or food products in their ultimate dried form, usually as a powder, generally involves three processes:—

1. Evaporation.
2. Drying.
3. Grinding.

The liquid to be dealt with is usually taken into an evaporator in which it is concentrated up to a suitable density. It is then subsequently dried and finally ground before being ready for sale. In the spray drier that we describe these three processes are performed in one operation.

With very few exceptions, this plant is suitable for the dehydration of any material which can be obtained in the form of a solution, or a finely divided suspension, from which it is possible to obtain a solid residue by means of evaporation. This covers a vast field, and embraces problems which arise in almost every industry.

Materials that can be dealt with will be referred to under two distinct headings:

1. Materials that are stable, that is, substances which are not decomposed or damaged when heated to a temperature of 100° C.
2. Unstable materials, that is, those which are affected by being heated to a temperature of 100° C.

These arbitrary definitions are taken for the purpose of this paper only.

In order that spray drying plant may operate successfully three essentials must be fulfilled:—

The first is the atomisation of the liquid to be treated.—The liquid must be continuously dispersed in the form of small particles of uniform size. The direction taken by the dispersed particles must be under control, and any apparatus employed to produce these results must be capable of operating for long periods under ordinary working conditions.

The second relates to the drying of the dispersed particles.—For this it is necessary to provide means in the drying plant whereby the dispersed particles are rapidly and uniformly brought into contact with the drying air for a sufficient period to ensure that the dispersed particles do not reach any part of the vessel in which the

drying is being carried out until they are in the solid state.‡

The third relates to the removal of the dried product from the air stream.

The importance of the above three essential requirements will be appreciated more fully as we proceed to discuss the matter in greater detail. First of all we will deal with atomisation—a term frequently used in connexion with spray drying work, but which, of course, must not be taken literally.

JET ATOMISERS

The first attempts to atomise liquids were by means of various types of jet, the liquid being forced through the jet at high pressures. It was soon found that the only way to obtain a really finely divided dispersion was to employ extremely high velocities in the jet apertures. The usual designs of spraying jets are familiar, and for certain purposes they are quite efficient, but the dispersion required for spray drying is of a different order from that required in normal spraying operations, and

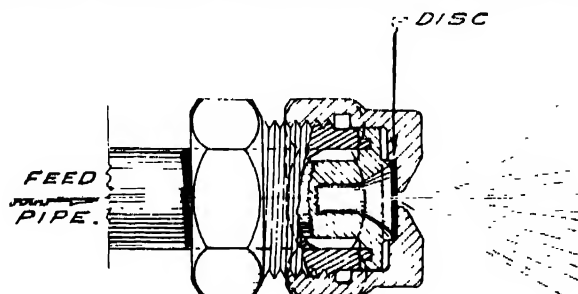


FIG. 1

considerable modifications in the jet design were necessary to obtain anything approaching the required results.

A jet which is probably the best of its type relies upon a minute orifice in a disc of specially hard metal through which the liquor to be atomised is forced at high pressures. Pressures of about 2000 lb. per sq. in. are employed, and under these conditions atomisation is obtained with a particle of a size which is sufficiently small for spray drying purposes.

With this type of atomiser, however, it is difficult to obtain the three essential conditions to which reference has been made. For instance, the spray leaves the jet in the form of a cone which spreads outwards, and it is difficult to mix the air thoroughly and rapidly with the sprayed particles. This will be discussed more fully when dealing with the methods employed to obtain efficient contact between the heated air and the atomised liquid, and, therefore, at this stage it is referred to only in passing.

To maintain the pressure of 2000 lb. per sq. in. in the jet presents considerable problems, particularly when the liquid under treatment is of a corrosive nature, or when it consists of foodstuff which must be uncontaminated during treatment. Again, the minute aperture

* Read at a meeting of the Chemical Engineering Group on Oct. 14, 1927.

† "Evaporation in the Chemical Industry," by J. Arthur Reavell, J.S.C.I., 1918, 27, 172 T.

in the jet disc is liable to obstruction by any trace of solid foreign matter in the liquid, and even if this should not occur the disc must be renewed frequently, as within a few hours the erosion caused by the liquid passing through the aperture is sufficient to increase its diameter materially.

With foodstuffs, which are usually of a relatively expensive nature, the question of cleaning is important. There is always a loss of material when the pumps and pipe lines are cleaned, and, in addition, there is always a loss at pump glands etc. during running.

Another difficulty is the variation in size of the particles leaving the disc aperture. If the flow of liquid through the aperture is considered, it will be obvious that its velocity will vary considerably across the disc diameter. This means that the condition of the liquid immediately after it leaves the orifice is not uniform, and therefore the sprayed particles cannot be uniform in size.

DISC ATOMISERS

This is a type of atomiser which operates on a totally different principle from that described above. In this type of atomiser use is made of the centrifugal force developed in a liquid which is rotated at high

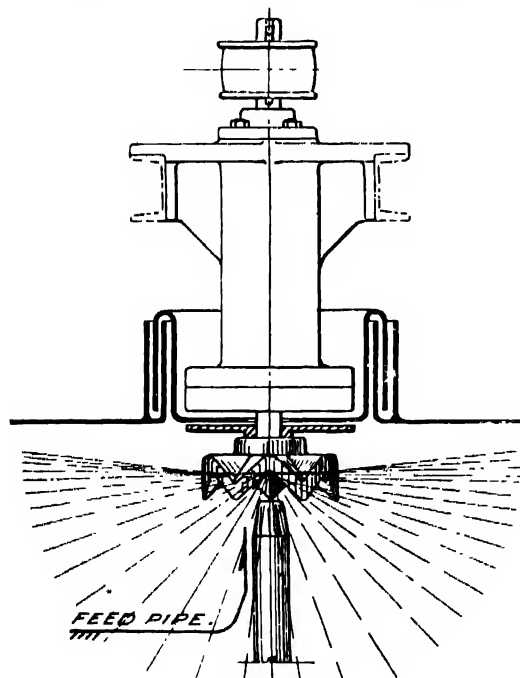


FIG. 2

speeds. In order to make use of this some form of wheel or disc is arranged from which the liquid is projected at considerable velocities. One of the early forms consisted of a disc with a number of angular projections, the liquid being fed to the centre of the disc and leaving at the periphery. This type of disc has been developed in various ways. In place of the projections jets have been arranged round the periphery of a rotating cup, but this modification only leads us back to the jet type of atomiser which was considered first. Therefore

attention will be confined for the moment to the revolving disc arranged with projections from which the liquid is thrown.

This type of disc has many advantages over the jet. There are no small apertures to clog; it does not involve the use of high pressures, and cleaning is quite a simple matter. It is difficult, however, to get a fine and regular dispersion, as the film of liquid behind any one of the projections is naturally thicker than in the space between the projections, and particles of irregular size are

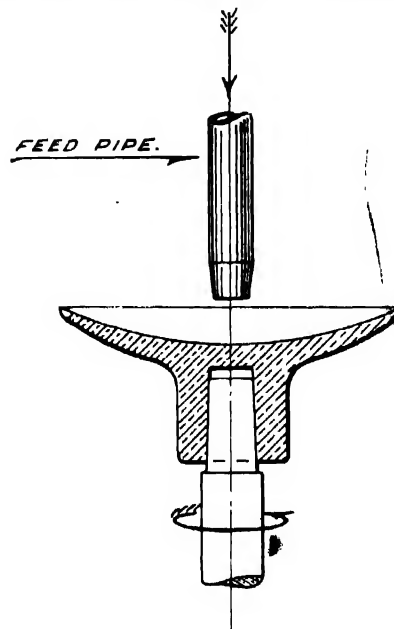


FIG. 3

invariably produced. It has its uses, particularly in dealing with solutions which contain suspended solid particles of irregular size.

We will now consider another type of disc which has been used successfully. It consists of a plain disc, which is rotated at a high speed about a vertical axis, the liquor to be atomised being applied in the centre of the disc. It was soon found that it was advantageous to work with a disc which is not flat across its upper surface, but which is hollowed toward the centre and raised at the outer edges. Greater adhesion of the liquid to the disc is obtained in this way, and the slip between the liquid and the atomising disc is thereby reduced.

This type of atomiser is simple, but its use is limited to spray-drying plants in which the liquid can be fed on the upper side of the atomising disc. It will be shown that there are great advantages in being able to atomise from the lower side of a rotating disc, the disc being driven from above.

The use of an underdriven disc is limited to a type of drying plant in which the dry air current moves in an upward direction. There are enormous advantages in drying with a downward current of air. Consequently considerable attention has been given to the design of an atomiser which is driven from above, and which can be situated in the upper part of a drying chamber.

In this case the driving spindle comes down to the centre of the disc and feed pipes are arranged around the spindle, directing the material into an annular cup, from which it passes outwards towards the edge of the disc. It is difficult with this type of atomiser to obtain

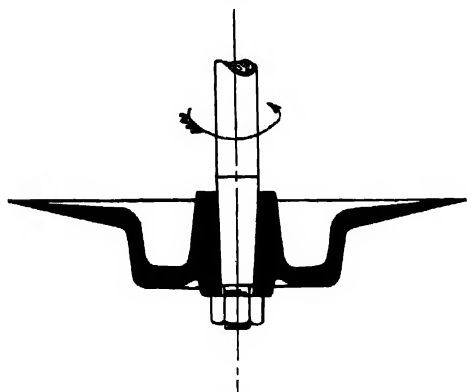


FIG. 4

a regular distribution of the liquid around the periphery of the disc, as there is a marked tendency for the liquid to leave the disc at positions dependent upon the position of the feed pipes, instead of forming a symmetrical film over its surface.

A recent design of disc has been evolved to overcome the various troubles associated with the types hitherto mentioned. The essential characteristic of this disc is that the liquor is sprayed from the underside, although the driving mechanism and the feed pipes are situated above the disc. It consists of a central ring in the outer

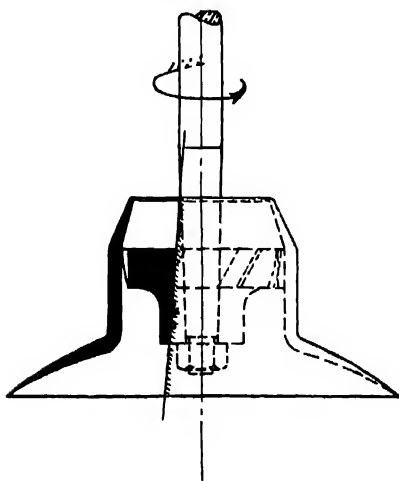


FIG. 5

periphery of which are a number of openings. These openings lead to the underside of a bell-shaped spraying disc. Above the bell-shaped portion and the central disc with its distributing openings a cup is formed into which the liquor is fed. The centrifugal force which is developed in this cup propels the liquid through the distributing openings, and it finally leaves at the lower edges of the disc itself. With this type of disc the supply of liquid to the spraying surface is obtained

from a large number of distributing openings, and by the time the liquid has traversed a small part of the bell-shaped portion it is spread evenly round the circumference, and finally leaves the edge as a film of regular thickness. The distributing openings can be of relatively large size, and therefore do not form a restriction on the flow of liquid, neither is there any risk of their becoming blocked by any small particles of foreign matter which are present in the material under treatment.

The disc is, from the point of view of accessibility, ease of cleaning, etc., of extremely simple construction, and in normal working, even with foodstuffs, it is cleaned by simply passing water through the spray. The atomised material leaves the periphery of the disc in a horizontal plane, and the atomisation consists of the rupture of a thin film of liquid on leaving the edges of the disc. It is important that no evaporation or drying shall take place until the liquid is clear of the disc and has become thoroughly dispersed, and therefore in normal cases a current of cold air is applied in a downward direction, the air being admitted above the disc and providing a cool zone in which the disc operates. This supply of cold air is of very considerable importance, as will be seen when the design of the drying chamber is considered. For the moment, however, it may be stated that the cold air assists in the atomisation of the liquid, while providing a cool zone in which dispersal is complete before the drying commences, and it is further used to cool the driving mechanism of the atomiser and the liquor feed pipes should this be necessary.

Owing to the even distribution of the liquid on the lower surface of the atomising disc, an extremely regular particle size is obtained, provided the rate of feed is sufficient to wet the whole of the under surface. It will be realised that vastly better results can be obtained if particles are of regular size than in cases where they are of greatly varying size.

We may now proceed to consider the means adopted to obtain the second essential condition—that is, the uniform mixing of the drying air and the sprayed liquid.

MIXING DRYING AIR AND SPRAYED LIQUID

It is extremely difficult to obtain rapid and uniform contact between the atomised particles and the drying air where a jet atomiser is employed. For the air to reach the inner part of the conical zone of sprayed liquid it must first pass through the outer and more dispersed part of this zone. The objections to this, particularly in the case of unstable materials, will be appreciated on further consideration.

If we assume that the air is entering the plant at a temperature of 130° C. it will first come in contact with the outer part of the cone. The particles here will be rapidly dried, but their quantity is not sufficient to reduce the temperature of the air materially. We can take, for instance, the air which, after passing through a certain part of the zone, has been reduced by the evaporation of water to a temperature of 120° C. This air will pass on toward the centre area in which there are moist particles, and will carry with it most of the material that has been dried. The temperature of

this material will rise to something approaching that of the air in which it is being carried, and at the same time some of the dried particles will mix and adhere to the moist particles into which they are being carried. If, however, it had been possible to mix the atomised particles and the air more rapidly, the temperature drop of the air would increase at a rate corresponding to the rate of evaporation of the whole of the particles, and under normal working conditions over-heating would be impossible.

A type of drying chamber that is employed with a jet atomiser consists of a rectangular box with the

type of drying chamber which is used for the under-driven disc atomiser. The atomiser is situated toward the base of a cylindrical chamber. The drying air passes upwards, and may be given a rotary motion with advantage. The great difficulty with this type of atomiser and drying chamber is that it is impossible, except in very exceptional cases, to provide an upward air current of sufficient velocity to carry the whole of the dried material forward, and if this is not done dried material will fall downwards through the moist zone. After falling through the moist zone this powder will have to pass through the incoming hot air, where it will

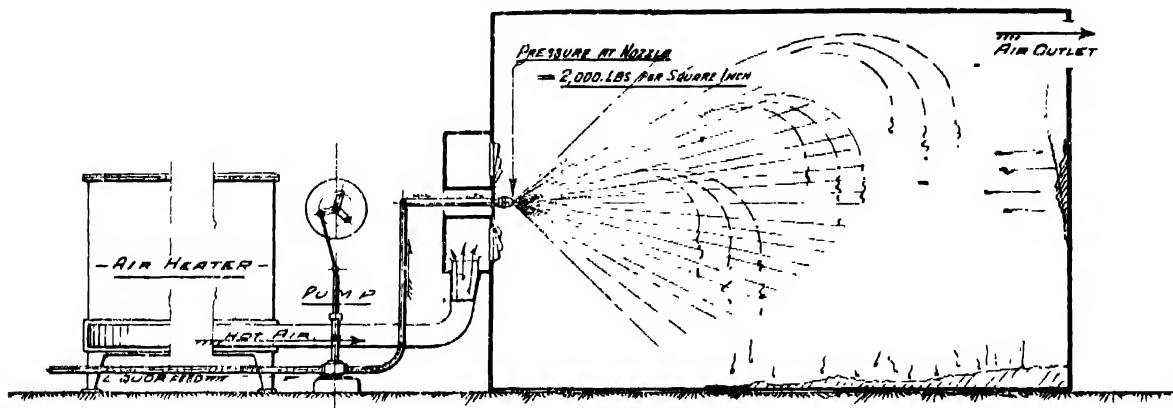


FIG. 6

air inlet forming a ring round the atomiser jet. The air may be given a spiral motion in order to assist in penetrating the sprayed liquid, but this spiral motion will not persist for a long period, as the shape of the drying chamber tends to retard it. The dried powder for the most part falls by gravity to the bottom of the drying chamber, and that which is not separated in this way is usually removed from the air stream by means of bag filters.

It will be seen that this type of drying chamber, when operated in conjunction with a jet atomiser, possesses three disadvantages, the first being that provision is not made for the efficient mixing of the air with the sprayed product, the second being that the dried product is carried or falls through the region in which there is still moist material, and the third being that the conditions are bad from the point of view of preventing moist material from reaching the sides or end of the drying chamber. This last is due to the fact that direction of the drying air current is the same as that of the spray which is projected from the jet. The jet atomiser may be placed in the top of a cylindrical drying chamber with a downward current of dry air, and here the conditions are better, as the dried powder does not fall through the moist zone, though the difficulty of penetrating the whole of this zone rapidly with the drying air remains.

The second type of atomiser that we considered, that is, the disc with a number of projections from which the liquid is flung, is only used in special cases, and in general the remarks which follow concerning the design of the drying chamber for disc atomisers will apply.

We will therefore pass on to the consideration of the

be over-heated. The whole problem of the separation of the powder from the air is greatly complicated if it is attempted to carry the powder forward by means of the drying air current. On the other hand, difficulties

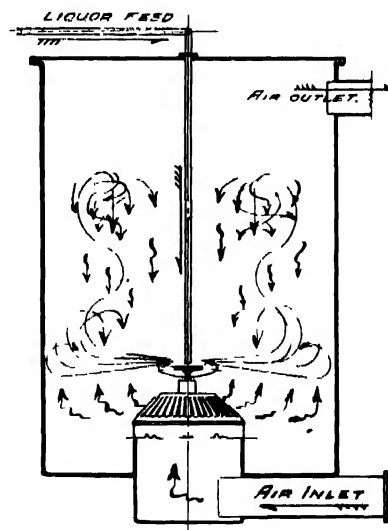


FIG. 7

arise if the particles are allowed to separate in the drying chamber.

With the atomiser driven from above and placed in the top of a circular chamber we are enabled to dry with a downward current of air. There is a limiting diameter for the drying chamber depending upon the distance

that the atomised liquid will travel from the disc periphery before its direction is materially affected by the air currents. Assuming, however, that a drying chamber is designed in which the radius is greater than this minimum distance, we will consider the question of applying the

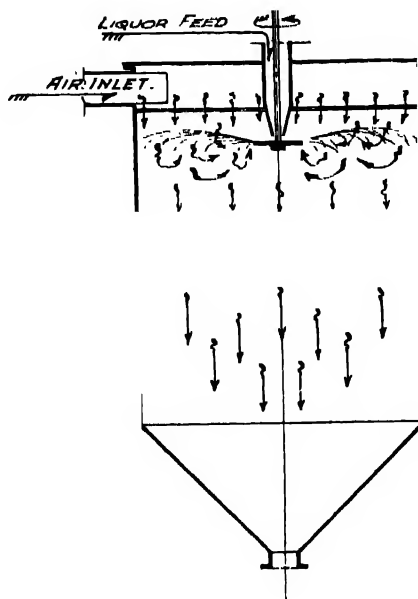


FIG. 8

heated air in the manner most favourable for rapid and uniform mixing with the dispersed spray. We have already seen that it is advantageous to employ a downward current of air, and the first attempts to design a drying chamber to work with a downward current were of a simple character. The air entered the drying chamber above the atomiser and travelled downwards at a uniform velocity, or, in some cases, it was supplied more intensely at either the centre or at the outer diameter. The great trouble with this design of plant was that, owing to the eddy currents set up by the swirl of the disc, the swirl caused by the velocity of the dispersed liquid, and, finally, the strong eddy currents set up by the rapid changes in temperature and consequently in pressure within the drying chamber, due to the cooling effect of the dispersed liquid, it was impossible to direct the moist spray uniformly down the chamber. On leaving the atomiser the spray, instead of travelling in a horizontal plane, was caught up by the various eddy currents and drifted to the top and sides of the chamber. Further, the drying was not regular, as it was extremely difficult to distribute the atomised spray uniformly into the whole of the incoming air stream owing to the presence of stagnant air pockets. These difficulties have now been completely overcome, methods having been found whereby a more efficient mixing of the dispersed liquid and the heated air can be obtained, and whereby the drying time, and consequently the size of the drying chamber for a given duty, can be reduced.

The particles leaving the disc travel in a direction which is more or less tangential to the disc periphery, and if an air stream which is moving in a similar direction

impinges on the particles, the latter do not deviate greatly from their natural course. This point is very simply illustrated by noting the effect of blowing a stream of compressed air into the vapour issuing from a steam jet. It will be found that if the air jet is blown into the steam at a direction at right angles to the flow of the latter, the course of the steam becomes irregular and confused. If, however, the air jet is blown into the steam in a direction which will readily converge into the original direction of the steam jet, the steam will be deflected, but its course is under control. An exactly similar phenomenon to that obtained in the first case is found within a drying chamber where the air is travelling vertically from the top to the bottom, and thereby impinges on the atomised liquid at right angles to the direction of its movement. If, however, the air stream is caused to travel in such a direction that it has an appreciable velocity component in the direction of the travel of the atomised liquid, the course of the latter is under control. The way in which this condition is assured is quite simple, but extremely important. The air is caused to enter the drying chamber with a rotary motion in the same direction as the rotation of the spraying disc. This leads to a type of drying chamber in which the whole of the top is in the form of a box containing a large number of air deflectors giving a rotary motion to the air as it enters the drying chamber.

Subsequently this type of air distributor has been developed and improved. With the latest type the hot air is admitted at a central distributor and at a secondary air distributor, the latter being situated at the outer circumference of the top of the drying chamber.

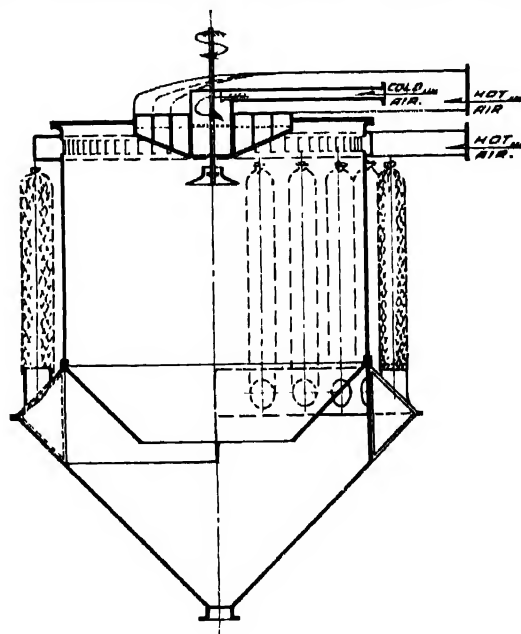


FIG. 9

The two supplies of air do not enter with the same rotary velocity, and thus the particles which are being carried by the first current of air are later taken up by the second and more rapid current, the slip between the particles which are moving relatively slowly in the

first current as they come to the second current assisting in the promotion of rapid heat transfer.

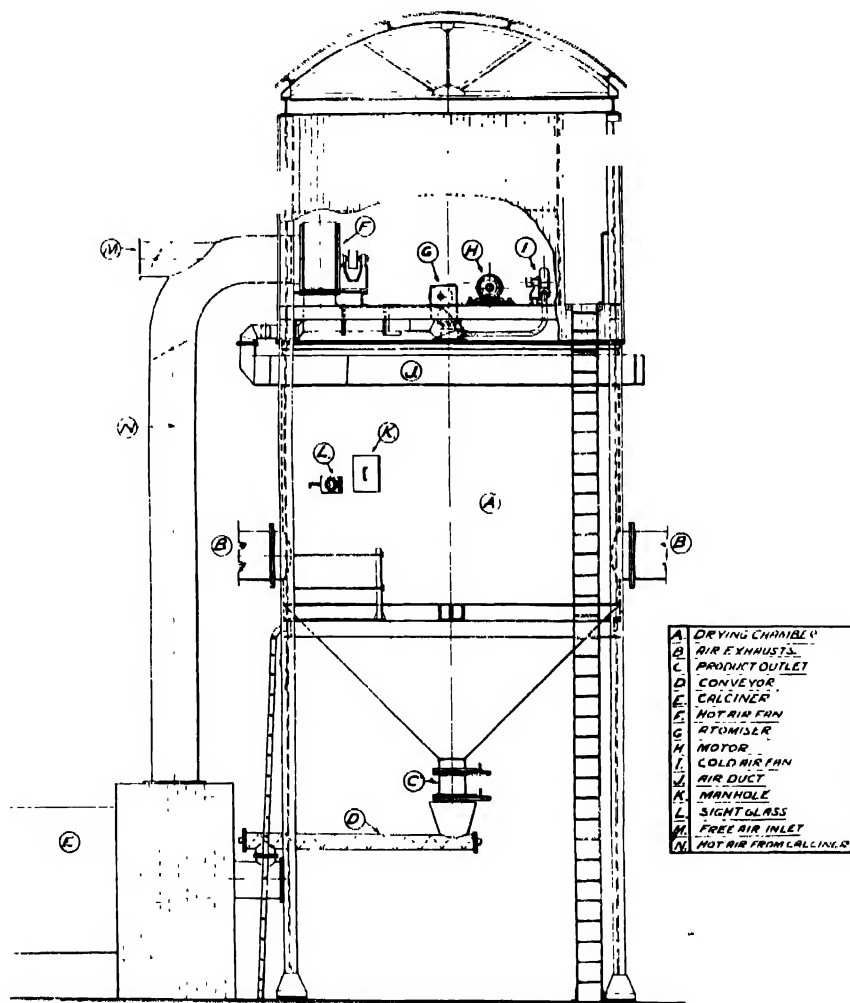
The atomised particles must be thoroughly dispersed before drying commences, and the cool air supply to the atomiser ensures this by forming a cool zone around the atomiser disc.

THE REMOVAL OF DRIED POWDER

Passing on to the third essential, that is, the removal of powder from the air stream, we have already seen the

of powder from the air stream, and in cases where this powder is eventually collected in a lower conical portion of the drying chamber the method adopted is as follows :—

An apron piece, in the form of a truncated cone, is fitted above the lower cone, and on this apron piece most of the powder collects. It falls from the apron piece to the lower cone of the drying chamber, the air passing upwards between the apron and the upper surface of the lower cone. The surface area for the air in this



KESTNER PATENT SPRAY DRYING PLANT.

FLUE GAS HEATED.

FIG. 10

objections to the use of gravity, except in the case of the spray drier with the disc at the upper part of the drying chamber. We have shown that a rotary motion of the air is of great value in promoting rapid drying, and it has a further use in separating the powdered product towards the sides of the drying chamber. It is not a difficult matter now to obtain a very efficient separation

space is great, and therefore the upward air velocity is low and the quantity of powder carried forward is small. This powder is collected in a number of bag filters, and these can be discharged into the lower cone of the drier direct, thus forming a most convenient and simple arrangement.

(To be continued)

BONE FOOD: PICKINGS FROM A DRY BONE*

By CALORIFER

"That Bone with a grave pyrotechnical look
 Made believe he had written a wonderful book
 And the Royal Society thought it was true,
 So they took it all in: a good joke it was, too.
 (With acknowledgments to "The Professor" and
 to Oliver Wendell Holmes.)

"To be once in doubt,
 Is once to be resolved."

H. G. Wells, in one of his imaginative stories, discourses of a Boon-Food which made those who ate it grow very big. The Bone-Food provided in this volume is a Super-Sanatogen which should keep the Institute of Fuel Technology, even that mystic but expensive entity the Fuel Research Board, occupied for some time to come. We imagine Sir Alfred Mond constantly using it, as a source of inspiration, in selecting topics for the public discourses which he delivers with such admirable effect. Every one interested in epipedonic progress will need to have it upon his shelves. The book is not only a record of daring and fascinating experimental achievement but bristles with points for discussion. The narrative is as stirring as that of Drake in Darien presented by a Benson. We can see readers growing bigger and bigger with conceit of knowledge as they thumb its pages—and equally satisfied, in the end, that they know almost nothing that is really worth knowing of the inner history of flame: that Drake's doings in Darien are far nearer to their comprehension than is the dance of death in which the molecules engage in a gas-engine cylinder.

Flame is indeed a wondrous subtle demon—as Carlyle and Norsemen before him have long since admitted. All honour, therefore, to the authors for having built so imposing an altar for the worship of the force that rules our world to-day and is likely ever to remain a source of wonder to those few of us who have the will to wonder—however well we may fancy we grasp the mystery of its being. A certain editor of our acquaintance, who professes that he is neither writer nor chemist—this latter we can at once grant—but none the less (we can't say "writes," in view of his assertion) spills ink over "One Dam Thing After Another," has not yet fastened and feasted upon flame, so we have a virgin field to cultivate. Difficult as are its furrows to plough, elusive as are high temperature festivities, our task is made easier, in a measure, as we notice that a double-dyed, thrice-unhung, dihard villain, not unknown to readers of these *Bits* he has called *Blue*, in reviewing the book in *Nature* (one of those strange periodicals devoted to the unnatural), has discussed the section on the mechanism of flame, especially the mystery of carbonic oxide, which is at least as difficult to unravel as that of Edwin Drood. In so doing, he has expressed disapproval of Prof. Bone's affectation of belief in the "dry" state. This we can support, as we saw recently a P.C. message from the Professor, in Switzerland, in which, whilst there was no mention of the mountain flora or even of snow, a certain beer was referred to

with approval. At the end came the mystic phrase "Courage, mon ami, le Diable est mort." This, being interpreted, means, we suggest: that, in future, the study of hell fire may be prosecuted with safety at S. Kensington and that even when told there to "Go to Hell," students need not boggle at the mandate, as they will find no belief in dryness in that popular resort.

What, then, is to be our main line of survey of the book—if not of attack? We are not attracted by "ignition temperatures"—the idea of a flame having "a temperature" coming to us in the light of *ignis fatuus*. Also, we have no burning desire to linger over "flame speeds"—evidently a "contrariwise" subject, as between London and Sheffield, of little more than local interest. We have difficulty, indeed, in thinking of flames as otherwise than lawless—each a law unto itself. At least their turbulent qualities, as well as their chemistry, will need far closer attention, especially mathematical interpretation, if we are to solve the intricate problems they present. The two sections are probably as good illustrations as may be found of the modern inquirer's tendency to pursue chimeras.

Section III, "Gaseous explosions in closed vessels," seems more likely to be a conducive and juicy morsel, "mellering to the organ"—a good text for a sermon, as the habit of living upon such explosions and even dying in their wake is a fast growing one, which is stirring our civilisation to its very roots, as seen in the recent tragic endeavour of a princess to defy the fate of Daedalus. At least, we can fly with their aid at 281.49 m.p.h.!!

When he has nothing to say, the parson is apt to begin by analysing the words of his text. This is the more necessary when much is to be said, so we may ask, "What is a gaseous explosion?" The authors do not raise, let alone answer, the question. Our feeling is, "There ain't no such thing!" The proof is of the classical order—old but uncrusted. The almost *uralt* iron column at Delhi is unrusted. Even the ancient Briton of the earliest Iron Age must have known that his weapons were only proof against attack so long as they were unwetted. "A wet" but not water, at least in vaporous form, at once makes iron rust—and the "wet" is well known to be dangerous; hence it is that we are allowed to have and to hold, in our pockets, steel latchkeys. What more than this popular knowledge do we need to confute the Drybonians and to frame a theory of rusting? No colloid-community singing will help us.

A pretty complete case can be made out in proof of the thesis that *gases do not interact*. To make them do so, a surface of some kind has to be called in, a sofa provided upon which they can recline; apparently, change takes place thereat and thereupon, always in a liquid film, maybe only of molecular thickness. The need arises because of the electrolytic nature of the process. We, therefore, say unto you, brethren, that our text is one to be interpreted with reservations. Combustion may be *in* gases but is not primarily *of* gases. Verily, it seemeth, there be many flies in the ointment of combustion.

* "Flame and Combustion in Gases." By Professor William A. Bone and Dr. Donald T. A. Townend, Pp. 548 + xvi + 30 plates and diagrams. London: Longmans, Green & Co., Ltd., 1927. 32s. net.

The sensational event discussed in the section is the strangely "cool" behaviour of nitrogen when a mixture of air with carbonic oxide is exploded at an initial pressure of 50 atmospheres (Fig. 127). Hydrogen, it will be seen (Fig. 126), goes bang straight away: the pressure rises very rapidly to a maximum and then quickly falls off, yet surely and steadily. Carbonic oxide is both a slow and a sly dog. The maximum pressure is not only gradually developed but is long maintained. "At first, it was thought," say our authors, "that the difference might be attributable to the 'slow-burning' habit of carbonic oxide, as compared with the quick burning of hydrogen; but further experiments revealed the operation of another totally unexpected factor, namely, the presence of nitrogen, which, as was discovered later, acts as an 'energy absorber' in the combustion of carbon monoxide at such pressures." Why nitrogen should have been a "totally unexpected factor," when it was introduced in

peculiar 'energy absorbing' effect and becomes chemically 'activated.' On such an assumption, the meaning of the $2\text{CO} + \text{O}_2 + 4\text{N}_2$ cooling curve is that the radiant energy which had been absorbed by the N_2 molecules during the previous combustion period was being slowly evolved in a kinetic form far into the subsequent cooling period, the 'activated' nitrogen not having entirely reverted to normal until at least 0.6 sec. after the end of the combustion period."

They stress certain points, namely:—

"(1) That the 'energy absorbing' nitrogen effect referred to was only obtained when carbon monoxide and oxygen were in juxtaposition in such high pressure explosions as though it were essentially a 'resonance' effect. (2) That the presence of hydrogen, which (as will be seen later) profoundly affects the radiation for a CO-air explosion, is inimical to it, a circumstance pointing to the 'effective radiation' being that arising from $\text{CO}-\text{O}_2$ but not from $\text{CO}-\text{OH}$ interactions.

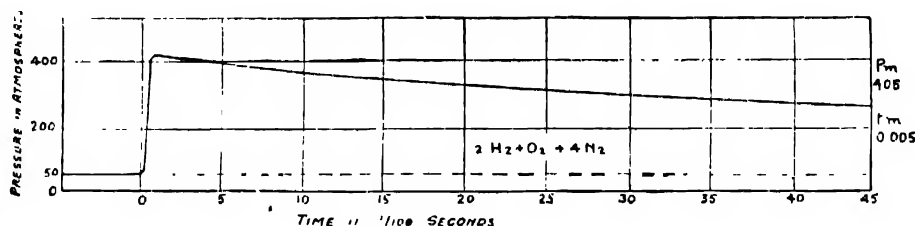


Fig. 126

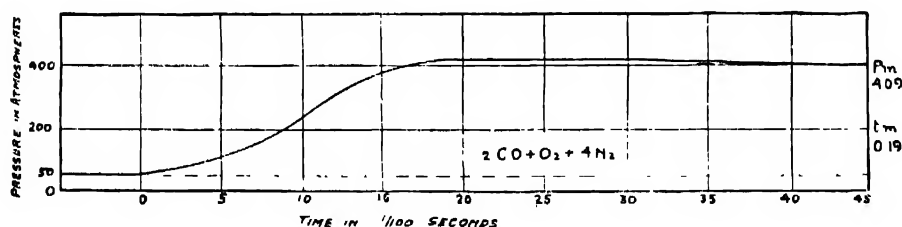


Fig. 127

so large a proportion, we have difficulty in understanding. From the days of Cavendish onwards, this Cinderella among gases has been known to take part in the combustion when hydrogen is burnt in air. Even the picking up of her slipper by Prince Haber and his German court seems, however, to have had little effect upon the public appreciation of her attractive beauty.

When either oxygen or argon, even carbonic oxide itself, is substituted for nitrogen in the mixture (Fig. 129), no cooling effect is observed; each such admixture would seem, indeed, to promote the rate of change. At least, it is difficult to avoid the feeling that carbonic oxide must be a slow-burning combustible as compared with hydrogen and that the rate is quickened by the gases mentioned, although lowered by nitrogen.

According to the authors:—

"The nitrogen functions differently in a hydrogen-air explosion, where it acts as an inert diluent only, from what it does in a carbon monoxide-air explosion, where, in addition to its ordinary diluent action, it has a

(3) That pressure is highly conducive to it; and (4) that recent experiments have shown that it is not manifested in methane-air ($\text{CH}_4 + \text{O}_2 + 4\text{N}_2$) explosions at high pressure, where equal volumes of carbonic oxide, hydrogen and steam are produced."

Provided that oxygen be present in excess of that required to burn all the carbonic oxide, a relatively large quantity of nitric oxide is produced. This, however, the authors regard as a secondary effect, occurring during the cooling period (1), though at high pressures it may begin sooner.

Finally, we are told

"that by the term 'activated nitrogen' the highly ionised 'active nitrogen' discovered by the present Lord Rayleigh is not implied but a less 'activated' form; also, that the radiation concerned, though it may in part be ultra-violet, is more probably infra-red, a point which has yet to be decided experimentally."

If not ultra-violet, the effective radiation is infra-red! Quite so! In other words, our elusive friend the Snark,

if not white, is black: equally content to be called either candle-ends or toasted cheese. The conclusion is one that should give satisfaction to all our souls. In fact, in telling us that the peculiar energy-absorbing effect, whereby it becomes chemically "activated," is a resonance effect, the authors use purely frumious language, having for some unexplained reason made up their minds that

"The shark's a peculiar creature that won't
Be caught in a commonplace way."

We are asked to believe in a big-drum response by the nitrogen- to visualise the molecules as kettle-drums at the back of the orchestra, vibrating in sympathy with

"Activated" is a horrid word,* though Baconian, not jargonesy, in its origin--all the worse when put into inverted-comma shorts. Let us hide it in the big drum, both to mute this and also spare our commas: there are always too few of these to satisfy composers' unhealthy desire to spoil the conjunction. Putting drum aside and sounding neither the loud timbrel nor the trumpet-- unless "Wait until the clouds (of theoretic doubt) roll by" be quietly blown upon this last, as a second theme, by way of a counterpoint under-current of melody, reminding us of our ignorance-- let us show ourselves able to reason dispassionately upon the super-plenitude of observation at our disposal: get back to Lavoisier, in fact. Recognising the inert

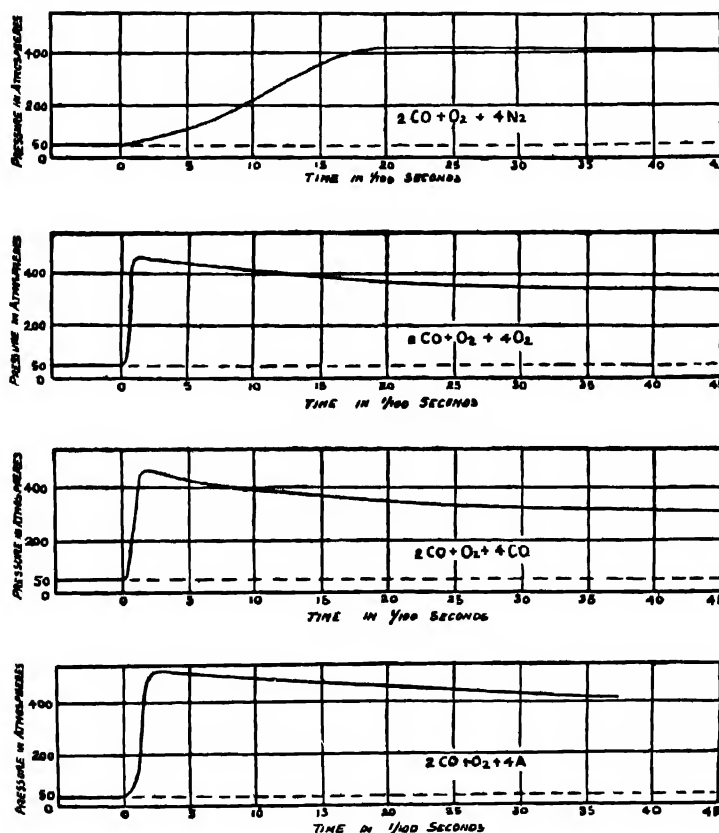


FIG. 129

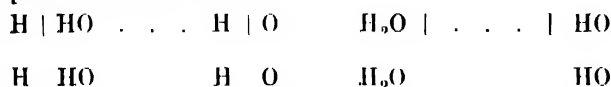
some other instrument, if not a high treble, then perhaps a double-bass; maybe, by some strange telepathic or ectoplasmic influence, in sheer response to the sharp tap of the conductor's baton. Unfortunately, in many attendances at Queen's Hall, we have always seen drummer and drum-sticks at work: Sir Henry Wood, in his wildest moments, has never hit the drum direct. Prof. Bone is but human, after all, in his desire to call in the big drum; we all love to make sprats, at least, of our minnows. The humble bacterium, however, seems to be able to do without the drum: when in its cold lodging underground, in the root nodules attached to the Leguminosæ, without the least fuss, it calmly and mutely assimilates nitrogen, which ultimately takes the form of protein.

qualities of the gas presented to him in air, Lavoisier eventually named this *Azote*. His genius inclined him to foresee the advantage, if not the need, of terming its principle, the element, *Aminogen*, rather than *Nitrogen*, the baptismal name ultimately chosen. The French use *Azote* to the present day but the genius of Lavoisier is no longer with them: they have but one name for the highly active element and for the strangely neutral, gaseous compound of two of its atoms which bulks so largely in our life. Never was question put so wrongly answered as, "What's in a name?" *Everything!* Much

* Active and activity are perfect words: to bring "ate" to them is to deprive them of their aural charm. If a verb "to make active" be needed, "activerie" is a far less strident form. Let us remember the poet's caution: "And don't confound the language of the State With long-tailed words in *orby* and *alo*."

of the stupidity whereby chemistry is so greatly helped to-day is due to the disregard of names and the use of bad language. Most atoms, it seems, find great difficulty in landing upon the azote raft - to get grip of the aminogen atoms and overcome their sturdy, brotherly affection, as is done by force of hydrogen within the bacterium. The potential at which hydrogen acts in such case must be a high one, of the big drum order. Many atoms find the aminogen atoms both attractive and affectionate - willing to marry them without outside dowry. Oxygen alone seems shy of aminogen—the molecules tend to coquette and the atoms do not seem to marry firmly: they do so only if a dowry be found for them; when married, their divorce is easily effected. The same may be said, however, of carbonic oxide. It and nitrogen are in much the same boat; they need hot wooing.

The irreverent chemist called Henry maintains that carbonic oxide cannot be and, in fact, never is married with ordinary oxygen—the dowry of energy at disposal being insufficient to satisfy the demands of the two families. Baptism must precede marriage. Holy water being provided and a spark applied, behold, a little hydrogen is born and burnt. A taper presented to the couple has an even greater effect, reeking as it does of hydrogen. The hydrogen may be only the proverbial "little one": still, it is there and in gas-land the code of morals is high. At once laid upon the sacrificial altar and burnt, it is transfigured into a higher sphere of usefulness: the late Mr. Clutton Brock would have told us that through its agency the oxygen becomes in part transcended—thus:

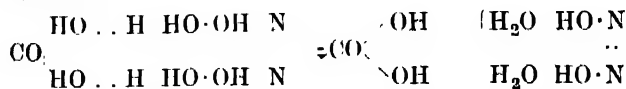


The charm of oxygen thus transcended, at the higher potential of the peroxide, can no longer be denied: the union with carbonic oxide is consummated. Hence it is that hydrogen sets the pace when present in more than minimum amount in an explosive mixture. On this account also, when more than a certain proportion of water is present at higher pressures, the rate of change is lowered: so much hydrogen is then set at liberty and in a position to act as "tweenie," to dispute enjoyment of the peroxide with the carbonic oxide. With such dowry, at the higher potential it has in the peroxide, oxygen is worth looking at by nitrogen. This also becomes amorous and insists upon marrying some of the oxygen atoms, per favour of the peroxide.

Since the days of Davy and Faraday it has been known that combustible materials are very human in their proclivities—much given to interfering with each other's business. It is strange that the authors pay so little attention to this peculiarity—that it should all but escape notice by the workers generally who have discussed combustion. This is the more remarkable, in view of the special attention called to the phenomena of interference by Moureu and Dufrasse in their wonderfully complete studies of the subject. We ourselves, organic nature at large, could not exist if oxidation were not most rigidly controlled and kept under.

Carbonic oxide and nitrogen are clearly jealous lovers of oxygen and violently interfere with each other's

enjoyment of the atom, much energy being wasted in the struggle—there seems to be no need, however, to assume that the effect of the nitrogen is in any way special or peculiar to the element but merely that the contending molecules are simultaneously converted into "perhydrols," which act and react, more or less as follows:—



Maybe both carbonic oxide and nitrogen are, at least in part, each burnt separately in circuit with hydrogen and their perhydrols then interact; also it is conceivable that a dissymmetric perhydrol $\text{N} : \text{N} \begin{smallmatrix} \cdot \text{OH} \\ \cdot \text{OH} \end{smallmatrix}$ is formed from nitrogen. Combustion is not complete, the marriage is not consummated at the $\text{CO} \begin{smallmatrix} \cdot \text{OH} \\ \cdot \text{OH} \end{smallmatrix}$ stage: this but corresponds to the signing on at the registry office and to church proceedings. The perhydrol may revert to the oxide or it may pass into carbonic acid, $\text{OC} \begin{smallmatrix} \cdot \text{OH} \\ \cdot \text{OH} \end{smallmatrix}$.

The extent to which one or the other change takes place determines the extent to which combustion is effective. The influence of an excess of either oxygen or carbonic oxide, used in place of nitrogen, may well be to increase the extent to which carbonic acid is formed.

What of argon? The effect produced by this gas does not seem to be merely that of an inert diluent. Although the rise in pressure is slightly less rapid, the level it reaches is higher than when any other gas is used and falls less. Such behaviour deserves further study.

Possibly, even probably, the argonides are not the chemical nullities they are supposed to be. Helium is clearly combined in radium and is let loose, we are told, short of two charges, like a "Widder" of a polyandrous people who has lost two husbands and has two affinities unsatisfied, ready on the first occasion that offers to join up in loose union with any pair of amorous electrons she may meet. Why not with oxygen? Prof. McLennan would have us believe that the characteristic intense green line in the spectrum of the aurora is due to oxygen. It is very faint in "oxygen"; better seen when a little helium is added but still better when neon is present and the strongest line in the spectrum of an argon-oxygen mixture. May not the line be the outward, visible sign of mating of flirtatious oxygen with a stolid argonide? The physicists' oxygen may safely be assumed to have contained a trace of helium, as this leaks selectively through heated glass into a vacuum. We trust Prof. Bone will be prepared to give our suggestion a "try": there is such twinkle in his eye that, at times, we can fancy we see green reflected in it, despite his north country origin.

Surely there can be no need to invoke any special act of Providence, in the form of radiant energy and resonance, to account for the phenomena so wonderfully depicted in the curves we have discussed. We would venture to exhort Prof. Bone to leave all such fancy explanation to the chelate school and the dreamers who asperse the monogamy of hydrogen—to cast off all such

calf's skin and wear no crab's claws but only a lion's hide of sound philosophy. If we are to use the drum, let it be to the refrain, "Rub-a-dub-dub, *three* men in a tub." *Drybonia* is not a habitable land. Like Heaven, it is a hypothetical region where there is neither giving in marriage nor marrying. Chemicals could not be there—only inerts, not even shorts.

The authors end their "Inquire within upon almost everything relating to flame and gaseous explosions" with the following epilogue:—

"Two hundred years ago it was believed that combustion was due to the escape of a subtle and imponderable *phlogiston* from the burning material. A century later it was universally regarded as the result of chemical interactions between oxygen and the combustible. Nearly 50 years ago it was discovered that, in certain cases, the rigid drying of such a system renders it comparatively (if not absolutely) unreactive (!) and, therefore, that combustion is either conditioned or greatly helped by the presence of moisture. To-day a new vantage point has been reached from which it seems probable that in the near future we shall be able to say that combustion is conditioned by an "ionisation" of the reacting (!) gases."

In thus ending, they but jump us from the frying pan into the fire—the blessed word *ionisation* has such ambiguous meaning that it is meaningless.

The proclaimed new vantage point is just a nullah. It will not only answer to "Hi!" but to any loud cry.

We are thus, as ever, brought back to words—for which we have no consideration. It is almost a characteristic to-day of the scientific mind to be careless in the use of words, to be obstinate in their misuse. Our science is advancing mechanically but not morally. In the work before us, the evidence is overwhelming of an ever-increasing care to be exact in deed—but there is no such evidence of desire to be exact in word. Although an inhabitant of Verulam and a leading light of the Baconian Club, Prof. Bone is in no way mindful of Bacon's statements that "the ill and unfit choice of words wonderfully obstructs the understanding"; that "words force and over-rule the understanding and throw all into confusion and lead men away into numberless empty controversies and idle fancies"; therefore, that "it behoves us to be most careful in our choice of words and concise in our definitions."

The words we use of chemical change are uncertain in their meaning. It is now recognised (it is our theory) that all chemical change involves action *between* substances—that the changes are *interactions*—why then speak of them as *reactions* and thus imply that they are one-sided, back actions? Only the billiard player learns to use the word action aright—he is told and must learn once and for all, if he desire to score, that action and reaction are equal and opposite. Our Editor might well give us an essay upon the theme: we derived our own sense of precision, in using the terms, in early youth, from a billiard manual. The authors are evidently sufficiently fallible to be caught in the toils of fashion, react to it, in fact, by using the abomination *reactant*. Surely agent is good enough for all purposes and all time. The *actant* is unknown to us, so why re him and

put so ungainly and unnecessary a term upon the line. Kelly's Directory has a long list of Agents but makes no reference to actants. Actors are in repute at the Savage but if our Editor or Mr. E. V. Evans spoke of them as actants they would be treated as mountebanks. If a few scatterbrained limelights at Cambridge perversely defy Sir A. Quiller Couch—let their's be the agony alone: there is no need to defile honest pages with their banal productions. Let it no longer be said

Which I wish to remark—

And my language is plain—
That for ways that are dark
And for tricks that are vain,
The heathen Stinkee* is peculiar.

We would specially beg our authors to be particular in the use of the word *theory* and to reserve this for state occasions. They say: "In science a theory should be judged by its ability to give consistent interpretation of the facts to which it applies and it may be accepted as a serviceable implement so long as it succeeds in doing so and until a better one is available. After all, theories are merely tools and vantage points, useful only so long as they best serve as such and not as objects of veneration, however they may please us."

No! No! A theory is a complete doctrine, into which all the facts may be fitted. The only theory known to us in chemistry is "The atomic theory." This stands complete and apparently impregnable. We have no *theory* of combustion at present—nothing more than halting doctrine: mostly speculation, guess, hypothesis, we may call it, according as we favour a Latin, Teutonic or Greek form of speech.

We don't worry over misprints, though we don't like "data is"; still the entry: *Berthollet. Essai de Statique Chimique* (1905) (p. 54) seems to hurt our sense of historical accuracy. We should like to have met him at that date and heard his opinion of us. To refer students to M. Faraday is more than desirable—but why to the originals and not to the cheap 2s. edition published by Dent? This every young chemist can and should have at his bedside.

To conclude: the book is a wonderful one but not all true. Royal Society opinion is well known to be fallible and subject to fashion and favouritism. When the next edition is issued, as it must be at an early date, rewritten with Baconian care and Bonian wealth of experience, the meaning of the word *theory* having been mastered and the attempt made to develop a consistent, logical doctrine worthy to rank as theory, therefore a safe guide to practice: the work will be monumental, because of the transcendent importance of the subject!

P.S.—The mystic message from Switzerland we have referred to has been confirmed in a recent address by the Bishop of Birmingham to the boys of Westminster School (*The Times*, Sept. 26). When bishops take the broom in hand it were time that chemists harrowed their field to clear it of some of its many superstitions. They cannot allow the Church to outdo them in their desire for truth.

* We fancy that *stinkee* lies some cryptic allusion to chemistry—Stinks?—Ed.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, is now ready.

The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

BRISTOL SECTION

At the opening meeting, held on October 6, the President of the Society, Mr. Francis H. Carr, C.B.E., gave an address on "Vitamins in relation to chemistry and medicine." Mr. J. Bernard, the new chairman, presided.

Mr. Carr first showed how the elements of an ordinary diet were not sufficient to maintain proper health, and required to be supplemented by vitamins. Lantern slides were shown to illustrate the effect on animals of diets rich in or lacking in vitamins. The President then discussed the five vitamins A, B, C, D and E, and remarked that there would probably be further subdivision, particularly of A, and very likely of C. An account was next given of the types of diseased condition due to lack of the various vitamins and of the methods used for studying the effect of vitamins on the animal. The sources of the different vitamins were discussed in detail, and it was pointed out that British Empire fish-liver oils were not only relatively high in their content of vitamin A compared with Norwegian oils, but their preparation was being rapidly improved.

The chemical tests for vitamin A were described, and the close connexion of vitamins A and D with the chemistry of cholesterol was emphasised. Upon vitamin D calcification of the bones largely depends, but for the vitamin to be effective it must be in suitable proportion to the amount of carbohydrate taken in. An account of the controversy about the relation of vitamin D to rickets was given, leading up to the recent work which has shown that cholesterol, activated by ultra-violet light, is extremely potent in restoring calcification, and that the effect is due not to cholesterol but to ergosterol, which is remarkable for the absorption of light. What actually happened was not known. Irradiation was best done in the absence of oxygen, and its action seemed to be that a maximum activity was quickly reached, after which the activity began to fall off. The body glands contain sterols, and there was reason to believe that the sunlight acting on the skin forms these substances. Here the chemist had discovered the method of producing vitamin D by artificial means; but although this information had been available to margarine makers for some seven months, it remained to be learned that any of them was making proper use of it in this country.

In the discussion which followed Mr. Carr's address, Mr. S. Badoek described the benefit obtained by adding cod-liver oil to the diet of pigs. Dr. Rixon paid a warm tribute to Mr. Carr for his very lucid address, in propos-

ing a hearty vote of thanks to him. Mr. Robertson, who seconded the vote of thanks, remarked on the fascinating, clear and concise account which Mr. Carr had given of the vitamins, those small facts which produce such relatively great effects.

CALENDAR OF FORTHCOMING EVENTS

Oct. 14.—Society of Chemical Industry, *Chemical Engineering Group*, Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "A recent development of spray drying," by J. Arthur Reavell. During the same afternoon a visit will be paid to the Kestner Experimental Works at Camberwell, where a machine of the type to be described in the evening will be seen at work.

Oct. 18 and 19. Society of Glass Technology. Meeting in Sheffield. On Oct. 18, at 6 p.m., meeting of Furnace Survey Committee. Informal Dinner at 7.30 p.m., at the King's Head Hotel, Sheffield. On Oct. 19, Visit to Glass Works of Messrs. Bealson, Clark & Co., Ltd., Rotherham, at 10.15 a.m. Luncheon at 1 p.m., at the King's Head Hotel, Sheffield. At 2.30 p.m. General Meeting in the Applied Science Department of the University, Sheffield. Introductory address by the President, Mr. W. Butterworth, senior. Papers will be presented as follows:—(1) "Opal glass—crystal growth and impact brittleness," by J. F. Hyslop. (2) "The Birmingham glass trade 1740–1833," by F. Buckley, and (3) "The detection of selenium in decolorised bottle glasses," by E. J. C. Bowmaker and J. D. Canwood.

Oct. 19.—Society of Chemical Industry, *Glasgow Section*. Held jointly with the Chemical Engineering group, Cadoro Restaurant, at 7 p.m. "The desiccation (De Vecchis) process of beet sugar manufacture," by C. Scott Garrett and G. W. Riley.

Oct. 19.—Institute of Chemistry, *London and South Eastern Counties' Section*. 30, Russell Square, London, W.C.1, at 8 p.m. "Chemists and dividends," by S. M. Gluckstein.

Oct. 20.—Chemical Society. *Ordinary Scientific Meeting*. Burlington House, Piccadilly, W.1, at 8 p.m. (1) "Studies of dynamic isomerism. Part XXIV. Neutral salt action in mutarotation," by Prof. T. M. Lowry and G. F. Smith. (2) "Studies of dynamic isomerism. Part XXV. The mechanism of catalysis by acids and bases," by Prof. T. M. Lowry. (3) "10-Chloro-5;10-dihydrophenarsazine and its derivatives. Part V. The general method of synthesis and determination of constitution," by C. S. Gibson and J. D. A. Johnson. (4) "On active nitrogen. Part IV. The independence of the afterglow and chemical properties of active nitrogen," by E. J. B. Willey.

Oct. 21.—Society of Dyers and Colorists, *Manchester Section*, at the Manchester Literary and Philosophical Society, 36, George Street, Manchester, at 7.15 p.m. "Light and life," by Prof. E. C. C. Baly. Joint meeting with the local Section of the Institute of Chemistry. Dr. H. Levinstein in the chair.

Oct. 27.—Society of Chemical Industry and Institute of Chemistry, *Edinburgh and East of Scotland Sections*. Joint Meeting. The North British Station Hotel, Edinburgh, at 7.30 p.m. Inaugural address by J. Adam Watson.

Oct. 27.—Coke Oven Managers' Association. Annual General Meeting at the Hotel Great Central, London, at 2.30 p.m., when Mr. G. A. Hebden will deliver his Presidential address. At 6.30 p.m. the Annual Dinner will be held.

Oct. 28.—Society of Chemical Industry, *Liverpool Section*. The University, Liverpool, at 6 p.m. "Merseyside -and chemical industries," by Dr. A. Holt.

Oct. 28.—Institution of Chemical Engineers, at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1, at 6.30 p.m. Public Lecture by Sir William Bragg, K.B.E., F.R.S., on "Crystallisation."

BIOCHEMICAL SOCIETY

A meeting was held in the Biochemical Laboratory, Cambridge, on October 8, when the following papers were read:—

"The scission of gelatin into constituent proteins," by S. B. Schryver and K. V. Thimann. Evidence was given of the lability of the proteins from which the gelatin complex is formed, and also of the possibility that the constitution of gelatin varies according to whether it acts anionically or cationically. Experiments were carried out with the object of obtaining two forms of gelatin. A product was used which had been freed from inorganic constituents by electrolysis, and from degradation products etc. by flocculation. The hydrochloride and sodium salt of this preparation were submitted to electrolysis. The gelatin obtained by the electrolysis of the hydrochloride formed a stiff gel, and very little nitrogen was present in the supernatant liquid. By the electrolysis of the sodium salt, however, two products were obtained, viz., a very slightly soluble, very bulky flocculum, and a soluble fraction, which showed no tendency to form a gel. These two products are provisionally named soluble and insoluble anagelatin. The former is soluble in water to the extent of about 15 parts in 100,000, and experiments were quoted to indicate that it cannot be dispersed in warm water without undergoing a small amount of irreversible change. The soluble fraction has a high molecular weight. A gel could not be formed by the mixture of the soluble and insoluble fractions in the correct proportions and the subsequent electrolysis of the hydrochloride. It was shown that the molecules in the anionic and cationic forms must have different intramolecular arrangements as they yield different products on hydrolysis. The relationship of the gel obtained cationically and of the soluble and insoluble fractions to one another was discussed, and it was suggested that the gel was formed by a combination of an insoluble gelatin and a soluble gelatin, the latter being derived from the former by the action of warm water during dispersion etc. On making the mixture alkaline, and removing the alkali by electrolysis, intramolecular change and separation of the two fractions takes place. Amongst other experiments in support of this conception were some which indicate that heating with water does not degrade gelatin, but converts it into a complex protein, for which the term metagelatin is suggested.

"The interferometer method for the diagnosis of pregnancy and malignant growths," by G. S. Haynes and C. G. L. Wolf. The method proposed by Paul Hirsch for the diagnosis of pregnancy and malignant growths depends upon the detection of a change in the refractive index of a serum, due to specific ferments in the serum acting upon a substrate prepared from the placenta, or a malignant growth. Haynes and Wolf find that a great part of the differences between the refractive index of the control serum and that in contact with the substrate observed by other workers is due to the giving off of soluble material from the unprotected rubber stoppers used to close the tubes containing serum and substrate during incubation. When the stoppers are protected with a covering of pure tinfoil these large differences between the two sera are eliminated. Performing the tests in this way the authors have re-

investigated the action of pregnant serum and serum from cases of malignant disease on their respective substrates. They are unable to find that any specific digestion of protein occurs in these conditions. Digestions were carried out at 37° and 0°. A small difference is usually obtained, in that the substrates kept at 37° usually give a higher reading. It is impossible to say whether this is a true ferment action, because absorption of water by the desiccated substrate undoubtedly occurs, leading to a change in the concentration and refractive index of the serum. This was shown in experiments where varying amounts of substrates were used with the same amount of serum. The increase in concentration was always higher in those tests where larger quantities of solid substrates were employed. Other solid colloidal material such as aluminium hydroxide, silica, and animal charcoal also produces changes in the refractive index of the serum. From these experiments the authors conclude that the method in its present form cannot be used either for the diagnosis of pregnancy or of malignant growth.

"The isolation of a second sterol from yeast," by Ida Smedley MacLean. In 1920, Smedley MacLean and Thomas (*Biochem. J.*, 14, 483) described the isolation of a dextrorotatory sterol from one sample of yeast instead of the levorotatory ergosterol obtained from all the other samples of yeast investigated. It is now found that, working on a somewhat larger scale, the crude sterol prepared by the saponification of yeast fat consists of a mixture of two isomeric sterols—(a) ergosterol, m.p. 158°; $[\alpha]_D^{20} = -134^\circ$ and (b) dextro yeast sterol which softens at 98°, finally melting at 105°, and having in chloroform a specific rotation of $+25.7^\circ$. The dextro sterol is considerably more soluble in alcohol and ether than the ergosterol, and like the latter is precipitated by digitonin. Both sterols have the same elementary composition, and each contains three double bonds; they may be separated by fractional crystallisation from ether. The biological properties of the new sterol are being investigated.

"On the origin of ethereal sulphates," by T. S. Hele. Proof of Baumann's original theory (1876) of the formation of ethereal sulphates in the animal by the direct union of phenolic compounds with sulphate has only been advanced in one series of experiments (Hele, 1924), wherein guaiacol was shown to be united in the dog with sulphate, in both instances being administered by the mouth. Many observers have failed to show any such direct synthesis, but such observers have in general used phenol. These failures have given rise to various theories; for example, (1) that phenols unite with such compounds as sulphites or cysteine and oxidation to ethereal sulphate follows conjugation, or (2) that ethereal sulphates only arise from endogenous sulphur and never from exogenous. For such theories there is really no experimental justification. It has, however, been suggested by Pryde (1926), in his book "Recent advances in biochemistry," that possibly guaiacol is a substance too far removed from the normal metabolic paths to warrant comparison with phenol, that is, the guaiacol experiments cannot be regarded as proof of a normal metabolic process. In the present experiments indol and phenol were administered with sodium sulphate by the mouth to dogs, and proof was forthcoming of the utilisation of the sodium

sulphate in forming the corresponding ethereal sulphate. Furthermore even when such formation of ethereal sulphate was effected at the expense of so-called endogenous sulphur, there was evidence that the reacting sulphur compound was a sulphate, replaceable directly by administered sulphate. In this consideration there is no difference between exogenous and endogenous metabolism.

"The rate of buffering of acids and alkalis by amino-acids and proteins—a preliminary study by thermal methods," by F. J. W. Roughton. Hartridge and Roughton's thermal method (1924) of following the velocity of rapid chemical reactions has been developed to a greater sensitivity. Chemical processes occurring within 0.002 sec. to 0.1 sec. can now be followed with an accuracy ranging from 1% to 10%, according as the total temperature change accompanying the reaction changes from 0.1° C. to 0.01° C. The neutralisation of NaOH by HCl, CH₃COOH, K₂HPO₄, KH₂PO₄, H₃BO₃, and of AmOH by HCl and CH₃COOH takes place in less than 0.002 sec. A new lower limit to the velocity of ionic reactions in solution is deduced. The effects of (H) and (OH) on the rate of reactions of dissolved CO₂ with alkali, and on the rate of reactions between bicarbonate and acid agree with those found by previous workers. Glycine and NaOH react in less than 0.002 sec.; glycine and HCl have not yet given consistent results. A mixture of the blood proteins (1 pt. blood to 3 pts. water) reacted with several acids and bases to within 10% of completion in less than 0.002 sec. The bearing of these results on the rate of buffering of acid in muscle is indicated.

"The osmotic pressure of isoelectric egg albumen," by J. Marraek and L. F. Hewitt. Sørensen (1917) measured the osmotic pressure of isoelectric egg albumen with 15.4%, 4.36%, and practically 0% of ammonium sulphate in the external fluid. The pressures varied greatly in the three cases. The authors have used as external fluids acetate buffers, *pH* 4.8, containing 0.124, 0.024, and 0.006 molar sodium acetate. The osmotic pressures found agreed well with those found by Sørensen with 4.36% ammonium sulphate. With the lowest salt concentration, the osmotic pressure was rather higher at low protein concentrations and lower at high protein concentrations, approaching what Sørensen found with no salt present. The molecular weight of egg albumen, calculated from these results, is higher than that calculated by Sørensen. The osmotic pressure of egg albumen at *pH* 7.3, plotted against the protein concentration, gives a curve convex towards the protein axis similar to that given by serum proteins.

"The adsorption of phthalein dyes by proteins," by L. F. Hewitt. When proteins are added to certain phthalein and fluorescein dyes, the colour is not discharged or altered as usual when acid is added. The absorption bands of these dyes are shifted by some 200 Å.U. towards the region of longer wave length when the protein and acid are added. Only those dyes usually changing colour on the acid side of the isoelectric point of the protein behave in this manner, and it is concluded that the quinonoid form of the dye forms an oxonium salt with the acid protein. These same dyes act as acid-fast stains for certain tissue sections and for silk and wool. When proteins are added to fairly concen-

trated solutions of any fluorescein or phthalein dye, and the mixture is gradually acidified, a precipitate appears when the isoelectric point of the protein is reached and the precipitate redissolves at about *pH* 2.5. These critical reactions are the same for widely different dyes and proteins. Analyses revealed 20–30 molecules of dye to 1 molecule of protein in the precipitate. The precipitation is ascribed to salt formation between the acid dye and the protein behaving as a base.

SOCIETY OF PUBLIC ANALYSTS

An ordinary meeting was held at the Chemical Society's Rooms, Burlington House, on October 5, Mr. E. Richards Bolton, President, being in the Chair.

Certificates were read for the first time in favour of L. V. Cocks, F. Dixon, B.Sc., D. M. Freeland, D. Geoghegan, C. G. Hyde, V. J. Tilley, L. Wild, B.Sc., H. A. Williams. Certificates were read for the second time in favour of C. E. Corfield, B.Sc., H. E. C. Powers, B.Sc., J. D. Rogers, and A. Samson. The following were elected Members of the Society:—F. C. Bullock, B.Sc., T. H. Fairbrother, M.Sc., R. S. Rack, and S. G. Sherman.

The President announced that the next meeting, on November 2, would be held, by invitation of the Pathological Institution of St. Mary's Hospital, in the theatre of that hospital. The following papers were read and discussed:—

"The oil of *Centrophorus granulosus*," by A. Chaston Chapman, F.R.S. The liver oil of the Portuguese shark "barroso" (*Centrophorus granulosus*) contains the unsaturated hydrocarbon, spinatene, an alcohol probably identical with the batyl alcohol found in Japanese shark oils, a liquid alcohol (sclachyl alcohol, C₂₁H₄₀O₃), cholesterol and glycerol (0.5–0.6%), together with stearic, palmitic and oleic acid, and possibly smaller proportions of other saturated and unsaturated fatty acids.

"The separation of titanium from tantalum and niobium," by W. R. Schoeller, Ph.D., and E. C. Deering, B.Sc. Previous methods of separating titania from the earth acids are reviewed and criticised, and an outline is given of a more accurate separation method based on the dissociation of the soluble tartaric complexes of the metallic acids by a mineral acid; the earth acids are precipitated, whilst the titanic salt remains in solution. The results as yet obtained are rather approximate, but work aiming at a more exact separation is in progress.

"The determination of aldose sugars by means of chloramine-T, with special reference to the analysis of milk products," by C. L. Hinton and T. Macara. Each molecule of chloramine-T is equivalent to two atoms of iodine, both in the oxidation of sugar and in the final liberation of iodine on acidifying. The oxidation proceeds more slowly than that with alkaline iodide solution. The most suitable conditions for the oxidation of dextrose and lactose have been worked out, and the extent of the slight oxidation of sucrose and levulose under standard conditions has been determined. The action of chloramine-T on the non-sugar constituents of milk serum has been studied; under the conditions specified it does not cause an error greater than 0.4% of the total lactose. A procedure is outlined for the determination of lactose in fresh milk and condensed sweetened and unsweetened milk.

CORRESPONDENCE

THE VALUE OF A UNIVERSITY EDUCATION

SIR,—It appears to me that the following letter, received by a chemist holding the degree of Master of Technical Science and with three years' industrial experience at home and abroad, on application for a position as a temporary junior chemist, merits publication:—

"Dear Sir,—We have your application of the 23rd ultimo, and after a perusal of its contents we consider that you will be suitable for the temporary vacancy we have to offer in our laboratory.

"The hours will be from 7 a.m. to 7 p.m. daily, including Sunday, i.e., 84 hours per week, and the rate of pay is 1s. 2d. per hour, making a total of £4 18s. per week.

"The duties consist chiefly of general analysis, including coal, limestone, and water.

"Should you accept this post, we shall expect you to be ready to take up your duties at 8 a.m. Monday, the 10th instant.

"We may add that you will find no great difficulty in obtaining lodgings in this neighbourhood, but should you desire it we will get into touch with apartments in anticipation of your arrival.

"Please oblige by replying at your earliest convenience.—Yours faithfully."

Might I say that the wages of a joiner and bricklayer in the Manchester district are 2s. 1d. per hour, of a plumber 2s. 2d., and of a labourer 1s. 7d. per hour? I think further comment is unnecessary.

Yours faithfully,

ANDREW McCULLOCH

THE PROFESSION OF CHEMISTRY

SIR,—All chemists should be grateful to you and to your correspondent, "STILL IN IT," for the publicity which you have given to at least one example of gross underpayment of qualified men.

Unfortunately, this is all too frequent a practice, but surely some remedy can be found (although it may be a long process) if only chemists generally will get together and discuss their problems. A few tentative steps along these lines have been taken, but have not received much support or consideration, even from the bulk of the members of the Institute of Chemistry, who at least are organised; they are all automatically members of their local section, where any subject affecting chemists can be discussed, but they don't even turn up! An average attendance of about fifty out of eighteen hundred members in London is pretty poor.

To my mind, the most hopeful way of tackling this problem of adequate remuneration is through the Institute, but the necessary "pep" must be provided by the rank and file, and preferably by the younger men, who are most affected.

I wonder if feeling on this subject has got beyond the grumbling stage yet.

Yours faithfully,

F. J. TRITTON

THE REGISTRATION OF CHEMISTS

SIR,—In the first number of the *Chemical Practitioner*, the new official organ of this Association, to be issued this month, the report of the Registration Committee will be published, so that some preliminary account of it may be of interest to your readers.

In the first place, the Committee insists that to form a General Chemical Council the co-operation of all societies with a membership confined to chemists is necessary. The Committee is rightly of the opinion that no society alone can deal with so complex a question, and that each would probably have valuable contributions to make before a scheme completely acceptable can be formulated.

The question of the minimum qualification for admission to the register is discussed, the Committee being of opinion that the "B" qualification of the British Association of Chemists will suffice as a satisfactory basis for the compilation of the register. The Committee further agree that six years after the inception of the register an approved university degree or diploma shall be the only recognised qualification for registration. Upon August 6 an official statement regarding the "B" qualification appeared in the *Chemical Age*, so that the requirements in respect of it have been widely circulated. It was there stated that the problem of qualification had been solved by this means, and the foundations of the register already existed, and, although doubtless it is capable of improvement in detail, it should relieve the Registration Council of a great deal of preliminary work in this direction.

The Committee does not suggest that membership of the Institute of Chemistry or of the British Association of Chemists should be a *sine qua non* of admission to the register at first, but it recommends that membership of one, or preferably of both these bodies is, as a matter of convenience, desirable. It would be open to any chemist supposing himself to possess "such qualifications as would be accepted by the Institute of Chemistry or the British Association of Chemists" to apply for admission to the General Register of Chemical Practitioners.

At this preliminary stage it will suffice to emphasise two points. In the first place, a report is generally open to the charge of being a "disappointing document." However that may be, the Council will be satisfied if, in criticising it thus, societies or individuals are moved constructively to criticise it. The work of the Committee is by no means final nor complete, nor does it represent more than in outline the detailed recommendations the Committee will be in a position to make. Secondly, emphasis may well be placed again upon the Committee's and Council's conviction that registration cannot and ought not to be the work of one society alone, and that discussion as to who shall have precedence in accomplishing that for the sake of which all should unite will do nothing to help forward the work.

I am, sir,

Yours faithfully,

HENRY T. F. RHODES,

General Secretary, British Association of Chemists

"Empire House,"

175, Piccadilly, London, W.1

PERSONAL AND OTHER ITEMS

Imperial Chemical Industries, Ltd., has given £1000 to the National Playing Fields appeal.

Sir Edward Brotherton, the head of Brotherton & Co., Ltd., the well-known chemical manufacturers of Leeds, whose many services to the public include the gift of £100,000 for a library to the University of Leeds, has handed over the ruins of Kirkham Abbey to the Office of Works for preservation for the nation.

The chief guest at the annual dinner of the Coke & Oven Managers' Association on October 27 will be the Right Hon. Earl Fitzwilliam. Among others present will be Prof. W. A. Bone, F.R.S., Mr. F. Hodges, Dr. C. H. Lander, and Sir Edward Ward. Mr. G. A. Hebden, the President of the Association for the ensuing year, will deliver an address.

Mr. H. R. Raikes, Vice-Rector of Exeter College, Oxford, has been appointed Principal of the University of the Witwatersrand, and will take up his duties early in the New Year. Mr. Raikes is a chemist and an enthusiastic airman. He is probably the only chemist who holds a pilot's certificate.

Dr. A. Reginald M. McLean, assistant professor of chemistry at McGill University, Montreal, and vice-president of the well-known firm of consulting chemists, J. T. Donald & Co., Ltd., has resigned these positions and accepted that of technical director of the Eastern Dairies, Ltd., a concern having large establishments in Montreal, Richmond, Que., Toronto, Ottawa and Winnipeg. Dr. McLean is an ex-chairman of the Montreal Section, and is well known to British members as the very able and agreeable cicerone on the occasion of the general meeting of the Society in Canada.

Sir Richard Gregory, the editor of *Nature*, received the honorary degree of LL.D. at the annual graduation ceremony at St. Andrew's University. The Vice-Chancellor and Principal, Sir James Irvine, F.R.S., presided over the ceremony.

The Iron and Steel Institute has awarded the Carnegie gold medal for the year 1935 to Mr. A. L. Curtis, Westmoor Laboratory, Chatteris, in recognition of his research work on steel moulding sand etc.

The E. I. du Pont de Nemours & Co., U.S.A., has celebrated the completion of 125 years since the establishment of a power mill by the founder of the firm in 1802. The firm employs nearly 400 chemists, and spends over \$2,000,000 each year in research.

We regret to announce the death, on October 5, of Dr. W. H. Sodeau, D.Sc., F.Inst.P., who was assistant to Professor C. S. Gibson, O.B.E., M.A., B.Sc., M.Sc., in work for the Dental Investigation Committee of the Department of Scientific and Industrial Research.

Prof. Max Planck has retired after 40 years' service from the chair of theoretical physics in the University of Berlin, on reaching the age limit.

The late Mr. W. F. Newman, director of Thomas Firth & Sons, steel manufacturers, Sheffield, left £4120.

The late Mr. G. J. Graae, joint managing director of the English Margarine Works, Ltd., left £5063.

Sir Alfred Mond on the Industrial Outlook

Speaking before the London Publicity Club on October 11, Sir Alfred Mond said he thought the industrial outlook was undoubtedly improving. Far from being despondent, we had every reason to assume that, with greater stabilisation, world industry must develop and benefit, and that a great industrial country like ours must have its share in the advantages of a general increase in the consumption of the world. More remarkable than industrial difficulty and depression was the fact that the world had recovered so much during the nine years since the war. There was to-day far too great a tendency to look on trade as a kind of limited static thing, of which there was only a certain amount, so that if someone got some of it, someone else had to lose. That was not true. There were opportunities of unlimited business, and the only thing they required was a general prosperity in the world which would lead to the necessary consumptive capacity. A great deal more coal was being produced than people could consume. Thus they got insensate competition, prices reduced below an economic level, and an industry not at peace, but in strife. Unless they got a close balance between production and consumption, they would not get an even curve of returns, but a zigzag, which was the most destructive thing to industry and to real progress. The greatest economic change of the present day was that the possibility of increasing production was so much greater throughout the world that they were apt to get violent fluctuations much more than was possible in the past. People to-day were apt to talk too much about what were generally called the heavy industries. Lugubrious gentlemen, while saying that another furnace had been damped down, forgot how many more motor-cars were being built and to what extent the motor industry was developing the wealth of the country. The artificial silk industry, again, was relatively only in its infancy, and in many directions there were being continually created new industries which did not exist a short time ago. England was pre-eminently a country of high quality produce. We should always suffer more in bad times than the producer of cheap goods, but we should always make more money when times were better. He was a great advocate of aggressive salesmanship as a vital factor in British industry. Compared with America we were backward in our methods. We had waited for people to buy our goods, but aggressive salesmanship meant selling a man something he did not want. So far as British industry went, a more aggressive policy had become imperative.

The De Vecchis Desiccation Process

The first provincial meeting of the Chemical Engineering Group for the current session will be held jointly with the Glasgow Section of the Society of Chemical Industry, on October 19, at the Ca'doro Restaurant, Union Street, Glasgow, when a paper on "The desiccation (de Vecchis) process of beet sugar manufacture" will be read by C. Scott Garrett, M.B.E., D.Sc., and G. W. Riley, M.I.Chem.E. The paper describes the drying of the beet cossettes and the plant which has been specially evolved for this purpose. Economic data are given and the process is compared with other existing methods of manufacture. It will form the most

complete paper on the de Vecchis process yet offered to a scientific meeting in any country. Advance proofs of the paper are being prepared, and will be issued shortly.

British Commercial Gas Association

The 16th annual general meeting of the British Commercial Gas Association, which is the research, advisory and publicity organisation of the British gas industry, was held in Southampton on October 4, 5, 6. An interesting and varied programme was provided.

The presidential address by Sir Russell Bencraft was read on his behalf, as he was absent through sudden illness: the address dealt largely with salesmanship and advertising in the industry. Sir Bruce Bruce-Porter discussed health in relation to industry, mentioning the contribution of the gas industry to the suppression of smoke pollution, and Miss Gladys Burlton dealt with the training of gas salesmen.

Mr. R. Halkett, speaking on the commercial prospects and future co-operation of the gas industry, suggested that the smaller gas undertakings should be absorbed by the larger organisations, and the whole linked up in various amalgamations to meet the challenge of electricity. There was no reason why coke-oven gas should not be conveyed at high pressure to furnish supplies outside the colliery areas. The distances were never so great that areas could not be allotted, and a network of distribution arranged so that gas could be supplied primarily from one or two chief manufacturing stations. These suggestions were endorsed by several other speakers.

American Electro-Chemical Society in Canada

The American Electro-Chemical Society, which has been holding its annual meeting in the north-western United States, held a technical session at Vancouver, B.C., on September 13. The members arrived in Vancouver from Seattle, Wash., the day before, and were entertained to a dinner, a concert, a drive, and a sail by the civic and mining officials.

At the technical meeting, Prof. S. C. Lind, president of the Society, occupied the chair, and papers were presented by Leopold Herry, Langerbrugge, Belgium; Konrad Teufel, Leverkusen, Germany; Dr. Colin G. Fink, secretary of the society; Chas. L. Mantell, Prof. G. A. Rousch, and S. W. Burwell.

A visit was made to the Lake Butzen hydro-electric plant of the B.C.E. Railway Co., and in the evening the party left for Tadanae, Trail, B.C., to inspect the works of the Consolidated Mining and Smelting Co.

On October 15 the 20 plants at Tadanae were visited, and at the banquet, tendered by the company to the members, Dr. Lind declared the reduction plant was "the best arranged, neatest, and cleanest smelter he had ever inspected"; whilst Dr. Fink said, "There is nothing like it in the world." The new No. 1 plant of the Kootenay Power and Light Co., at Bonnington, was characterised by Monsieur Herry, Belgium, as "the most modern and best-equipped hydro-electric installation seen on the trip through the U.S.A. and Western Canada."

COMPANY NEWS

BRITISH CYANIDES, LTD.

The annual general meeting, held on October 5, was presided over by the chairman, Mr. C. F. Rowsell, who said that the heavy reduction in capital was due to the fact that the manufactures for which the plant had been erected had become unprofitable to the company. There was every reason to believe that the profits would be substantially increased by the end of the year. The most important factors in improving the company's revenue position since the commencement of the present year had been the rise in the market price of prussiate of soda and the decreased cost of manufacture owing to the reorganisation of the hours of working. Another reason was that whereas six months ago the company were indebted to their bankers for £55,000, they now had £30,000 on deposit. Agreements had been entered into whereby the whole of their output of prussiate of soda and red prussiate of potash had been disposed of until the end of 1928 on terms which should bring in a better revenue from these sources next year, thus releasing their sales organisation for other purposes. It was upon the cheap manufacture of thiocarbamide that the success of the company must ultimately depend, because, although they had patents which they believed to be master patents and to be so strong as to be practically unassailable, it was impossible to foretell the strength of any patent until it had been attacked and successfully defended; but so long as they were able to make thiocarbamide more cheaply than anyone else in the world they were independent of patents until some substitute for thiocarbamide in making their water-white resins and translucent moulding powders was found. During the past six months the company had succeeded in placing the manufacture of thiocarbamide upon a very strong economic basis. The cotton side of the business had reached an interesting stage. Successful tests on a commercial scale had been carried out, and would be followed up by commercial trials in one or other of the works of the Bradford Dyers' or Bleachers' Associations, or both. The moulding powder business was developing on sound and satisfactory lines. The company was selling powder in the United States of America and, in addition, was in negotiation with two great firms in that country (one firm being Marshall Field & Co., of Chicago) for the sale of mouldings and for the operation of their patents in the United States. Negotiations were in course for the sale of the company's powders on exclusive terms to a European country. During the last few months the company had consolidated its position in respect of the chemicals it had so long manufactured on lines which, it was believed, would be beneficial both to themselves and to the trade as a whole. (For accounts, cf. CHEMISTRY AND INDUSTRY, September 30, 1927, p. 888.)

GLENBOIG UNION FIRECLAY CO., LTD.

The profit for the year ended August 31, 1927, including £3653 brought forward, amounted to £20,118, compared with £28,153 for the previous year. The sum of £1500 has been placed to depreciation of plant and machinery (same), and £2000 (same) to reserve against taxation. A dividend has been recommended at the rate of 10%, less tax, carrying forward £4618.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS.

Acid Acetic, 40% tech. —£19 per ton.
 Acid Boric, Commercial. —Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric. 3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots, £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS.

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep. 6s.—6s. 3d. per lb.

Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 10s.—£10 per ton. Good demand.
 Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—7½d.—8d. per lb. Crude 60's, 2s. 3d.—2s. 5d. per gal.
 Acid Cresylic, 99/100. 2s. 6d.—3s. per gal. 97/99. —2s. 4½d.—2s. 7d. per gal. Pale, 95%, 2s. 3d.—2s. 5d. per gal.
 Dark, 90%, 1s. 9d.—1s. 10d.; 95%, 2s. 1d.—2s. 3d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9½d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 6d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 6d.—2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 4d.—1s. 5d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7½d. per gal. ex works. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/100, 9½d.—10d. per gal. Solvent 95/100, 10½d.—1s. 4d. per gal. Solvent 90/100, 9½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—84s.—90s. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180—4s.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—7½d. per lb., naked at works.
 Aniline Salts.—7½d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb., 100%.
 Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—5½d. per lb.

m-Cresol 98/100%.—2s. 7½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—2s. 3d. per lb.

Dimethylaniline.—1s. 11d. per lb.

Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.

Dinitrochlorbenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

α-Naphthol.—2s. per lb. d/d.

β-Naphthol.—11d.—1s. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb.

β-Naphthylamine.—3s. per lb.

p-Nitraniline.—1s. 8d. per lb.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb.

R. Salt.—2s. 2d. per lb.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—7½d. per lb.

p-Toluidine.—2s. 2d. per lb., ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.

Acid, Benzoic B.P.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 4d. per lb. Technical 11½d.—1s. per lb. Good demand.

Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Amidol.—9s. per lb. d/d.

Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—9s. 6d. per oz.

Barbitone.—5s. 9d.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—9s. 9d.—9s. 10d. per lb. Bismuth

Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—

8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—

8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb.

Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Sub-

chloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—

7s. 9d.—8s. per lb. Extra and reduced prices for

smaller and larger quantities respectively; Liquor

Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—

1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s.—2s. 3d. per lb. Potassium.

1s. 9½d.—1s. 10½d. per lb. Sodium.—2s.—2s. 1d. per lb.

Granulated ½d. per lb. less. All spot. Large quantities at lower rates.

Calcium Lactate.—1s. 2½d.—1s. 4d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ethers: S.G. 730, 10½d.—1s. 1½d. drums. Other gravities at proportionate prices.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—4s. 9d.—5s. per lb.

Hexamine.—2s. 3d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal. in car-

boys; Winchester, 2s. 11d. per gal.; 20 vols., 4s. 3d.

per gal. in carboys; Winchester, 5s. per gal.

Hydroquinone.—2s. 11d.—3s. 2d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots.

Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green,

2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—20s.—22s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less

2½%; Heavy Commercial £21 per ton, less 2½%; in

quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol—A.B.R. recryst., B.P., 17s. 9d. per lb. net.

Synthetic detached crystals, 9s.—12s. 6d. per lb., accord-

ing to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d.

per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sub-

limate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—

5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb.,

Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d.

per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow

Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.

—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.

Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonat.—8s. 9d.—9s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—2s. 6d.—2s. 9d. per lb.

Phenazone.—4s.—4s. 3d. per lb.

Phenolphthalein.—6s. 6d.—6s. 9d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 98s.

per cwt., less 2½%.

Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.;

U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—10s. 8d.—17s. 2d. per lb., according to

quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included.

F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz.

tins.

Resorcin.—3s. 9d.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C.,

1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d.

per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d

consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—10s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net.
 Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 8½d.—1s. 9½d. per lb. Crystal,
 1s. 9½d.—1s. 10½d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d. 1s. 2d. per lb. •
 Sod. Sulphite, anhydrous.—£27 10s. £28 10s. per ton
 according to quantity, delivered U.K.
 Sulphonal.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder 2s.—2s. 1d. per lb.
 Thymol, Puriss. 10s.—10s. 3d. per lb., according to
 quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone. 6s. 6d. per lb.
 Anabpine (*ex linalhol*).—10s. 6d. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s.
 per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl
 Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 3d. per lb.
 Coumarin.—9s. 9d. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. 6d. per lb.
 Ethyl Phthalate.—2s. 9d. per lb.
 Eugenol.—8s. per lb. Geraniol (Palmarosa).—18s. 6d.
 per lb. Geraniol 6s. 6d. 10s. per lb. Heliotropine.—
 4s. 9d. per lb. Is. Eugenol.—13s. 6d. per lb. Linalol.—
 (*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb.
 Linalyl Acetate.—(*ex Bois de Rosa*) 18s. 6d. per lb.
 (*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Saffrol.—1s. 6d. per lb. Terpenol.
 —1s. 8d. per lb. Vanillin.—17s.—17s. 6d. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—2s. 9d. per lb. Bergamot.
 —28s. per lb. Bourbon Geranium.—14s. 6d. per lb.
 Camphor. 75s. per cwt. Cananga, Java, 18s. per lb.
 Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d.
 per oz. Citronella, Java, 1s. 10d. per lb., c.i.f. U.K.
 port, for shipment over 1928.—1s. 7½d. prompt shipment
 from Java. Ceylon, Pure, 1s. 8d. per lb. Clove, pure
 5s. 6d. per lb.
 Eucalyptus, Australian 2s. 3d. per lb. Lavender.—Mont
 Blanc, 28/40%, 17s. 6d. per lb. Lemon.—7s. 6d. per lb.
 Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d.
 per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian,
 75s. per oz. Palma Rosa.—9s. 3d. per lb. Peppermint
 —Wayne County, 15s. 9d. per lb. Japanese, 8s. per
 lb. Petitgrain.—7s. 6d. per lb. Sandalwood—Mysore,
 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Dec. 8th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Oct. 20th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Barber. Autoclaves. 25,825. Sept. 30. Mixing apparatus, 25,826. Sept. 30.
 British Thomson-Houston Co., Ltd. Crucibles. 25,633. Sept. 28. (U.S., 1,10,26.)

Clifford. Filtering apparatus. 25,468. Sept. 27.
 Gewerkschaft Sachtleben, and Küppers. Rotary furnaces. 25,886. Sept. 30. (Ger., 5,3,27.)
 Gregson, and Gregson & Partners, Ltd. Regenerative furnaces. 25,552. Sept. 28.
 Williams. Impregnating etc. materials with liquids. 25,674. Sept. 29.

I.—Complete Specifications

15,065 (1926). Duffield. Pulverisers. (277,734.)
 15,831 (1926). Sturtevant Co. Heat-exchange apparatus. (251,702.)
 28,193 (1926). Svenska Akkumulator Akt. Jungner. Filters. (272,841.)
 29,999 (1926). Dwight & Lloyd Metallurgical Co. Treating materials. (269,480.)
 10,100 (1927). Sturtevant Co. Heat-exchange apparatus. (269,560.)
 *23,417 (1927). Internat. Combustion Engineering Corp. Distillation. (277,952.)

II.—Applications

Brand and Laing. Utilising pulverulent carbonaceous materials. 25,327—8. Sept. 26.
 British Thomson-Houston Co., Ltd. Anti sludging means for oil. 25,631. Sept. 28. (U.S., 28,9,26.)
 Hirschberg. Treatment of coal etc. 25,456. Sept. 27. Distillation of coal etc. 25,710. Sept. 29.
 Humphreys & Glasgow, Ltd. Manufacture of mixed gas. 25,513—4. Sept. 27. (U.S., 13,10,26.)
 Johnson (L.G. Farbenind.). Manufacture of liquid hydrocarbons from olefines. 25,592. Sept. 28. Recovery of hydrogen. 25,732. Sept. 29.
 Koppers Co. Coke ovens. 25,399. Sept. 26. (U.S., 27,9,26.)
 Maclaurin. 25,948. See VII.
 Masters. Vertical gas retorts. 25,843. Sept. 30.
 Patentakt. Gröndal-Ramen. Manufacture from bituminous shales of a product adapted for dry distillation. 25,861. Sept. 30. (Sweden, 2,10,26.)
 Salerni. Distillation retorts etc. 25,756. Sept. 29.
 Soc. du Gaz de Paris. Purification of gas. 25,725. Sept. 29. (Fr., 11,10,26.)
 Stredwick. Manufacture of gas. 25,795. Sept. 30.

II.—Complete Specifications

18,026 (1926). Spindler. Transforming methane into a carburetting agent similar to petroleum. (255,493.)
 25,576 (1926). Bretherick and Glossop. Low-temperature carbonisation of coal, lignite, etc. (277,819.)
 29,369 (1926). L.G. Farbenind. Destructive hydrogenation of moist solid fuels. (262,099.)
 9606 (1927). Silica en Ovenbouw Mij. Regenerative coke ovens. (269,188.)
 14,536 (1927). Chilowsky. Manufacture of gas from heavy oils. (271,907.)
 *22,181 (1927). A.-G. f. Kohlenäureind., and Auerbach. Refining or fractionating mineral oils. (277,946.)
 *23,680 (1927). Urbana Coke Corp. Treating solid fuel. (277,955.)
 *24,864 (1927). Spilker, Zerbe, and Ges. f. Teerverwertung. Hydrogenating and splitting hydrocarbons, distillation products of coals, and coals. (277,974.)
 *25,033 (1927). Perolis. Treatment of mineral oils by heat. (277,983.)
 *25,045 (1927). Daniels. Production and activation of carbon. (277,987.)
 *25,399 (1927). Koppers Co. Coke ovens. (278,012.)

III.—Application

Maclaurin. 25,948. See VII.

III.—Complete Specification

15,708 (1926). Lechler. Production of emulsion-like preparations of water in tar. (255,044.)

IV.—Applications

Carpmael (I.-G. Farbenind.). Vat dyestuffs. 25,901—2. Sept. 30.

Johnson (I.-G. Farbenind.). Manufacture of vat dyestuffs. 25,731. Sept. 29.

Scottish Dyes, Ltd., Thomas, and Tonkin. Production of anthraquinone derivatives. 25,642. Sept. 28.

Scottish Dyes, Ltd., Beckett, Fairweather, and Thomas. 25,784. *See XX.*

IV.—Complete Specifications

15,718 (1926). I.-G. Farbenind. Producing tertiary nitriles. (253,950.)

16,052 (1926). British Dyestuffs Corp., Baddiley, Chorley, and Brightman. Manufacture of intermediate compounds and of azo dyestuffs. (277,756.)

32,841 (1926). I.-G. Farbenind. Manufacture of benzanthrone derivatives. (263,845.)

V.—Applications

Brandwood. Washing artificial silk filaments etc. 25,941. Oct. 1.

Carpmael (I.-G. Farbenind.). Protecting wool etc. from moth. 25,620. Sept. 28.

Dreyfus. Manufacture of cellulose derivatives. 25,637. Sept. 28.

V.—Complete Specifications

7306 (1926). Marks (Kohn-Rottweil A.-G.). Production of artificial fibres etc. from viscose. (277,716.)

8275 (1926). Dreyfus. Manufacture of cellulose derivatives. (277,721.)

10,688 (1926). Kershaw, Barrett, and Bleachers' Assoc. Treatment of cellulosic materials. (277,722.)

*25,063 (1927). Stubner. Manufacture of coloured or pigmented cellulose. (277,989.)

VI.—Application

Williams. 25,674. *See I.*

VI.—Complete Specification

29,897 (1926). Holliday & Co., Ltd., and Shaw. Dyeing wool and/or silk. (277,833.)

VII.—Applications

Anderson, Cash, and Stephens. Manufacture of titanium-containing compounds. 25,953. Oct. 1.

Caro and Frank. Production of metal cyanamides etc. 25,887—8 and 25,893—4. Sept. 30. (Ger., 23.10.26, 28.10.26, and 2.12.26.) Production of calcium cyanimide etc. 25,889—90. Sept. 30. (Ger., 27.10.26 and 2.12.26.)

Deutsche Gold- und Silber-Scheideanstalt, Freudenberg, and Kloepper. Production of alkali hydrides. 25,586. Sept. 28.

I.-G. Farbenind. Extracting clay etc. with acids. 25,740. Sept. 29. (Ger., 29.9.26.)

Johnson (I.-G. Farbenind.). 25,733. *See II.*

Maclaurin. Recovering ammonium and phenolic compounds from ammonia liquors. 25,948. Oct. 1.

Smith. Manufacture of cream of tartar substitutes. 25,827. Sept. 30.

VII.—Complete Specifications

17,122 (1926). Klein and Brown. Utilisation of waste acid liquors. (277,769.)

28,882 and 29,027 (1926). Omnium des Ind. Chimiques (Proc. Tocco & Landi). Production of ammonia. (262,090 and 272,842.)

4002 (1927). New Jersey Zinc Co. Manufacture of zinc oxide. (268,301.)

5378 (1927). I.-G. Farbenind. Treatment of crude nitrate of soda. (266,744.)

8892 (1927). I.-G. Farbenind. Precipitation of heavy metals from ammoniacal solutions. (269,164.)

*18,824 (1927). Haynes. Manufacture of carbon dioxide. (277,938.)

*23,552 (1927). Jungmann and Kolbert. Manufacture of a solid alcoholic solution of free iodine. (277,953.)

VIII.—Complete Specification

12,149 (1927). U.S. Metals Refining Co. Magnesite refractories. (271,847.)

IX.—Applications

Marks (International Cement Corp.). Manufacture of cement. 25,386. Sept. 26.

Palm and Thorsson. Cement compositions. 25,576. Sept. 28.

Rigby. Apparatus for cement manufacture. 25,543. Sept. 28.

Walsh. Treatment of wool. 25,583. Sept. 28.

X.—Applications

Ashcroft. Metallurgy of ores etc. 25,856. Sept. 30.

Birmingham Small Arms Co., Ltd., and Page. Colouring stainless steel. 25,554. Sept. 28.

Chapman (Chapman). Solder. 25,459. Sept. 27.

Corson. Treating alloys. 25,355. Sept. 26. (U.S., 4.10.26.)

Cushing. Metallurgical furnace. 25,382. Sept. 26.

Dietzsch. Wet extraction of copper. 25,352. Sept. 26.

Gustafsson. Producing metals in electric furnaces. 25,333. Sept. 26. (Sweden, 27.9.26.)

International Nickel Co. Chill cast-iron alloys. 25,769. Sept. 29. (U.S., 21.10.26.) Grey iron alloys. 25,770. Sept. 29. (U.S., 21.10.26.)

Johnson (I.-G. Farbenind.). Production of anticorrosive lead antimony alloys. 25,730. Sept. 29.

Lindhorst. Hardening iron etc. 25,600. Sept. 28.

Ragg and Rahtjen. Producing mixtures containing metal powder. 25,944. Oct. 1.

Taylor. Electrodeposition of metals. 25,641. Sept. 28.

X.—Complete Specification

*25,333 (1927). Gustafsson. Producing metals in electric furnaces. (278,005.)

XI.—Applications

Child, Hall, and Eton Glass Battery Co. Primary electric cell. 25,344. Sept. 26.

Gustafsson. 25,333. *See X.*

Roberts. Electric accumulators etc. 25,663. Sept. 29.

Siemens & Halske A.-G. High-frequency induction furnaces. 25,502. Sept. 27. (Ger., 10.6.27.)

Taylor. 25,641. *See X.*

XI.—Complete Specifications

12,502 (1926). Carreras. *See XIII.*

22,519 (1926). Hazlehurst. Electric batteries. (277,798.)

13,544 (1927). Comp. Franc. Exploit. Proc. Thomson-Houston. Electric dry cells. (271,496.)

*25,333 (1927). Gustafsson. *See X.*

XII.—Applications

Chapman, and Imperial Chem. Industries. Cleavage of oils and fats. 25,748. Sept. 29.

Oel und Fett-Chemie Ges. Treating tall oil. 25,393. Sept. 26. (Ger., 11.10.26.)

Verein. Chem. Werke. Elimination of smell from glycerin. 25,898. Sept. 30. (Ger., 11.10.26.)

XIII.—Applications

Azzopardi. Manufacture of printing inks. 25,774. Sept. 29.

Du Pont de Nemours & Co. Pigmented carbohydrate compound compositions. 25,390. Sept. 26. (U.S., 5.10.26.)

Kalischer. Manufacture of inks etc. 25,834. Sept. 30.

XIII.—Complete Specifications

12,502 (1926). Carreras. Manufacture of white lead by electrolysis. (277,723.)

18,840 (1926). British Thomson-Houston Co., Ltd. Coating-compositions. (257,243.)

*22,766 (1927). Stubner. Manufacture of pigments and pigmented products. (277,949.)

XIV.—Applications

Davey, Martin, and Rubber Growers' Association. Preservation of indiarubber. 25,378. Sept. 26.

Dawson, Porritt, and Res. Assoc. of Brit. Rubber & Tyre Manufs. Preservative coatings for rubber goods etc. 25,760. Sept. 29.

XVI.—Application

Caro and Frank. 25,887—8 and 25,893 4. See VII. 25,880—90. See XVI. Production of fertilisers. 25,891—2. Sept. 30. (Ger., 23 10,26 and 3.3.27.)

XVII.—Application

Varman and Wayre. Manufacture of sugar. 25,716. Sept. 29.

XVII.—Complete Specification

*15,726 (1927). Nouvelles Industries Chimiques. Recovery of nitrogen and acetone from vinasses, molasses, etc. (277,932.)

XIX.—Applications

Carpmael (I. G. Farbenind.). Protection of stored corn from vermin etc. 25,414. Sept. 26.

Salomon. Preservation of eggs. 25,611. Sept. 28.

XIX.—Complete Specification

16,441 (1926). Peck. Making nutritional beverages and food products. (254,724.)

XX.—Applications

Carpmael (I. G. Farbenind.). Manufacture of substituted guanidines. 25,413. Sept. 26

I. G. Farbenind. Manufacture of condensation products of urea. 25,475. Sept. 27. (Ger., 8.10.26.)

Johnson (I. G. Farbenind.). Manufacture of mono- or polyvalent alcohols. 25,593. Sept. 28.

Scottish Dyes, Ltd., Beckett, Fairweather, and Thomas. Production of benzoic acid etc. 25,784. Sept. 29.

XX.—Complete Specifications

17,903 (1926). Haythornthwaite, and May & Baker, Ltd. Manufacture of solutions of bismuth salts of aryl-arsenic acids. (277,774.)

25,945 (1926). Mannich. Manufacture of cyclotrimethylene-aryl-pyrazolones. (260,577.)

30,409 (1926). Mannich. Manufacture of alkyl and aralkyl derivatives of cyclotrimethylene-aryl-pyrazolones. (263,773.)

1766 (1927). Naef and Firmenich. Increasing the yield in civetone, starting from civet. (267,893.)

*24,882 (1927). German. Distillation of organic calcium salts. (277,975.)

XXI.—Complete Specification

11,727 (1927). I. G. Farbenind. Protective layers for photographic films. (270,347.)

XXII.—Applications

Dynamit A.-G. vorm. A. Nobel & Co. Production of gelatinised explosives etc. 25,478. Sept. 27. (Ger., 21.12.26.)

Holden (Rimac). Matches. 25,404. Sept. 26.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Argentina*: Stone-crushing and screening plant (A.X. 5278). *Australia*: Machine tools, cranes, steel products, anti-friction metals (275). *British India*: Paper, drugs, chemicals (276); water-pipes, caustic soda (The Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Czechoslovakia*: Tin, lead, antimony, zinc, phosphorous copper (A.X. 5301). *Lithuania*: Lubricating and cylinder oils (B.X. 3859). *Portugal*: Tinplate (292).

Rumania: Metals, leather, tinplate, ironplate, tin sheets, antimony, lead, copper, zinc (294). *South Africa*: Steel plates (A.X. 5290).

Safeguarding of Key Industries

The Treasury have made an Order under Section 10 (5) of the Finance Act, 1926, exempting the following articles from Key Industry duty from October 8, 1927, to March 6, 1928:—Didial (Ethyl morphine diallyl barbiturate); Ethylene bromide; Lead tetra-ethyl; R. Potassium hydroxide (R. Potassium caustic, R. Potassium hydrate). The Treasury Order will be published shortly.

The Board of Trade give notice that representations have been made to them under Section 10 (5) of the Finance Act, 1926, for the exemption from the duty imposed by the Safeguarding of Industries Act as amended by the Finance Act, 1926, of lithium carbonate, lithium hydroxide, and quinine ethyl carbonate. Communications regarding these applications should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W. 1, before November 11.

Merchandise Marks Act

The Standing Committee appointed by the Board of Trade to inquire as to whether imported pottery should bear an indication of origin will meet at 2.30 p.m. on October 24, and at 10.30 a.m. on October 25 and 26, at the New Public Offices, Great George Street, S.W.1.

News from Advertisements

A research assistant is required for blast-furnace reactions research at the Imperial College of Science and Technology (p. vi).

A chemical engineer is required for a large factory in the Midlands (p. vi).

A junior assistant is required by consulting chemist (p. vi).

The Imperial College of Science and Technology (Department of Chemistry) announces an additional post-graduate course in the chemistry and microscopy of food, drugs, water, etc. (p. vi).

A set of this JOURNAL is for disposal (p. vi).

A highly-trained chemist requires a junior partnership in a chemical concern (p. vi).

An assistant chemist is required for the East (p. vi).

There are now 121 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

AN INTRODUCTION TO THE SCIENTIFIC STUDY OF THE SOIL. By N. M. Comber, D.Sc., A.R.C.S. Pp. 192. London: Edward Arnold & Co., 1927. 7s. 6d.

ANALYTICAL TABLES. By A. O. Bentley, Ph.C., and J. E. Driver, M.Sc., A.I.C. Pp. xvi. London: Oxford University Press. 1927. 6d.

HISTORY OF SCIENCE TEACHING IN ENGLAND. By D. M. Turner, M.A., B.Sc. Pp. x + 208. London: Chapman & Hall, Ltd. 1927. 7s. 6d.

REPORT OF THE GOVERNMENT CHEMIST UPON THE WORK OF THE GOVERNMENT LABORATORY, FOR THE YEAR ENDING MARCH 31, 1927. Pp. 41. H.M. Stationery Office, 1927. 1s. 3d.

PAPERMAKERS' ASSOCIATION OF GREAT BRITAIN AND IRELAND, 1912 (INC.). PROCEEDINGS OF THE TECHNICAL SECTION, 1925. Vol. VI. October, 1925. Part I. Pp. 187. London: Papermakers' Association. 10s. 6d.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, OCTOBER 21, 1927

No. 42

EDITORIAL

The Lamp of Unity

SIR ALFRED MOND has again called public attention to the need for industrial peace. We could all do this, perhaps not so eloquently or so skilfully, but we could do it after a fashion. He has the advantage over most of us in that he has persuaded the majority of thinking people to believe that he talks good sense, and in this particular cause, that he puts into practice what he preaches. It was said that the chief disadvantage of knowing more and seeing farther than others is not to be generally understood. We think this is hardly true of Sir Alfred Mond: he knows more and sees farther than most of us who are concerned in the chemical industry, but he has the habit of plain thinking and plain speaking, and if his remarks on industrial peace are not generally understood this cannot be due to the obscurity of his utterances. Imperial Chemical Industries, Ltd., are so important a part of the chemical industries of the Empire that their decision in labour questions is one which must be followed by all who are large enough and wise enough to do so. We have, on the whole, always had in the chemical industry of this country a happy co-operation between brains, capital, and labour. This has been largely due to the good sense and good feeling of those two pioneers of the heavy chemical industry, Dr. Ludwig Mond and his partner Sir John Brunner. The principles they laid down have been adopted, modified, improved, and extended during the last five and twenty years, and a new generation has sprung up to whom these principles are familiar, a new generation of labour, a new generation of capitalists, a new generation of scientific control. The application of these principles to the various companies in Imperial Chemical Industries is explained in their labour programme published in this week's issue, and it includes many details of considerable

interest. At the Mansion House meeting on Monday last, important speeches were made by Sir Alfred Mond, Mr. Tom Shaw, and Sir Robert Hadfield, all of whom have contributed articles to this JOURNAL. It is no mere coincidence this; the fact is that our chemical industry is a striking example of good industrial relations, and that the Central Labour Department of Imperial Chemical Industries is merely a continuation and an extension of a system which is in actual operation. Sir Alfred Mond has been the spokesman—and probably much more—of the new labour programme, his son, Mr. Henry Mond, will direct the new department. Mr. R. Lloyd Roberts, who is a successful expert in labour matters, and has for many years guided Messrs. Brunner, Mond & Co. in their labour policy, will advise the new department; we can think of no one who has had equal experience and of no one whose advice on such matters is based on equal good sense and good judgment. To create a new staff grade of workers seems, at first sight, fair and wise; how it will work out in practice we do not know, but the experiment is well worth trying, and if it turns out a success it will probably be a great success. We cannot think of any objection to it, and it certainly gives a security of tenure much greater than the very meagre security enjoyed by the average worker.

We took the title of this article from Mr. Cronsshaw's address to the Manchester Section, an address which we read with much pleasure and shall read again. We hoped that his remarks on Research, Precision, Service, Unity, Judgment, Leadership, and Vision would be an inspiration to us which would enable us to write a little. His remarks certainly have inspired us, but not to write: an address such as his has required a great deal of thought and a great deal of experience. We dare not cull a few phrases from it and comment on them hastily and light-heartedly; there are some things in

this world too good to spoil. Mr. Cronshaw's address deals with many topics, some of which may properly be considered in close relation to the topics of industrial peace and industrial fair dealing which have engaged the attention of Sir Alfred Mond. It covers, however, a much wider range of thought, and is of a very unusual and welcome type. Mr. Cronshaw has abundant experience in the manufacture of dyestuffs, and has made use of his experience in the preparation of his address, but his mental activities have been applied not merely to this industrial process, but to chemistry, to life, and to ethics. Not only is his title derived from Ruskin, but his thoughts are so replete with vision and experience that he must have learned some of the methods of study of Ruskin. We always thought that Ruskin was both a great writer and a great artist: we could never understand why he considered it desirable to constitute himself as our universal adviser. It is a satisfaction to find that his influence has inspired the chairman of the Manchester Section to deliver a first-rate address.

Marcellin Berthelot

On Tuesday next the world of science will honour the memory of Pierre Eugene Marcellin Berthelot, who was born in Paris on October 25, 1827. We are proud to think that British chemists and chemical students need but the reminder of this historic date to set their hearts vibrating in harmony with those of their friends across the Channel. Berthelot belongs by right of birth to France, but his influence upon the science of chemistry remains a heritage to all nations. During his lifetime Berthelot was honoured by British chemists no less than by his own countrymen and his memory will be revered in this country so long as the science of chemistry has any being. The British chemist may have the reputation of taking his work too seriously, his pleasures too sadly, and his great men too much for granted, but he has a depth of sincerity in his nature which will not allow him to scatter complimentary phrases indiscriminately. We were never more sincere than we are at present when we ask our French colleagues to allow us to join with them in paying a glorious tribute to the memory of Marcellin Berthelot.

Berthelot lives in our memory chiefly as a master of fundamental research, for during his 57 years of strenuous work he published over a thousand original papers from L'Ecole Supérieure de Pharmacie de Paris and the Collège de France. His work may be broadly divided into four groups, namely: synthetic chemistry, thermo-chemistry—a branch of the science which he may be said to have created—agricultural chemistry, and historical chemistry. We ourselves think of him most of all as a synthetic chemist, for, although his work in other directions and his researches and literary efforts in the realm of Egyptian alchemy were truly brilliant, he laid the foundations of our amazing modern edifice of synthetic organic chemistry. At a time when organic chemistry was only just escaping from the thralldom of belief in a *vis vitalis*, Berthelot performed miracles with the aid of carbon, hydrogen, and oxygen. His syntheses of acetylene, benzene, methane, formic acid, ethyl alcohol, and other compounds considered so simple in

constitution to-day as compared with, shall we say, indigotin, muskone or thyroxine, represented in his day veritable triumphs of chemical skill, and exercised a powerful influence upon the progress of chemical science. He showed how it was possible to prepare "une multitude de corps nouveaux semblables ou supérieurs aux produits naturels," and yet he never took out a single patent. His joy was in his work and in the benefit which it would confer upon his country and the world at large. His love for France was deep, and his public services as Minister of Public Instruction and Minister of Foreign Affairs and in many other directions were distinguished by care, thoroughness, and whole-hearted effort. The influence of Marcellin Berthelot and of his family of distinguished sons and daughters upon politics, chemistry, philosophy, and diplomacy will long remain.

It was a happy inspiration on the part of the French chemists to make the Berthelot celebration the occasion for a world-wide co-operation between chemists. There are undoubted difficulties to be overcome before all their projects can be realised, and we are not sure that the scheme of enlisting the assistance of the Governments of the world for the particular purposes of *La Maison de la Chimie* was the best way of securing the sympathy of the chemists of some of the countries. Nevertheless we treasure the memory of Marcellin Berthelot, and we honour his countrymen for their desire to associate his name with every celebration and every memorial that they consider will promote the advancement of the science to which Berthelot contributed so largely.

The Supermiser

We are not responsible for the name given to a new means of heat conservation which appears to be a useful adjunct to boilers of the Lancashire type. The Supermiser is a combination feed-water heater and air pre-heater, and consists broadly of a set of concentric tubes. The innermost tube takes the feed water which is heated by the hot combustion gases passing to the stack through the annular space between the innermost tube and the outer annular space. Through the latter is forced cold air which thus becomes pre-heated on its way to the combustion zone. In addition, the hot combustion gases circulate outside the series of concentric tubes and all gas velocities are maintained high. Simple but effective heat interchange results, and the whole apparatus is of a robust character. The results obtained with the Supermiser, we are informed, approach and perhaps equal those demonstrated in large boiler installations where the installation of air pre-heaters is more general. Thus it is claimed that with Lancashire boilers operating with mechanical stokers, the flue gases can be reduced at the base of the stack to 250° F., whilst at the same time the feed water is raised from 120° F. to 240° F. The air passing to the combustion zone becomes pre-heated at 350° F.

If plant of the type described in outline above can be economically installed in relatively small boiler houses the steam-raising efficiencies of the latter should be considerably increased for, as we have indicated upon former occasions, the value of pre-heated air does not begin and end with the recovery of heat otherwise wasted in the stack.

THE LABOUR PROGRAMME OF IMPERIAL CHEMICAL INDUSTRIES, LTD.

Below we give details of the Labour Programme of Imperial Chemical Industries, Ltd., to supplement the General Statement by Sir Alfred Mond on October 7. of which we gave an account in our previous issue.

I.—CENTRAL LABOUR DEPARTMENT

To give effect to the purpose of having a common Labour policy throughout all the works of Imperial Chemical Industries, Ltd., a Central Labour Department has been established. It will be under the direction of Mr. Henry Mond, one of the executive directors of the company, who will have as his Chief Labour Advisor Mr. R. Lloyd Roberts. Its exclusive purpose will be to deal with all questions affecting the relations between the Company and its workers. It will be administered by specialists and will have the assistance of an Advisory Committee, consisting of those officials of the constituent companies whose duty it is to administer the labour policy at the various works. This Committee will secure the necessary interchange of view, between those who frame the policy and those who execute it.

II.—WORKS COUNCILS

Works Councils, which have already worked with great success in the works of one of the constituent companies, will be set up in all the works of the combine. These Works Councils, which will be of three forms, will provide a direct link between the Board of Imperial Chemical Industries and the workers in the remotest works, and will be representative equally of the management and of the workers.

(a) *The Local Works Council* consists of an equal number of management representatives and of workers' representatives from one works, and deals with all local matters affecting the workers at that works. It meets at a fixed time and date each month. The workers, therefore, know that there are regularly fixed and officially appointed occasions when they have the opportunity of raising any matter for discussion with the local management. The meetings also provide opportunities for the management to inform the workers on such questions as the output and programme of the works, and general matters affecting the industry.

(b) *The General Works Council* is similarly constituted of an equal number of management representatives and of workers' representatives, but its members are appointed from and by the various Local Works Councils of the workers of that constituent company. Thus, the Local Works Councils from works of the Brunner Mond, Nobel, British Dyestuffs and the United Alkali groups each appoint a General Works Council for their respective group. The functions of the General Works Councils are similar to those of the Local Works Councils, but matters of general interest to the workers of the whole group of works are dealt with, instead of purely local matters affecting a particular works.

(c) *The Central Works Council* is also similarly constituted of an equal number of management representatives and of workers' representatives, but its members

are appointed from and by the General Works Councils. It therefore is a body fully representative of the management and of the workers of the whole of Imperial Chemical Industries, Ltd. Its chairman is the chairman of the combine. It is intended that the Central Works Council shall meet regularly in London to discuss any matters raised by the workers, and to give the directors the opportunity to consult and discuss with the workers on questions affecting their general well-being.

The three different classes of Works Councils enable the management of the individual works, the higher management of the groups of works, and the directorate of the Combine respectively, to establish the closest possible contact with all ranks of workers. From this close contact all the co-partners in industry, the industrial trinity as Sir Alfred Mond has elsewhere described them, can co-operate effectively in making a success of the company they all serve, and thereby making their own work still more certain and secure.

III.—WORKS MAGAZINE

Again, in order to maintain and increase contact and consultation between all the co-partners in the prosperity of the company, a monthly sixty-four page illustrated magazine is to be established, which will deal with all matters of interest to the workers, particularly on their social activities. It is felt that this periodical will acquaint those engaged in the operations of the company from one end of the country to the other with the doings of the others employed, and will make them all feel they are a band of brothers.

IV.—STAFF GRADE OF WORKERS

A staff grade of workers is to be established for the purpose of giving the best workers a greater economic security and a higher status than they have had previously. All men of five years service and over will be eligible for promotion to the staff: such promotion to be made annually by the directors. It is contemplated that even up to 50 per cent of the men eligible may be promoted. Those promoted will be paid a weekly wage instead of an hourly rate and will receive the following in addition:—

- (a) A month's notice of termination of employment.
- (b) Payment of wages for Bank Holidays even if not worked.
- (c) Payment of full wages (less National Health Insurance Benefit) for all certified sick absence up to six months in any year.

V.—WORKERS' SHAREHOLDING SCHEME

For the purpose of encouraging all ranks of workers to obtain direct financial interest in the company a Workers' Shareholding Scheme to be applied in which the following are a number of the points:—

- (1) The worker may any day purchase Imperial Chemical Industries Limited ordinary shares at 2s. 6d. below the mean market price.
- (2) Free shares will be presented on the following scale:—To workers receiving £200 a year or less one free share for every 4 shares bought; from £201 to £500 a year one free share for every 5 shares bought; from £501 to £1000 a year one free share for every 6 shares

bought; from £1001 to £1500 one free share for every 7 shares bought; from £1501 to £2000 one free share for every 8 shares bought.

(3) If the worker should die before completing his payments, which may be by instalment spread over two years, the company will take over his obligations and hand the shares fully-paid to his next-of-kin.

(4) The scheme is intended as an Investment Scheme, and while no absolute restriction is placed upon the workers, they will not be expected to speculate with their shares. The Directors naturally reserve the right to refuse to allot further shares to a worker who does not enter into the right spirit of the proposal.

(5) The maximum individual allotment to be such number of shares as can be purchased by an expenditure of a sum not exceeding 20% of the annual wages or salary of the employee. To this 20% may be added an additional 1% for each year of service above five. An employee with 20 years' service therefore may spend 35% of his wage or salary etc. etc.

PEACE IN INDUSTRY

At the invitation of the Lord Mayor of London, a conference of employers, labour leaders, and officials of the Brotherhood Movement was held at the Mansion House on October 17 to consider what could be done to secure peace in industry.

Sir Thomas Inskip, Solicitor-General, said that the essential condition of peace in industry was mutual confidence as to the conditions of industry.

Mr C. G. Ammon, M.P., said that there must be give and take. Trade unions and employers' organisations had, in a certain measure, reached the limits of their development along the old lines. Such terms as masters and men were no longer suitable; they must be co-operators. There should be increasing opportunities for training workers in management and administration, and a frank recognition on both sides that agreements should be honourably observed. The present haphazard system of fixing wages must go. Regard should be had to the trade and industry of the whole country. General conferences should be held between the management and the workers at which all the relevant factors should be reviewed by both sides.

Sir Alfred Mond, M.P., emphasised the importance of eliminating politics from industrial discussions. He said that he was glad to see, from the Trades Union Congress, a strong movement to eliminate political verbiage from industrial discussions. When the Trade Disputes Bill was under discussion Sir Leslie Scott and he put down an amendment by which, if a trade dispute in any essential service could not be mutually settled either party could apply to the Ministry of Labour for the appointment of a board of conciliation and investigation. With such machinery public opinion, instead of being belogged, would have before it a decision as to who was the aggressor. If a sanction were asked for, his reply was that the great sanction in the modern world was the human conscience. People did not realise sufficiently the loss caused to industry, not merely by spectacular labour disputes,

but by the mass of continual small stoppages. The whole of our industrial future would be jeopardised unless we could obtain a steady, continuous programme of production and development in this country. In the company with which he was associated they had not had a labour dispute during 53 years. Those who initiated that industry did, as a matter of course, many of the things which Mr. Ammon had mentioned. On the whole, the British workman was reasonable if he realised that he was being given a fair deal. Referring to the scheme of works councils which he recently published, Sir Alfred Mond laid stress on the importance of organisation which would ensure that contact was maintained between those at the top of a great combination and the workers whom they employed. His experience was that the operation of works councils was all to the good. They helped to remove friction and to enable people to understand each other's point of view. The question how to create industrial peace was fundamental to the future well-being of this country. They wanted a definite programme accepted and carried out by the people. The moment was ripe for a real step forward. The scheme should be kept entirely out of party politics. They wanted something so strong that every party would have to accept it; something so sound that the common feeling of the nation would insist on its being implemented. Low wages and long hours, as a remedy for industrial depression, was a retrograde step. He wanted high production, cheap costs, and high wages.

Mr. T. Shaw, M.P., said that as a national body to lay down a programme had been suggested, he would point out that a National Industrial Council had formerly been set up, but it was scrapped by the Government of the day. The only basis on which industrial peace was possible was a decent livelihood for the workers.

Sir Robert Hadfield, F.R.S., said that the strong federations now existing on both sides were not elastic enough, and did not sufficiently study the human factors involved.

CANADIAN PULP AND PAPER INDUSTRY

An amalgamation of the selling organisations of 11 large Canadian newsprint manufacturing companies has been formed under the name of The Canadian Newsprint Co., Ltd. The company will handle 5000 tons, the daily output from the following companies: -Laurentide Co., Ltd.; Price Bros. & Co., Ltd.; Port Alfred Pulp and Paper Corp.; St. Maurice Valley Corp.; Canada Paper Co.; St. Anne Paper Co., Ltd.; Spanish River Pulp & Paper Mills, Ltd.; Fort William Paper Co., Ltd.; Abitibi Power & Paper Co., Ltd.; Manitoba Paper Co., Ltd.; and Anglo-Canadian Pulp & Paper Co., Ltd.

The Nova Scotia Wood Pulp & Paper Co., Ltd., Charleston, N.S., has been taken over by the Scott Paper Company, of Chester, Pa., U.S.A. The works will be enlarged later in the year.

The Backus interests have started the construction of a 200-ton paper mill at Fort William, Ont. This will form the first unit of a large paper establishment.

A RECENT DEVELOPMENT OF SPRAY DRYING

By J. ARTHUR REAVELL, M.I.Mech.E., M.I.Chem.E.

(Concluded)

Two typical spray-drying plants will now be described which are working under different conditions.

The spray drier is being very successfully employed in connexion with a patented process for the manufacture of a metallic oxide. The raw material in this case is a solution of the metallic salt, which, after drying, is calcined to give the oxide. The waste gases from the

and silver plating is the method that has been adopted with complete success. This plant is producing about 3 cwt. per hour of dry powder, this being removed from the drying chamber and transferred continuously to the calcining plant.

In another type of plant (Fig. 11) it is necessary to use a supply of clean air, and in this case, the material being stable, fairly high temperatures can be safely employed. For this plant an oil-heated air heater raises the air to a temperature of about 240° C., the air leaving the plant at about 100° C. Owing to the low vapour pressure of the moisture in the partially-dried

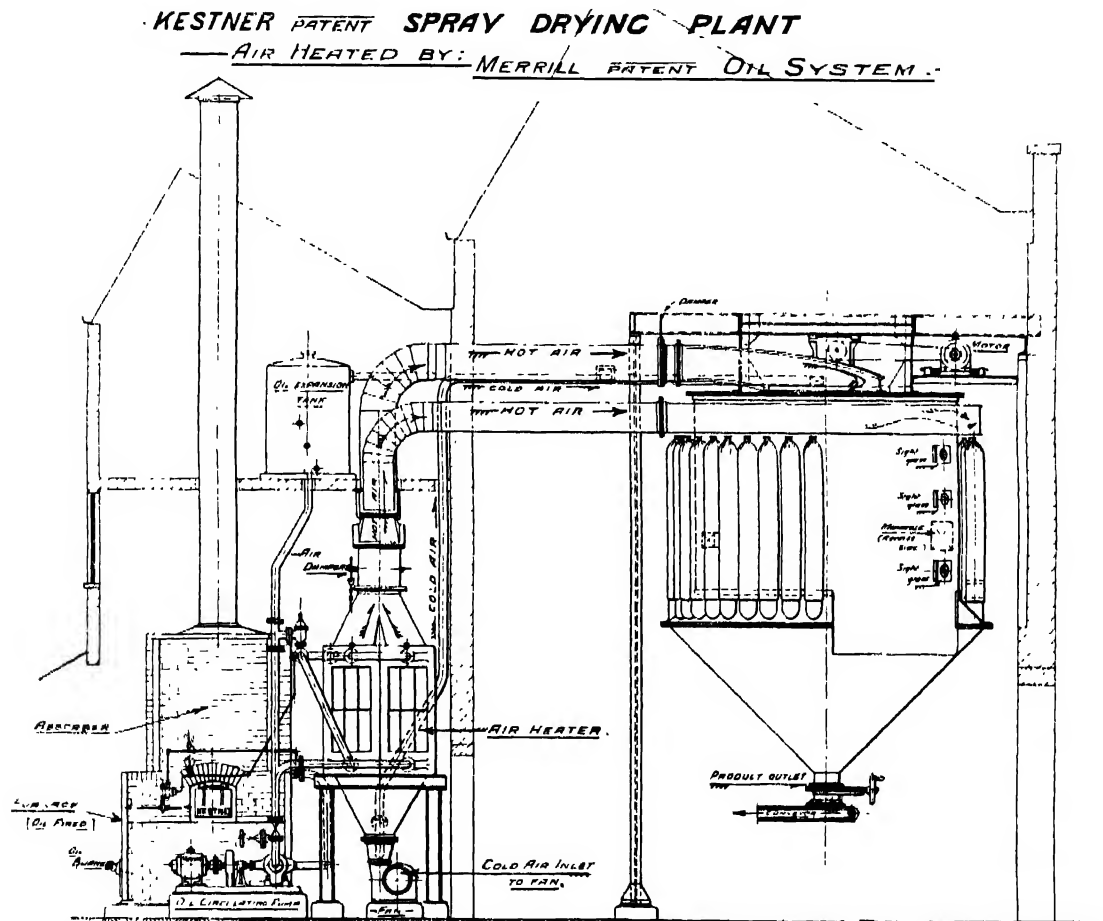


FIG. 11

calcining plant are used as the heating medium. The calciners are coke-fired, and the flue gases, after serving for the calcination of the salt, are taken, together with a quantity of excess air, to the air distributors of the spray-drying plant. The temperature of the gases at the inlet to the air distributor is between 250° C. and 300° C., and by evaporation of the solution which is fed to the drier the gases are reduced to a temperature of about 90° C. before they are discharged to the atmosphere. The solution contains a small quantity of free acid, but the only parts of the plant which come in contact with it are the feed pipes to the atomiser and the atomiser disc itself. There is no difficulty in protecting these,

material, it is found advisable to maintain the exit air temperature rather higher than would be necessary for most other products.

THE ECONOMICS OF SPRAY DRYING

In dealing with the economics of the process, the main factor to consider is the provision of the necessary heat for evaporation. At first sight it would appear that the limiting condition for the use of air as a drying medium is the saturation of the air by moisture at the air exit temperature of the plant. If, however, the moisture saturation curves for air are considered, it will be seen that the saturation value rises rapidly when

Where K = calories per 1° C. mean temperature difference per m^2 per hour and K_1 , K_2 and K_3 are the heat transfer coefficients for the two films and the dividing wall respectively.

With heat transfer between steam and air, conductivity of the wall is usually so much greater than the films that it may be neglected, and we may write

$$K = \frac{1}{\frac{1}{K_{\text{air}}} + \frac{1}{K_{\text{steam}}}} = \frac{K_a \times K_s}{K_a + K_s}$$

The required heating surface

$$S = \frac{\text{calories transmitted per hour}}{K \times \phi_m}$$

where ϕ_m is the logarithm mean temperature difference between the air and the heating medium.

Thus the surface is proportional to

$$\frac{K_a + K_s}{K_a \times K_s}$$

In tubular steam-heated air heaters, the values of K_a and K_s are in the order of 30 and 5000 respectively, and it will be appreciated that the controlling factor is the air film resistance which must be reduced as much as possible, e.g.:

Let $K_s = 5000$ $K_a = 30$
where the suffixes s and a refer to steam and air respectively.

$$\text{Then } K = \frac{5000}{\frac{5000}{30} + 30} = 30 \text{ (approx.)}$$

now let $K_s = 1000$ and $K_a = 15$

$$\text{then } K = \frac{1000}{\frac{1000}{15} + 15} = 15 \text{ (approx.)}$$

Thus, when heating air there is little advantage to be gained in employing high steam velocities, whilst every effort should be made to obtain the highest practicable air velocity in order to reduce the air film resistance.

The main sources of heat supply available commercially are:

- Steam.
- High temperature oil circulation.
- Flue gases
- Direct firing.
- Electricity.

HEATING WITH SATURATED STEAM

Steam is undoubtedly the best medium for heating the air up to temperatures of about 130° C., employing steam pressures of 60 lb. (t. 153° C.) to 120 lb. per sq. in. (t. 176° C.).

The advantage gained by using higher pressures is the larger mean temperature difference obtained, thus reducing the heating surface. The heat transfer from saturated steam to a metal wall is extremely high, thus the heating surface is reduced to a minimum.

The only practical disadvantage of steam as a heating medium is that we are limited to pressures of about 120 lb. per sq. in., as higher pressures would necessitate the use of air heaters of special and costly design.

The following table shows the effect of steam temperature on the amount of heating surface required:—

Steam pressure gauge	Temperature	Mean temperature difference ϕ_m	Heating surface
lb./sq. in.	$^\circ$ C.	$^\circ$ C.	
120	176	92	100
100	170	85	108
80	162	75	123
60	153	64	144

At first sight it may appear that the air could be heated to higher temperatures if superheated steam were used. Unfortunately, superheated steam is not nearly so good a transmitter of heat as saturated steam, and a much greater surface in the heaters would therefore be required to maintain the temperature. This fact, which is generally recognised by steam users, has received experimental confirmation in the work of R. Poensgen, at the Munich Technical College.*

In these experiments superheated steam was passed at velocities varying from 8 to 49 ft. per sec. through weldless steel tubes $3\frac{1}{4}$ in. and $1\frac{1}{8}$ in. inside diameter and $4\frac{1}{4}$ in. and $1\frac{1}{2}$ in. outside diameter, the tubes having a length of $11\frac{1}{2}$ ft. The steam pressures varied from 15 to 132 lb. per sq. in. absolute, and the steam temperatures from saturation to 350° C. (662° F.). Briefly, these experiments showed that the highest value of heat transfer from the steam to the metal wall at a pressure of 120 lb. gauge, absolute, 200° C. of superheat and a velocity of 29 ft. per sec. was $K_s = 180$.

Whilst with steam at a pressure of 30 lb. per sq. in. and a velocity of 8 ft. per sec. and 100° C. superheat a value of K of about 20 was obtained. The corresponding value for saturated steam lies between 5000 and 10,000 whilst the value of K_a may vary between 30 and 90, so that in practice the use of superheated steam would reduce the overall coefficient by half, thus doubling the heating surface.

A second, and perhaps more important, objection to the use of superheated steam is that the superheat is only a small fraction of the latent heat, so that if a given quantity of air is first heated to a temperature approaching the saturation temperature of the steam, the further rise in air temperature due to superheat will be quite small.

An example will make this clearer. Steam at a pressure of 120 lb. per sq. in. gauge (176° C.) is superheated to a total temperature of 344° C. The latent heat (491 calories) given out in condensing 1 kg. of steam will heat about 14 kg. of air from 15° C. to 160° C., whilst the superheat will only raise its temperature a further 39° C. It would be necessary to increase the heating surface by 32% to obtain this additional increase of 14° in the air temperature. This is illustrated graphically in Fig. 14.

HEATING BY MEANS OF HOT OIL CIRCULATION THROUGH THE AIR HEATER

Let us now consider the means available for heating the air to temperatures higher than 130° C.

The employment of hot oil circulating through the tubes of the air heater forms a ready and easily-controlled

* R. Poensgen, *Forschungsarbeiten*, Vols. 191 and 192, Berlin, 1917. "Ueber die Wärmeübertragung von strömenden überhitzten Wasserdampf an Rohrwandungen an Wasserdampf." Published for the V.D.I. by J. Springer.

method of heating. Oils of a special grade having a high flash point may be circulated through the air heater at 290°C ., heating the air to within 20° .

Some advantages of this method are:—

1. High air temperatures can be obtained without difficulty.
2. The low pressure of oil in the heater (in the order of 15 lb. per sq. in.) simplifies the construction of the air heater.
3. Easy regulation of the temperature.
4. Smaller heating surface required.

As any convenient velocity can be chosen for the oil flow through the pipes, a high overall heat transfer coefficient may be obtained, which, together with the large mean temperature difference, causes the heating surface required to be comparable with that for steam heating.

ture of an economiser tube is at sensibly the same temperature as the water, whilst in the case of the air heater the temperature of the metal tubes is nearly a mean of the gas and air temperatures, and is thus usually well above the dew point.

HEATING WITH DIRECT FIRING

(Air passing through tubes)

At first sight it would appear that direct heating of the air would be very efficient, as by suitable design the radiant heat could be utilised as in the case of a steam boiler. There are, however, in practice many grave objections to this method.

(a) It is difficult to prevent localisation of the heat, which causes rapid deterioration of the tubes unless these are made of a special heat-resisting metal.

It may be objected that a direct-fired absorber for

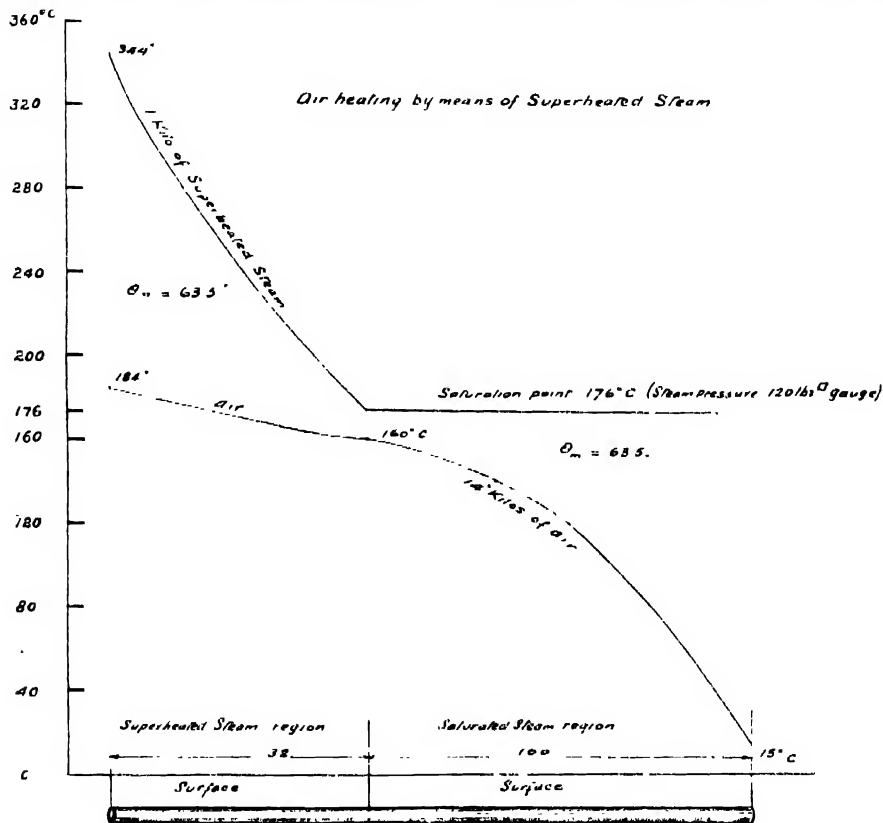


FIG. 14

HEATING WITH FLUE GASES

When large quantities of waste gases are available, this is undoubtedly the cheapest method of heating, but necessitates the provision of a very large heating surface due to the very low heat transfer between a gas and air. Broadly speaking, the surface required is more than double that of a heater using oil or steam as the heating medium. In addition, the formation of soot and other deposits from the gas further reduce the efficiency of the heating surface.

Fortunately there is little danger from corrosion due to condensation, such as often occurs on the outside surface of economiser tubes when the gas is cooled below dew point. This is due to the fact that the wall tempera-

oil or a tubular boiler is subjected to a similar condition, but the cases are in reality quite different. In a water boiler tube or oil heat absorber the tube temperature is little higher than the steam or oil temperature, whilst an air heater tube is at approximately the mean temperature between the furnace and air.

(b) There is a difficulty in regulating the temperature as there is no storage such as is in a boiler. This renders efficient firing and the maintenance of a steady temperature extremely difficult.

ELECTRICITY

Whilst the efficiency of electrical heating is from a purely thermal standpoint exceedingly high, it is ruled out on account of cost, except in cases where extremely

cheap water power is available and coal or other fuels are not easily obtainable.

A moment's consideration will show this, *e.g.*,

1 Kilowatt-hour = 3414 B.Th.U. This power, if passed to an electric air heater, would heat 69.5 lb. of air from 15 to 130° C., assuming 95% efficiency of heating. If, instead, steam were employed at a pressure of 60 lb./sq. in. (latent heat 915 B.Th.U. per lb.) efficiency 95%, 4 lb. of steam would be required.

Assuming coal of a calorific value of 11,000 B.Th.U. per lb., 70% overall boiler efficiency.

$$\therefore \text{The equivalent coal} = \frac{4 \times 915}{11,000 \times 0.7} = 0.474 \text{ lb.}$$

Thus, 1 B.O.T. unit of electricity would be equivalent in actual air heating value to less than $\frac{1}{2}$ lb. of coal. Therefore electricity at 1d. per unit is equivalent to coal at £18 11s. per ton.

The choice of the above-mentioned methods for heating air will naturally depend upon local conditions. In many works there is available a surplus of steam at pressures ranging from 60 to 100 lb. per sq. in. and in such cases the best method undoubtedly is to heat the air in steam heaters to about 130° C., and after to heat to 240° C. by means of hot oil.

It has been suggested to use the flue gases leaving the steam boilers, but here we are faced with the difficulty that if the boiler plant is efficient, the exit temperature of the gases is so low that it is difficult to obtain sufficient temperature drop to carry out heating to a high temperature.

In describing a plant in which a metallic salt is being dried the use of waste gases was mentioned, these gases being taken direct into the drying chamber. This naturally provides the most economical source of heat that could be obtained, as the spray drier can be operated quite satisfactorily with gases at the temperature at which they would normally be allowed to escape to waste; thus the cost of the heat is that of conducting the flue gases to the drying plant. The use of this method is limited to plants where the products will not be adversely affected by the presence of impurities, although where the gases originate from oil or producer gas-fired furnaces it is not difficult to arrange matters so that extremely little ash dust passes forward to the spray drier.

Products of combustion will contain considerably more moisture than heated air, but if the moisture content is so great that it is necessary to work with a relatively high air-exit temperature, this is not a serious matter. If any other source of heat were being utilised it would be important to work with the lowest possible air exit temperature in order to obtain the highest heat economy in the plant, but where waste heat is being used such economy is of little or no importance.

TYPE OF HEATERS EMPLOYED

For heating by means of oil or steam, the most efficient type is that in which the steam or oil passes through rows of tubes or passes over the outside of the tubes in a direction at right angles to the tube length. In this type high velocities of the oil and steam can be maintained inside the tube, whilst considerable velocity can also be given to the air passing over the tube surface.

For heating with flue gases the heaters may be built up in a similar design to steel economisers, the air passing through the tubes, whilst the flue gases pass outside at right angles to the tube length. Alternatively, they may be arranged as a nest of tubes in a cylindrical body, the air passing through the tubes while the gases pass in a sinuous course through the body, baffle plates being fitted at intervals. Suitable openings are provided so that the tubes can be brushed.

In this design the air can be given a high velocity through the tubes so that a high heat transfer is obtained from the air to the tubes, whilst flue gases, owing to the larger space in the jacket, pass through at a relatively low velocity. It is difficult in practice to obtain a high velocity from the flue gases, as one is usually limited by the amount of chimney draught available. In many cases, however, it may be possible to employ forced-draught fans.

The following example illustrates the advantages of using high air temperatures in the spray-drying plant. A greater proportion of the temperature drop is utilised, whilst, in addition, the weight of air for a given evaporation of water in the drier is reduced; *e.g.*, 1 kg. of air at 15° C. is raised to 130° C. and is cooled in passing through the drier to 70° C.

$$\text{Thus, heat given to the air} = 0.238 \times (130 - 15) = 27.4 \text{ calories.}$$

$$\text{Heat utilised in the drier} = 0.238 \times 60 = 14.28 \text{ „}$$

$$\text{Heat rejected} = 13.12 \text{ „}$$

If, on the other hand, the air has an inlet temperature of 240° C. and an exit temperature of 80° C., and the same heat (14.28 calories) is utilised in the drier, the

$$\text{quantity of air is reduced to } \frac{14.28}{160 \times 0.238} = 0.374 \text{ kg.}$$

$$\text{and the heat rejected} = 0.374 \times 0.238 \times 65 = 5.78 \text{ calories.}$$

Therefore, by increasing the inlet temperature we reduce the weight of air by 62% and heat loss by $\frac{5.78}{13.12} = 44\%$. In addition, the size of the drying chamber may be reduced considerably, as the rate of heat transfer from the air to the atomised liquid will be greatly increased.

Power represents a very small item in running costs. The power required for the atomiser dealing with a given volume of liquid is not constant, and varies with the degree of atomisation that is required and the nature of the liquid that is being atomised. The viscosity and the specific gravity of the liquid must be taken into account in calculating the power which will be necessary, and, as the viscosity in particular is usually materially affected by the temperature of the feed liquor, this also must not be neglected.

For plants which are dealing with quantities of about 150 gals. per hour it may be taken, in general, that the power for the atomiser will not exceed 5 h.p. For smaller plants it is naturally lower.

The power required for the fans can only be determined by consideration of each particular installation. The resistance to be overcome in the spray-drying chamber itself and in overcoming the resistance of the air-filtering part of the plant is not great, as the pressure within the drying chamber is seldom greater than about 3-in.

water-gauge *pression*. There may be an additional but smaller resistance, due to the air heater, but in other cases the resistance of the spray-drying chamber and the dust-collecting plant represents the total pressure against which the air is to be delivered.

For a plant which is evaporating about 3 cwt. of water per hour, in which the total resistance may rise to about 5-in. water gauge, the power required for the fan will be approximately 6 h.p. Thus it will be seen that the cost of power for the drying process is very low, particularly when it is compared with the cost of the power required for other processes in which grinding plant follows the drying plant. The finished product from the spray drier is already in the form of a fine powder, and there is no necessity for grinding or screening.

Labour is the remaining item in the working costs, and when it is pointed out that one man can quite easily attend to the filter bags of several drying plants, if the lay-out of the plant has been suitably arranged and the same man can attend to the removal of the powder from each of the drying chambers, it will be seen that the labour costs are reduced to an absolute minimum.

CANADIAN INDUSTRIAL NOTES

The Hamilton By-Products Coke Ovens, Ltd., Hamilton, Ontario, is erecting a plant for the recovery of benzol and toluene, at a cost of about \$400,000. It will take care of the by-products of the daily carbonisation of 1000 tons of coal.

The H.M. Doherty Company, of New York, has abandoned boring for oil on Prince Edward Island. The company has expended about \$400,000 on borings, one of which reached nearly 6000 ft., but failed to discover any gas or oil.

British financial interests have acquired the plant of the Lignite Utilisation Board at Bunfuit, Saskatchewan, and will start operations at an early date. The Board expended over a million dollars upon this plant.

The International Paper Company has announced that it will not enter the field of rayon manufacture, and has no financial interest in any company making rayon. It is solely interested in the manufacture of sulphite cellulose pulp suitable for the production of high-grade rayon. The company has purchased the Ottawa-Montreal Power Company, which gives it the control of hydro-electric power in the Ottawa Valley, reaching as far as Montreal Island. This system will be linked up with the Gatineau Power Company, and make power available for industrial development.

The Procter and Gamble Company of Canada, Ltd., soap manufacturers, is increasing its works at Hamilton, Ontario, and making general arrangements for increasing production. The cost for the improvements will approximate \$300,000.

Revised figures, prepared by the Dominion Bureau of Statistics, show the production of asbestos in Canada, for the year 1926, as 279,403 tons, valued at \$10,099,423, with an average value of \$36.15 a ton as compared to \$32.82 in 1925. Fourteen plants reported as against 12 in 1925. The total exports were 277,991 tons, of which 224,334 went to U.S.A., 14,193 to Germany, and 9304 tons to Great Britain.

THE SEVEN LAMPS OF CHEMICAL ENTERPRISE*

By C. J. T. CRONSHAW, M.Sc.

The path of chemical enterprise is both long and sinuous, and beset with pitfalls; it must, therefore, be of importance, and moreover of interest, to such a centre of chemical industry as the Manchester Section, to consider the lamps which illuminate the route so many of us must travel.

The chemical industry in this country, particularly the organic chemical industry, has been for a decade and a half the ambit of much careful analysis and diagnosis, and has possibly suffered somewhat from such critical aid. Usually the results of such diagnosis have been confined to the single theme of the importance of research in chemical industry, but, as I hope to show as I proceed, successful chemical enterprise is much more complicated than an equation with one unknown. There are many principles involved, perhaps not all of equal importance, and the neglect of any of these lays bare penalties which may easily disturb and wreck the whole structure. Chemical enterprise is to some extent peculiar; in few realms of commercial endeavour is the liability to economic changes of such capital and vital importance.

The possible routes to chemical substances are usually both numerous and varied, and the ultimate choice is made, perforce, on general economic grounds. Consequently slight changes in price of a few products are sufficient to upset almost a section of chemical industry; and this same economic trend may often, further to complicate the position, bring new products into extended use. Moreover, economic factors often play strange tricks, converting useless by-products into the salvation of a moribund industry, and relegating hitherto profitable materials to the background. As the science of chemistry grows and expands, it robs, and even as it robs it bestows, not unfortunately always on its early victims, great and glittering prizes.

Perhaps these generalisations will more gracefully commend themselves to you supported by some of the specific examples upon which they properly stand. There are many cases which may be cited. The coal-gas industry is probably the classic example. An industry which originally found its initiative in the provision of an illuminant now holds its place, at any rate in coal-bearing countries, by reason of the financial rewards in its coal tar and ammoniac. Even this sequence is on the threshold of disturbance by reason of the advance of synthetic ammonia, and it may be that ultimate and final relief is coming by way of low-temperature carbonisation. And this latter may also constitute a threat to the raw materials of the dyestuffs industry, since the tendency is for by-products to change from an unsaturated character to saturated. The dyestuffs industry almost exists on the presence of the double bond. The production of metallurgical coke has passed through the same stages and has found the same solutions. One might also quote, though not quite with the same force, the soap industry and glycerin.

And that these examples are not solely of the past,

* Chairman's Address to the Manchester Section on October 7, 1927.

there is the production by fermentation, during the war, of acetone with its then almost useless attendant accumulation of normal butyl alcohol. To-day this process flourishes and lives by reason of its butyl alcohol, and the nitro-cellulose lacquer for motor-cars is the result. There is, too, the striking development of phthalic anhydride, and the synthesis of anthraquinone. Similar instances will, of course, readily come to mind. I would, however, like to mention one other example, somewhat different from others I have recalled to you, in that the threat that emerged from the darkness was neither the inexorable progress of science, nor the shifting of economic trend, but entirely due to national politics. I mean the position of the distilleries in the United States when prohibition became law. New solvents were developed on an abundant scale; the use of alcohol as an anti-freeze in the radiators of motor-cars extended, and the so-called solidified alcohol as a solid fuel became almost an industry in itself. It was an industry with its lines of communication severed, but it took as its safeguard against this danger, the safeguard which chemical enterprise must always, for all dangers which lie hidden in the future, take, and that is, the "Lamp of Research."

RESEARCH

Research has, at various times, been divided into all sorts of categories. People have spoken of pure research, applied research, technical research, and sometimes of research in capital letters, and with almost a supernatural awe in the voice. That sort of research I am persuaded is the least valuable, and on careful inspection it usually turns out to be a vague theory that research is inherently so valuable it should be undertaken on a vast scale, and with little or no thought either for its quality, or its aims.

"The progress of any science," as Lord Curzon observed, "will always depend upon the character and ability of the men who devote their life to it, rather than the money expended in its name."

Pure research as I understand it means the prosecution of experiments or enquiries solely directed towards the acquisition of knowledge for its own sake. No reasonable person who derives his income mainly from the practical applications of science, or who has received a scientific training, will for one moment deny the value or the need for such research. It is important in that it is fundamental for the progress of the world and the training of subsequent generations of chemists, but it is no part of the duty of chemical enterprise to do other than extend a financial helping hand to pure research.

It is the business of the horticulturist to set his seeds and grow his plants in the soil and atmospheric conditions best suited to their full fructification. There can be no question at all that the soil and atmosphere best suited to pure research is and always will be the universities. Anyone who really has strong and deep convictions about the fundamental and cardinal importance of this kind of research will do well to hesitate before advocating its removal to other soil of necessity less suited to its abundant development.

With technical or applied research, chemical enterprise is, of course, mainly concerned. It is, as I have said, the lamp to illuminate the darkness lying in the future.

Its importance has quite properly been stressed in every public critical analysis to which chemical enterprise has in the past been subjected; but this repeated emphasis has only, in my opinion, been rightly necessary because of the danger, since the results of research must necessarily lie in the future, of its being abandoned altogether. Thus both the value and danger of technical research arise because it is concerned with the future, and the shortsighted have sometimes yielded to the apparent necessity of the present.

No matter of research is easy, but technical research is, quite apart from the inherent obstacles of the specific problems, a matter of some difficulty, in that there is no easy measuring stick to hand with which to test its excellence; no ready criterion of the amount of expenditure necessary; often no surety of ultimate reward; no positiveness that the goal really exists; and because of all these, I feel that the supreme difficulty in technical research is the difficulty of its wise direction. Sir Ernest Rutherford, at the British Association in Liverpool, speaking of this same difficulty of direction, remarked that "it is fatally easy to spend much money in a direct frontal attack on some technical problem of importance when the solution may depend on some addition to knowledge in some other field of scientific enquiry which can be gained possibly at a trifling cost."

Stripped of its technical obstacles, applied research is therefore a problem of marksmanship. Just as the fighting efficiency of a battleship depends firstly upon good guns, the right ammunition, and efficient shooting, but fundamentally on target control, so good research is target shooting; in other words, accurate direction towards a valuable objective.

May I crystallise my remarks on research by saying that the only illuminant to burn in the Lamp of Research is the oil of good direction.

PRECISION

Having said a word on the thought that chemical enterprise must give to the future, we can turn to its problems of the present. As the world extends its knowledge and the scope of its endeavour, it becomes more exacting. The present century is growing into an age of the minute. In the cotton industry much of the development is towards finer counts; in the motor industry the tendency is for finer tolerances. In a recent motor catalogue I observe that more than 5000 operations are gauged to one thousandth part of an inch, and over 100 to a thirtieth of the thickness of a human hair. Catalytic reactions, of growing importance, are in the domain of the minute. That division between acidity and alkalinity which we used to call the neutral point has grown into a domain of p_H values. And these observations bring me to my second lamp—the "Lamp of Precision."

Chemical products are tending more and more to be sold, not for what they are, but for what they will do, and this naturally entails a uniform standard of performance. A dyestuff is sold not on its chemical composition, but because it will dye an almost definite weight of textile material to a desired shade, and with a defined degree of permanence to the factors, such as light, acids, alkalis, chlorine, heat, it will have to

withstand. An organic rubber accelerator—for example, diphenylguanidine—is sold not so much because it is this or that chemical substance, but because it will in a definite rubber mix effect a satisfactory cure at a definite temperature and within a defined period of time.

There are many other examples: insecticides, drugs, seed disinfectants, dispersing agents, wetting-out agents. Moreover, all these are concerned with what I might term the chemistry of the relatively small effect, in that the result produced is out of proportion to the quantity employed. "Stainless" steel is an example of what I call the small effect, and if chemical enterprise is to be equal to its task it must keep well trimmed the Lamp of Precision. Fortunately, so long as this need for accuracy is recognised, the lamp is to our hand, for the practice of analysis is the oldest section of chemistry, but the analyst, if he is to help chemical enterprise on its future path, must give even finer methods of precision, and of enlarged scope and technique. He must give us precise methods for evaluating effects rather than methods for determining composition. Chemical enterprise still has to carry on with methods almost by their nature incapable of fine and exact mathematical expression. The only way to test and standardise insulin is to keep an army of rabbits: the only way to test dyestuffs is to dye them on the fabric for which they are intended. The Lamp of Precision must, by its light, drive away all empiricism.

As I mentioned earlier, the chemical enterprise, particularly the organic chemical enterprise, is more and more selling an effect rather than a substance, and as a natural consequence of this the problems of the general customer are becoming those of the chemical industry itself. We see this in all sorts of ways: the development of acetate silk had to synchronise with the development of new dyestuffs, and new dyeing methods; the development of pyroxylin paints hinged upon the development of suitable methods of application.

It may be possible that this question of application of chemical products is a fundamental principle of all chemical enterprise. Perhaps synthetic petrol will not only abundantly assist natural supplies, but ultimately revolutionise the petrol engine by reason of some new and unknown property, which initially is merely a problem to be solved before successful use is assured. Some of the greatest drawbacks to the use of chemical products have turned subsequently to be amongst the greatest virtues.

As a general proposition, it is easier to discover a new product for a specific use than invent a use for a new product. I mention this in passing, as there have been occasions when the service which pure research has expected from chemical enterprise has been the discovery of uses for new products whose sole claim has been their novelty. Now, because the effect of a product is becoming more important than the product itself, it is essential that chemical enterprise shall have another lamp to guide its path, and that is the "Lamp of Service."

SERVICE

The importance of this Lamp of Service was perhaps early realised. Let me quote to you what

Sir W. H. Perkin said on this subject so long ago as 1896:—

"Before aniline purple could be introduced for dyeing woollen and mixed fabrics, weeks were spent at Bradford in finding out suitable methods of applying it. Not only had the difficulties welded to its manufacture to be grappled with and the prejudices of the customer overcome, but a large amount of time had to be devoted to the study of its applications."

This type of service was probably first developed logically by the great German dyestuffs firms, but it has had a prominent place in the development of the British dyestuffs industry. It is not, however, something peculiar to the dyestuffs business, but a fundamental part of the function which chemical enterprise must play in any country. No one who has been in the United States recently, and seen what they are doing in this direction, will deny the importance of the Lamp of Service.

On this question of service, there should, however, perhaps be sounded a note of warning. It is fatally easy to exaggerate what a substance will do. Some of the old advertisements of patent medicines, I think, sufficiently illustrate this point. Chemical enterprise in its service must beware of what it claims to do. The patient justification of results is better infinitely than wholesale claims. The Lamp of Service must burn brilliantly, but only by reason of the wick of honesty.

UNITY

And now we come to a very important lamp, which I have called, for want of a better designation, the "Lamp of Unity."

Chemical enterprise cannot be good in parts—it survives only by reason of the strength and well-being of the whole; and this can only be measured in terms of the financial and commercial health of its manufacturing ability. The heart and kernel of successful chemical enterprise is efficient manufacturing operation, and this is only possible under the rays of the Lamp of Unity. Precision; organisation (a word with a bad past but, properly understood, having a glorious present); chemistry; engineering; physics—all are necessary; but it is only the blend and unity of these in equivalent excellence that can ensure successful manufacturing operations. One observes that in any critical survey of British chemical enterprise this important item seems never to have been discussed at all; and although there have been addresses which, if not pointing the finger of example to Germany, have directed it towards the United States, it has apparently escaped observation that in the United States the problem of manufacturing operations has been appreciated at its proper value and in many directions realised its greatest achievements. This is not due to any national characteristic, but because American industrial enterprise as a whole is finally convinced of the urgent necessity for this Lamp of Unity.

Organic chemical manufacture is to-day intrinsically more difficult than ever; greater complication exists (think of the number of dyestuffs which to-day are manufactured and sold—surely, by the way, far too many); greater degrees of precision and purity, more sensitive control, are required than ever before.

The days when a new product could be sold at a price which would both allow a rich reward for the inventor and a high cost of manufacture have departed. The world has opened up so much, and means of transport become so extensive and so flexible, that nearly everything, both new and old, is competitive.

Users of dyestuffs perhaps forget that magenta started its commercial career at a price of about 3s. an oz.; but there is to-day no dyestuff, however valuable its possible particular properties, to be discovered that could survive such a price. Acetate silk and viscose compete in a general way with silk and cotton; synthetic resins with natural gums; whatever is, has its value and its new possibilities; but whatever its properties and its virtues, it must still come within the ambit of price presented by products of analogous utility.

All this inevitably means that the initial manufacture of any product must be more fully examined and perfected before any manufacture can begin. Often in the past chemical manufacture grew up and solved its problems as it grew; to-day, and even more in the future, chemical manufacture must start grown up at the beginning. Perhaps an illustration may make this point clear. No theatrical producer opens his first night until everything—play, stage, players, scenery—is absolutely first class: it entails patient design, discussion, training, team work and secret anxiety, but these he must face simply because he cannot afford to start an undertaking prejudiced against its success. Manufacture to-day is almost a science; and there is a vast difference between manufacturing a product and making it on the large scale.

Many reasons have been advanced at different times by various eminent gentlemen to account for the fact that Great Britain lost so quickly the initial lead in the synthetic dyestuffs industry; but it is interesting to note that, although for the period 1869–1871 the production of alizarine in Great Britain was greater than elsewhere, within the narrow space of two years it had fallen to one third. Such reasons as Patent laws, restrictions on the use of alcohol, lack of research work, are insufficient properly to account for such a sudden and drastic change. Meldola, speaking in 1908, said: "By that time (1873) it was fully realised that a complete revision of the plant had become necessary. It required enlarging and modifying." I think you will find that the reason for the first stages of the decline was that the Lamp of Unity had grown dim.

Sir W. H. Perkin himself, speaking of the question of manufacture, recalls the "number of matters which were apparently of small importance, but it is remarkable the amount of difficulty and annoyance they caused."

The spirit to burn in the Lamp of Unity, and there can be no other, is the spirit of thrift. Thrift means to the chemical manufacturer the highest standard of performance for everything. It means the highest yields; the best process; and the best use, therefore, of labour, time, material, and money. It is the chemical definition of the word "immaculate."

Chemical enterprise with this Lamp of Unity need fear no competition and no comparisons.

JUDGMENT

There is another lamp of chemical enterprise, and that is the "Lamp of Judgment." If this quality is not most important of all, it is, perhaps, most difficult to find. The faculty of judgment can be fostered, but it cannot be created. Research may provide the information, manufacturing operations may have their unity and thrift, service may be all that we desire, but it is the Lamp of Judgment which must illuminate the whole area of chemical enterprise.

The "when" and the "where" are in any enterprise of great importance: the time, the place, the material. All sorts of factors have to be taken into account: questions of transport, availability of materials, proximity of markets; but even with the guidance derived from these factors, the ultimate decision will often rest upon impartial and clear judgment.

The problems which arise in chemical enterprise of to-day are so many-sided, and often such a seeming balance of pros and cons, that in the end, despite all the wonderful resources of chemical industry to-day, the decision can come only with a clear-eyed sense of judgment.

Possibly you may think I have stressed this point too much. Lord Rosebery said, speaking of the Premiership, "The most necessary quality is judgment." And it must be true of all places and positions where the L.C.M. of any problem is still subject to a host of uncanceled qualifications.

Chemical enterprise of the future will succeed best on a broad basis. There are, inevitably, so many cognate products to be made which can properly only exist contiguous to their respective principal manufactures. The synthetic production of methyl alcohol best exists adjacent to synthetic ammonia, and once you get the starting point, other manufactures inevitably follow.

There is no other course. You have a consideration which even to-day organic chemical industry has to face—the problem of where to stop. Chemical enterprise, if it is to be successful, is bound to become larger in scope, and the size of the industrial unit increase. I think there is nothing to be alarmed at in this, because it is going to be an asset, and the more synthetic we become in our methods the more will chemical endeavour be geographically concentrated, and the greater our dependence on the coalfields. This tendency of the enterprise in the very nature of things to become fundamentally large in its scope does bring, perhaps, some new problems in its train, in that chemical enterprise will tend to become a community; it will enlist in its service the chemist, the engineer, the physicist, the labourer, and the artisan. The psychology of this "group mind" will require patient study. You will have the imagination and ardour of the chemist; the constructive skill of the engineer; the detailed and logical mind of the physicist; the pride of the craftsman; the honest and ungrudging toil of the labourer.

The problem, therefore, of its government and its correlation will require tact; wisdom and fairness; and statesmanship equivalent to that necessary for the well-being of a country, and this reflection brings us to the "Lamp of Leadership."

LEADERSHIP

Much of the success of chemical enterprise in the future will depend on whether it is able sufficiently to command this quality.

Good leadership is not a solitary quality. It has been said, "An emperor who is his own council of ministers in peace, and his own general staff in war, is unlikely to leave behind him any considerable or coherent body of political theory." It is equally true that the industrial leader who does likewise is also unlikely to leave behind a prospering and continually developing enterprise. There is a tyranny of thought and action which in industry is in the long run as fatal as any political tyranny. The will to play the tyrant exists in every man: it is one of the deadly sins to which human nature is liable. Good leadership is not a tyranny: it means efficiency: personality; urbanity; the capacity for suspended judgment; idealism; and appreciation of value; team work; and the genius for doing the right thing because it is the right thing.

Good leadership will, therefore, create good leaders, and will surround itself with good leaders. It is the business of good leadership to be prepared for all eventualities, not as a result of the inspiration of the moment, but by the careful consideration of all the factors in advance of the eventuality.

Leadership must, as Lord Moulton remarked, "take the necessary time and reflection before we commit ourselves to any course of action. The delay of deliberation is far less than that of defeat."

Leadership means much: as I see it, it means the knack of inspiring a large body of different sorts of people with the same enthusiasm for the same objective; with creation of a constitutional form of government within the undertaking; with making every man, however insignificant, feel that he is an important link in the chain, or to change the metaphor, of being a king in his kingdom: it means the building up of an organisation which is not only capable of solving its own problems, but of providing its own training ground for its high positions. The industrial leader is surely not he who can brilliantly extricate it from the chaos into which it has drifted, so much as he who by careful staff work, and the considered solution of problems before they occur, can keep it from ever descending into chaos. It is true that the old method seems more brilliant, but the other way is the real way, and is more difficult since it does not depend upon erratic moments of inspiration.

VISION

Now we come to the "Lamp of Vision." Thus far my lamps have been mainly concerned with the well-being and stability of the enterprise, but it is of capital importance that in its vision it should be clear and definite as to its purpose and proper function in a modern world.

I think, in considering the point, we have to go back to fundamental things. Nature is, after all, the greatest chemist, and is, moreover, pre-eminently an organic chemist. In the inorganic field Nature has confined herself to relatively few materials, even a goodly number but still relatively few, whereas in the organic field we have natural dyestuffs, perfumes, coal, oil, textile fibres,

resins, drugs, tanning materials, leather, to say nothing of the complex structures of which the animal and vegetable kingdoms are comprised, and from which individual products are derived.

The ultimate proper function of chemical enterprise, I would say, is to improve upon Nature—a supremely difficult operation—particularly and mainly with respect to the time factor.

Civilisation has arrived at such a point of complication that it can no longer afford to wait for Nature. Nature acts in units of a year, a century, or a millenium, as the case may be, and the modern trend of chemical enterprise is to reduce this to units of days and weeks.

It is interesting to pause here to observe that, I think, the only section of organic chemistry which has almost completely surrendered to chemical enterprise is that of synthetic dyestuffs; but essential as they undoubtedly are, dyestuffs from the standpoint of ultimate national economies are amongst the least important of the objectives of organic chemical enterprise. Synthetic resins will surely have to make up for the inevitable shortage of natural resins and gums; artificial silks already enable cellulose, Nature's largest single production, to replace the patient and seasonal output of the silkworms. Synthetic methyl alcohol and synthetic acetic acid have already enabled us to dispense with the old wasteful destruction of cellulose. Synthetic petrol, of which perhaps we are to-day but treading on the threshold, represents possibly the most striking and far-reaching of the results of vision in chemical enterprise.

Our task in the future is still further to supplement the armoury of the agriculturist against the less benevolent of Nature's activities: by chemical sprays and washes it must resist the attacks of insect pests on both the growing plant and its seed. Fermentation processes must more and more be enlisted in the service of chemical enterprise. Synthetic rubber, at one time much heralded, will eventually arrive. And one day chemical enterprise must address itself still further to the ultimate problem of all, the problem of food supply. Synthetic fertilisers have done much, and will do more, but is it certain—I ask the question—is it certain that it is beyond the ultimate grasp of chemical enterprise to furnish that "something," whatever it be, which will eventually and surely cut down the period of time necessary for plant and vegetable growth, and thus make harvests so abundant that succeeding generations may straighten shoulders no longer burdened as are ours? Than this, chemical enterprise, in its vision, can have no better horizon.

CANADIAN MINING AND METALLURGY

A Montreal syndicate has leased the antimony mines at Lake George, York Co., New Brunswick, from the North American Antimony Smelting Co., and will resume operating the mine at once. The same syndicate is negotiating for the purchase of the Malagash salt mine, Malagash, Nova Scotia, and is also considering the development of the large salt deposit near Dover, Westmoreland Co., New Brunswick. It is understood that the syndicate has in view the erection of large chemical works in the Maritime Provinces.

THE FIRST MEETING OF THE INSTITUTE OF CHEMISTRY OF THE AMERICAN CHEMICAL SOCIETY

For six years past there has been held at Williamstown, Mass., an Institute of Politics that has aroused widespread interest. The organisers of this annual conference have shown considerable enterprise in arranging discussions on aspects of political science that are seldom publicly debated. In no way could this be illustrated better than by the fact of their devoting part of last year's session to a round-table discussion of the relation of chemistry to world affairs.

A number of prominent chemists, including Principal Sir James Irvine, were present, and so much were they impressed with the value of the discussion that the idea arose of founding an Institute of Chemistry organised on somewhat the same plan as the Institute of Politics, and devoted to extending the basis of co-operation between chemical science and industry, and to widening the interest of the man in the street in advances in these fields of knowledge.

Convinced of the potential value of an annual conference of this character, the initiators—Dr. H. E. Howe (editor of the *Journal of Industrial and Engineering Chemistry*), Dr. Gerald Wendt (Dean of Chemistry, State College, Pa.), and Dr. Whitmore (Professor of Chemistry, North Western University, Ill.)—supported by many prominent industrialists, threw themselves heart and soul into the scheme, and, in spite of the fact that the decision was reached at a date so late that it seemed an impossibility for a meeting to be organised for 1927, all obstacles were swept aside by the enthusiasm and incessant labour of these men and of the Executive secretary, Dr. A. W. Keimsey, of the Du Pont de Nemours Company.

No praise can be too high for the manner in which the meeting, held this year in State College, Pa., during the month of July, was organised. It impressed the writers as one of the most efficiently conducted and valuable chemical conferences in their experience. The choice of State College as the centre of activities of the first Institute was commendable, for it enabled the delegates from all parts of the States to escape the terrors of an American city in the hot weather and to have at one's doors plenty of opportunity of recreation in leisure moments.

The State University, around which revolves the life of the small town of State College, is beautifully situated at the foot of one of the fertile valleys separating the steep, razor-back ranges of the Alleghenies. The University buildings (the photograph shows the uncompleted Chemistry building) lie scattered round a beautiful campus of sweeping lawns and shady avenues, whilst for many miles in every direction stretches some of the finest country in Pennsylvania.

The main features of the Institute were the morning conferences at 11 and the evening lectures at 8. At the former a general paper was read on some problem of modern interest and was followed by a discussion, whilst the latter were devoted to reviews of a more popular nature.

In addition to these arrangements, there were a number

of courses organised in connexion with the Summer school at the University, which could be attended by students or by delegates who desired a "refresher" in any particular direction.

A typical day at the Institute would open with attendance at a lecture of one of the many courses at 8.30 or 9.30. Then practically every one would assemble in the large theatre, known locally as "the Bull-pen," at 11, for the morning lecture and discussion, after which there would be dispersal to Fraternity House or elsewhere for lunch.

The afternoons were kept free for recreation, and abundant facilities were available. Tennis courts were reserved on the University campus for the use of the delegates, and both men's and women's tournaments were organised. Other delegates would motor to Bellefont for bathing, to the University lounge or the country club for golf, or into the surrounding country to see its beauties. Apart from the wonderful scenery in the mountains, this part of Pennsylvania is of great interest in that the fertile valleys running between the ranges of the Alleghenies are to a large extent populated by what are known as the Pennsylvania Dutch. Descended from German settlers of the early eighteenth century, these hard-working simple farmers have retained the speech (Plattdeutsch), customs and religion of their fathers, and spend their primitive existences almost undisturbed by the whirl of modern American life all round them. Within a few miles of the roaring high road between Philadelphia and Pittsburgh one can come across communities of the strict sect of these people known as the Mennonites, both men and women of which do not cut their hair, and wear the plainest garments of dark grey cloth devoid of even so innocent a decoration as a button, in accordance with what they regard as the authority of the Bible. These parts are not only a stronghold of fundamentalism, but are rich in old German folk-lore and custom.

At 6.30 every evening, after an early dinner, it was possible to visit the local cinema and see series of films dealing with many aspects of chemical industry, after which at 8 came one of the semi-popular lectures in the "Bull-pen." The end of this lecture did not, however, close the day, but actually opened what proved to be one of the most enjoyable and profitable periods, namely, the hour or two when all the delegates foregathered, at one of the Fraternity Houses, for a chat and quiet rubber of bridge or an informal dance.

Many a friendship was made, and many a problem was thrashed out for better or worse at these pleasant informal evening gatherings.

Amongst the many excursions organised by the Committee the most interesting was to the home of Priestley at Northumberland on the Susquehanna River. The old house, situated in a pleasant garden sloping down to the river, stood much as it must have appeared in Priestley's time, except that neglect had caused it to fall into a very dilapidated condition. Fortunately, it was saved from the housebreakers' hands a few years ago by the efforts of the late Dr. Pond, then Dean of Chemistry at State College, Pa., and is now being restored and preserved by the American Chemical Society. The house in its present condition is shown

in the accompanying photograph, which does not, however, show the small museum that has been built in chemistry. Perhaps the success of the meeting was in greatest measure due to the arrangement by which



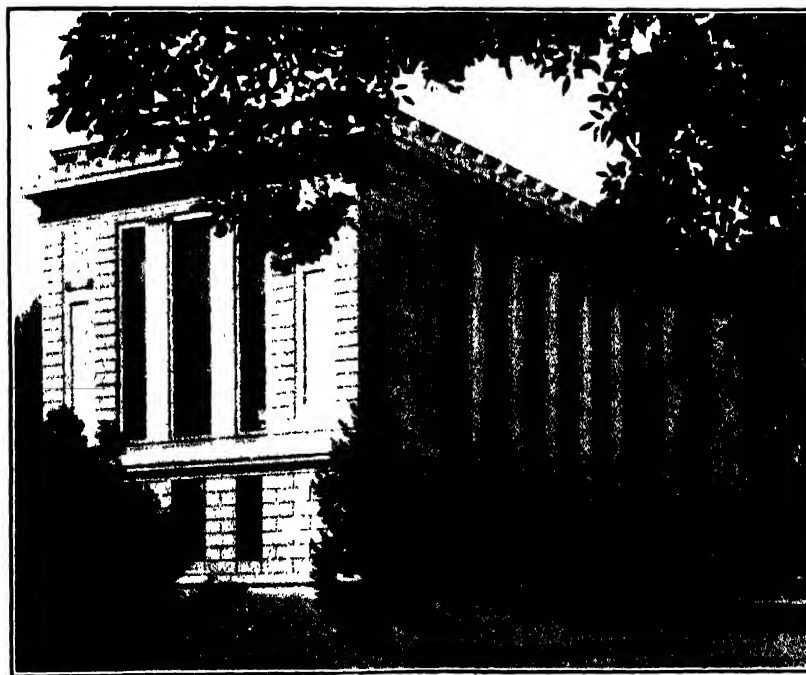
Dr. G. W. Kenney, Exec. Sec. Dr. F. C. Whitmore, Assoc. Director Dr. H. E. Howe, Editor, "Ind. and Eng. Chem." Dr. C. L. Parsons, Sec. A. C. S. Dr. G. Wendt, Director

A group of Organisers, State College, 1927

in the grounds to accommodate a valuable collection of Priestley's books, letters, and apparatus.

In every respect the Conference was a great success.

several days were devoted to the discussion of one or several closely-related subjects, which followed one another in a carefully-thought-out sequence. Thus



Part of the Uncompleted Block of Chemistry Buildings. State College, Pa.

The attendance was good, averaging from 200 to 250 each week, and representative of every branch of chemistry for four days the conferences and evening lectures dealt with theories of catalysis, surface films, catalytic

syntheses, ammonia synthesis, and oxidation and high-pressure synthesis, thereby enabling chemists who could

greater than the most optimistic member of the Committee had hoped to attain.



A group of Lecturers at the Institute of Chemistry, State College, 1927

not afford the time to attend the Institute for the whole period to be present for those days during which they would be sure to find a large proportion of the other

Already plans are being made for next year's meeting which, it is understood, will be held at the North Western University, Evanston, Ill., and the writers can wish



The House of Priestly, Northumberland, Pa.

scientists present sharing their interests and a programme presenting particular attractions.

The American Chemical Society is to be congratulated on the success of its new venture, which must have been

it no greater success than that which attended the first meeting, nor wish those delegates who will be there a more delightful experience than they themselves had at State College.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

LIST OF MEMBERS ELECTED

October 14, 1927

- Angus, Harold T., Brooklands, 331, Station Road, Yardley, Birmingham. Chief Chemist.
- Appleyard, Kenelm C., Birtley Springs House, Birtley, Co. Durham. Engineer.
- Archer, David C., "Gracemere," Haig Street, Maroubra, Sydney, N.S.W. Assistant Chemist.
- Arrowsmith, John C., The Pressed Steel Co. of Great Britain, Ltd., Cowley, Oxon. Metallurgist.
- Baldwin, Robert T., 52, East 41st Street, New York, N.Y., U.S.A. Secretary.
- Bartow, Edward, University of Iowa, Iowa City, Iowa, U.S.A. Professor of Chemistry.
- Bicknell, Richard S., 21, Bergen Place, Red Bank, New Jersey, U.S.A. Engineer.
- Blackater, John C. jun., 2, Crown Terrace, Dowanhill, Glasgow, W.2. Analyst.
- Bowyer, Cyril H., 73, Sternhold Avenue, Streatham Hill, Brixton, London, S.W.2. Assistant Chemist.
- Brabrook, George H., Tennis and Racquet Club, 939, Boylston Street, Boston, Mass., U.S.A. Mines and Mining.
- Bradshaw, Francis L., 83, Crane Avenue, Isleworth, Middlesex, Commercial Traveller.
- Bramson, Mogens L., Abbey House, 2-8, Victoria Street, London, S.W.1. Consulting Engineer.
- Brentnall, A. S., Betteshanger Colliery, Northbourne, Eastry, Kent. Chemist.
- Campbell, Robert C., c/o Rickett Smith & Co., 52, Mark Lane, London, E.C. Coal Salesman.
- Carothers, John N., Federal Phosphorus Co., Anniston, Ala., U.S.A. Vice-President.
- Carter, George H., "Greenholme," 31, Horsforth Avenue, Bridlington, Yorks. Metallurgical Chemist.
- Dodds, George P., c/o Isaac Spencer & Co., Ltd., Albert Quay, Aberdeen, Scotland. Factory Manager.
- Donald, Maxwell B., Oficina Celia, Estacion Salinas, Pampa Central, Antofagasta, Chile, S.A. Chemical Engineer.
- Drummond, Walter J., Ashington Colliery, Ashington, Northumberland. Engineer.
- Dunworth, James F., 9, Boston Avenue, Currock, Carlisle, Works Chemist.
- Durnford, Norman S. M., c/o James Durnford & Son, Ltd., Wapping Wharf, Bristol. Managing Director.
- Edwards, John, 8, The Grange, Westbury-on-Trym, Bristol. Technical Chemist.
- Evans, J. M., c/o Associated Oil Co., Associated, California, U.S.A. Chemist.
- Garçon, Jules, 82, rue Taitbout, Paris, IXe, France. Engineering Chemist.
- Garner, William E., Chemical Department, The University, Bristol. Professor of Chemistry.
- Golodetz, Nathan, 117A, Fenchurch Street, London, E.C.3. Director of Companies.
- Green, George C., 469, Belchers Lane, Little Bromwich, Birmingham. Analytical Chemist.
- Honeysberg, Herman F., c/o Apartado No. 318, Bogota, Rep. of Colombia, S. America. App. Chemist.
- Hopkinson, Percy, 28, Rhodesia Road, Chesterfield. Industrial Furnace Engineer.
- Hunter, Miss Elizabeth, PX Laboratory, Parlin, New Jersey, U.S.A. Chem. Librarian.
- Kenney, Frederick J., P.O. Box 225, Hewlett, Long Island, New York, U.S.A. Chemist.
- Landon, Nathaniel R., Delaware, Lackawanna & Western Coal Co., 120, Broadway, New York, U.S.A.
- Liebovitz, Dr. Sidney, Bolinross Chemical Co., 12-22, Orange Street, Newark, N.J., U.S.A. Chemist.
- Macdonell, Colin C., 514, Essex Avenue, Narberth, Pa., U.S.A. Chemist.
- McLusky, John W., City Chambers, 30, John Street, Glasgow, C.1. Gas Engineer.
- Mahler, Paul, 50, East 41st Street, New York City, U.S.A. Consulting Chemist.
- Meredith, David O., Electrolytic Zinc Co. of Australasia, Ltd., P.O. Box AA B, Hobart, Tasmania. General Superintendent.
- Mundy, Cecil W. A., "Lyndhurst," London Road, Ewell, Surrey. Oil Technologist.
- Norman, George M., c/o Hercules Powder Co., Wilmington, Delaware, U.S.A. Technical Director.
- Odams, Ronald C., Stanford House, Stanford-le-Hope, Essex, Chemist.
- Palmer, Charles S., Chemical Laboratory, Northwestern University, Evanston, Ill., U.S.A. Assistant Professor of Chemistry.
- Reece, William H., Leyland & Birmingham Rubber Co., Ltd., Leyland, near Preston, Lancs. Chemist.
- Sohn, Erwin, c/o Standard Sanitary Mfg. Co., 2801, Preble Avenue, Pittsburgh, Pa., U.S.A. Director of Research.
- Tower, Dr. Olin F., Western Reserve University, Cleveland, Ohio, U.S.A. Professor of Chemistry.
- Wheeler, Albert W. E., 98, Clements Road, East Ham, London, E.6. Works Chemist.
- Wilson, Ellery L., c/o Rumford Chemical Works, Rumford, R.I., U.S.A. Vice-President and General Superintendent.

NOTTINGHAM SECTION

The meetings of the Nottingham Section of the Society commenced on October 19 with an address by John Allan, F.R.S., on "Soaps in the textile industry." On November 9 the subject will be "The action of chlorine and hypochlorous acid on wool," by S. R. Trotman, M.A., and E. R. Trotman, Ph.D. The final meeting of the year will be held on December 7, when Prof. R. Robinson, D.Sc., F.R.S., will speak on "The indole group of the alkaloids." In the New Year a meeting will be held on January 11 or 12, when S. R. Trotman and E. R. Trotman will present a paper on "The action of acids on wool."

CALENDAR OF FORTHCOMING EVENTS

Oct. 24.—Institution of Electrical Engineers. Informal Meeting.

Oct. 24.—Institution of Mechanical Engineers, *Graduates' Section*. Storey's Gate, Westminster, S.W.1, at 6.30 p.m. "The liquefaction of air," by J. Rogers.

Oct. 27.—Society of Chemical Industry and Institute of Chemistry, *Edinburgh and East of Scotland Sections*. Joint Meeting. The North British Station Hotel, Edinburgh, at 7.30 p.m. Inaugural address by J. Adam Watson.

Oct. 27.—Coke Oven Managers' Association. Annual General Meeting at the Hotel Great Central, London, at 2.30 p.m., when Mr. G. A. Hebden will deliver his Presidential address. At 6.30 p.m. the Annual Dinner will be held.

Oct. 27.—Institute of Brewing, *North of England Section*. Midland Hotel, Manchester. "The determination of anti-septic power, with special reference to hops," by Dr. T. K. Walker.

Oct. 27.—Institution of Mining and Metallurgy. *General Meeting*. Burlington House, Piccadilly, W.1, at 5.30 p.m.

Oct. 27.—Institute of Brewing, Midland Counties Section, White Horse Hotel, Congreve Street, Birmingham. "Brewer's microscope—a demonstration of its selection and use, with some hints on photomicrography," by H. Lloyd Hind.

Oct. 27.—Institution of the Rubber Industry, Manchester and District Section, Geographical Society, St. Mary's Parsonage, Manchester. "Transmission and conveyor belting," by W. A. M. Keith.

Oct. 28.—Institution of Mechanical Engineers. Informal Meeting.

Oct. 28.—Manchester Literary and Philosophical Society. Chemical Section Meeting.

Oct. 28.—West Cumberland Society of Chemists and Engineers, at 7 p.m. "Use of explosives in mining and quarrying," by J. E. Lambert.

Oct. 28.—Coke Oven Managers' Association. Visit to H.M. Fuel Research Station, East Greenwich, by the courtesy Dr. C. H. Lander.

Oct. 28.—The Physical Society, Imperial College of Science and Technology, Imperial Institute Road, South Kensington, S.W.7, at 5 p.m.

Oct. 28. Institution of Chemical Engineers, at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1, at 6.30 p.m. Public Lecture by Sir William Bragg, K.B.E., F.R.S., on "Crystallisation."

Oct. 28.—Society of Chemical Industry, Liverpool Section. The University, Liverpool, at 6 p.m. "Merseyside and chemical industries," by Dr. A. Holt.

Oct. 28.—University of London, University College, Gower Street, W.C.1, at 5.15 p.m. "Symbiosis, parasitism and immunity in plants," by Prof. B. Nemes.

Oct. 31. Society of Chemical Industry, Yorkshire Section. Joint meeting with the Institute of Chemistry, Leeds Area Section. The University, Leeds, at 7.15 p.m. "Flame," by O. C. de C. Ellis.

Nov. 1.—Royal Institution of Great Britain, 21, Albermarle Street, W.1, at 5.15 p.m. "Light and sight," by Sir J. H. Parsons.

Nov. 1.—Institute of Metals, North-East Coast Local Section. Armstrong College, Newcastle-on-Tyne, at 7.30 p.m. "Mechanical properties of metals at high temperatures," by G. Burns.

Nov. 1.—Institution of Civil Engineers, Ordinary Meeting. Great George Street, Westminster, S.W.1, at 6 p.m.

Nov. 2.—Institution of Sanitary Engineers. Annual Dinner.

Nov. 2.—Society of Public Analysts, Ordinary Meeting. St Mary's Hospital, W.2 at 8 p.m.

Nov. 3.—Chemical Society, Ordinary Scientific Meeting. Burlington House, Piccadilly, W.1, at 8 p.m.

Nov. 3.—Institution of Electrical Engineers, Ordinary Meeting. Savoy Place, Victoria Embankment, London, W.C.2, at 6 p.m. "Higher steam pressures and their application to the steam turbine," by A. H. Law and J. P. Chittenden.

Nov. 3.—Society of Dyers and Colourists, West Riding Section. "The synthesis of sugars from carbonic acid by means of light," by Prof. E. C. C. Baly.

Nov. 3.—Society of Chemical Industry, Bristol Section. The University, Woodland Road, Bristol, at 7.30 p.m. "The manufacture of viscose artificial silk," by H. H. S. Clotworthy.

Nov. 4.—Institution of Mechanical Engineers, Thomas Hawksley Lecture. Storey's Gate, St. James's Park, S.W.1, at 6 p.m. "Application of X-rays to the study of the crystalline structure of materials," by Sir W. H. Bragg.

OBITUARY

Dr. R. GREIG-SMITH

It is with great regret that we have to announce the death of Dr. Robert Greig-Smith, D.Sc., a member of the Society of Chemical Industry since 1890, and the chairman of the Sydney Section of the Society from 1906 to 1908. He was joint secretary with Mr. R. H. Cambage of the Royal Society and Macleay bacteriologist to the Linnean Society of New South Wales, and published numerous papers connected with his researches in general, economic, and pathological bacteriology. He was born in Edinburgh in 1866, and educated at George Watson's College and later at the Edinburgh University, where he won the medal in chemistry, the special prize in senior botany, and first-class honours and prizes in other subjects. In 1891 he was appointed lecturer in agricultural chemistry in the University of Durham College of Science, and was additional examiner in agricultural chemistry in the University of Edinburgh and additional examiner in chemistry and physics to the Highland and Agricultural Society of Scotland. In 1890 he took the degree of B.Sc., and graduated D.Sc. of Edinburgh in 1903 with a thesis on certain fermentations of saccharose. He was also awarded the M.Sc. of Durham. He was a great student and a man of sterling worth, who will be greatly missed.

CORRESPONDENCE

UTILISING A BROKEN BURETTE

SIR, —With further reference to my letter in your issue of September 30, under this heading, Mr. V. Stott, of the National Physical Laboratory, through the courtesy of the Director, has kindly pointed out to me the importance of making the orifice of the inserted jet of such size as to give the burette the same delivery time after repair as it had before breakage.

At the time I wrote the letter, I fear that I had uppermost in mind the value of the little gadget to the student who has had the misfortune to break his burette tap, and to the institution whose annual grant is strictly limited in amount.

I should be glad if you would publish this in order that the value of Mr. Stott's recommendation is not lost.

I am, Sir, etc.

Technical College, Huddersfield

A. O. JONES

PERSONAL AND OTHER ITEMS

The Rt. Hon. Viscount Cave, G.C.M.G., Lord Chancellor of England and Chancellor of the University of Oxford, will open the new School of Biochemistry at Oxford on October 21.

Sir Alfred Mond and Sir Robert Hadfield were among the speakers at a meeting held last Monday at the Mansion House, under the presidency of the Lord Mayor of London, with the object of exploring the possibility of establishing peace in industry (cf. p. 950).

Lieut.-Col. E. T. Lea has been elected Prime Warden and Mr. E. P. T. Elyard as Reuter Warden of the Dyers' Company.

According to the *Evening News*, Sir John Brunner has resigned from the board of Imperial Chemical Industries, Ltd.

We are glad to announce that Mr. J. W. Woolcock, B.A., the son of Mr. W. J. U. Woolcock, C.B.E., Past-President of the Society of Chemical Industry, has been elected to a war memorial studentship in chemistry at Balliol College, Oxford. Mr. Woolcock, junr., who was formerly at St. Paul's School, and recently a Williams exhibitor in National Science of Balliol College, obtained a first class in the final school of natural science (chemistry) last June.

Prof. E. Cohen, director of the Van't Hoff Laboratory of the University of Utrecht, has celebrated the completion of 25 years' occupancy of his chair in the University. Prof. Cohen, who is a well-known figure at chemical gatherings in England and abroad, will receive the heartiest congratulations from all chemists.

Mr. E. George Eddy has consented to accept nomination as Mayor of Kidderminster for the ensuing year. He is managing director of Messrs. B. Hepworth & Co., chemical manufacturers, of Kidderminster, and Cleckheaton, Yorks.

Mr. W. Cartwright has been appointed assistant lecturer in metallurgy and Mr. C. Chew has been appointed demonstrator in chemical technology in the University of Manchester.

Prof. J. A. Prescott, professor of agricultural chemistry in the Waite Institute, University of Adelaide, has been appointed adviser on soil problems to the Commonwealth Council for Scientific and Industrial Research.

At Emmanuel College, Cambridge, the research studentship in biochemistry held by C. Rimington, B.A., has been continued, and a grant from the Research Fund has been made to C. B. Allsopp, B.A., for research in physical chemistry.

The Institution of Civil Engineers has awarded the Howard Quinquennial Prize to Prof. W. E. Dalby, in recognition of his researches on the strength and structure of iron and steel.

The late Mr. W. Stubbs, J.P., a retired manager of salt works belonging to the Salt Union, Ltd., left £5276.

The following deaths are announced from Germany:—G. Eichler, formerly director of the German Potash Syndicate; Dr.-Ing. E. Ichenhaeuser, a deputy director of the I.G. Farbenindustrie A.-G.; L. Rosney, a well-known petroleum expert; Dr. J. Ephraim, a well-known chemist and patent expert; Prof. E. Lawes, of Hannover; Dr. H. Gebhard and Dr. Weber, chemists at the Offenbach works of the I.G. Farbenindustrie A.-G., as the result of an accident.

Sources of Vitamins A and D

In *Nature* (October 8), Mr. P. W. Tainsh, of the Port Sunlight Research Laboratories, referring to a previous letter by Messrs. Rosenheim and Webster (*Nature*, September 24, noted in CHEMISTRY AND INDUSTRY, October 7, p. 912), states that a large-scale method has been developed in those laboratories of obtaining from cod-liver oil a palatable extract containing vitamins A

and D in highly concentrated form, and it has been found possible to incorporate this concentrate in margarine without loss of vitamin efficiency, as has been shown by colorimetric and biological tests. Margarine containing uniform quantities of both vitamins of the same order as those found in butter could now be purchased.

Mr. C. A. Hill, of the British Drug Houses, Ltd., writes (*Nature*, October 15) to say that ergosterol is now available commercially, as it and the irradiated product are made on a large scale by the British Drug Houses, Ltd. It is already on the market in a popular form for public use: it is available for margarine manufacturers to bring their product up to the standard of summer butter, which they can do at a fractional increase in cost; and chocolate manufacturers are already experimenting with it.

The Chemist at the Motor Show

If proof were needed, Olympia this year shows whether cellulose products are replacing oil paint in the motor-car trade or not. Of the 630 odd cars on show, 120 are finished in cellulose paint, 146 in the Weyman type fabric, and the remainder fall to the older type of oil paint. Last year 56 cars were finished by the cellulose process, and one or two French cars had fabric bodies. The previous year cellulose made its first appearance in this country. Is this not progress, and one of which the chemist may justly be proud?

Cellulose paints find themselves now not without a new competitor in the form of the fabric-covered body. This is made up to resemble leather, and in the majority of cases consists of a nitrocellulose base. Some fabrics are definitely stated to be "cellulose leather fabric," whilst others are marketed under the trade names of Rexine, Ceymal, Fabrikoid and Autohyde.

Are there remaining any of the old-established oil and paint manufacturers still too sceptical to be interested in cellulose lacquers and enamels?—H.S.G.

Metallurgical Photomicrographic Apparatus

From *Nature* it is learned that several orders for metallurgical photomicrographic apparatus have recently been placed abroad. To meet this unsatisfactory position Sir Robert Hadfield, Bart., F.R.S., announces that as his firm, Messrs. Hadfields, Ltd., desires to purchase an up-to-date outfit for metallurgical photomicrography, he or his firm is prepared to pay a premium of £50 over the price of the foreign apparatus for a British-made equipment which fulfils metallurgical requirements as well as does the foreign product.

Faraday Society's "Transactions"

In future the *Transactions* of the Faraday Society will be published in twelve monthly parts. Where the reports of general discussions extend over more than one part, two or more parts may be published simultaneously. The membership subscription remains unchanged, and the *Transactions* will still be available to non-members in the form of volumes or of parts.

Chemical Warfare

The International Red Cross Committee of Geneva has decided to call an international meeting of experts to study how to protect civilians against the effects of chemical warfare. The meeting will be held in Brussels on January 16, 1928.

High-pressure Boilers

There is every probability that very high steam pressures will come into use in the chemical industry. Already a 4000 sq. ft. cross-drum type of boiler, working at 1000 lb. pressure, has been installed at a Missouri sawmill to provide high-pressure steam for the conversion of waste into fibreboard, and other high-pressure boilers for chemical works are said to be under consideration.

British Standard Paints

The British Engineering Standards Association has recently issued British standard specifications (Nos. 293, 294, 295, 297, 298, and 299 of 1927) for ready mixed linseed oil paint (oil gloss), green, black and red oxide of iron, lithopone oil paste for paints, red oxide of iron oil paste (class 1, natural or mixed oxides, and class 2, oxide of iron base) for paints. They contain clauses regulating the composition, together with standard reception tests, for the purchase of these materials, together with appendices giving methods of carrying out the tests.

Copies of these six new specifications (Nos. 293, 295, 297, 299, 1927) can be obtained from the British Engineering Standards Association (Publications Department), 28, Victoria Street, London, S.W.1, or from the publishers, Messrs. Crosby Lockwood and Sons, 7, Stationers' Hall Court, London, E.C.2, price 2s. 2d. each, post free.

Standard for Ice Cream

A deputation representing the Ice Cream Association of Great Britain and Ireland has submitted various recommendations for the control of the manufacture and distribution of ice cream to the Ministry of Health. The chief recommendations are that ice cream should be legally defined as a frozen product containing not less than 8% milk fat and not less than 10% milk solids not fat, and that its preparation and distribution should be controlled in a manner similar to milk.

Cinchona Alkaloids for Moth-proofing Fabrics

L. E. Jackson and H. E. Wassell (Ind. & Eng. Chem., October, 1927), in the course of an investigation of possible moth-repelling chemicals, have found that the cinchona alkaloids and their derivatives are particularly effective moth repellants (U.S.P. 1,615,843 of 1927). One of the cinchona alkaloids has been in successful commercial use for over a year in the dry-cleaning and dyeing industry, and the process promises to be applicable in a wide range of uses, particularly as a variety of solvents can be employed. Application (by spraying or immersion) is easy and economical, and the treatment does not show on or affect the properties of textiles.

Collapse of Ontario Nickel Mine

With reference to the collapse (cf. CHEM. & IND., October 7, p. 913) of the Worthington Mine in Ontario, one of the properties of the Mond Nickel Company, the directors of the company, in a statement issued to the Press, report that as the mine was the smallest and one of the company's oldest, the closing of it will in no way jeopardise the company's supplies of ore, nor affect their production of nickel.

Lignite Distillation in New Zealand

A company, Carbonite, Ltd., has been formed in Auckland to work the Debauche process for distilling lignite.

A test was recently made in Belgium during a week, on 75 tons of Waikato (New Zealand), and 11 cwt. of residual fuel per ton of coal was obtained. The yield of heavy oil was 10 galls., and of motor spirit 2 galls., though 11½ galls. and 2½ galls., respectively are expected to be obtained in commercial working. The fuel obtained after screening yielded a nut coal suitable for marine and industrial use, and fines which were briquetted. Both nut coal and briquettes gave excellent results in use.

Low-temperature Carbonisation in Chile

In 1926 a committee was appointed to consider the possibility, technical and commercial, of producing oil by the low-temperature carbonisation of Chilean coal. As a result of the recommendations of the committee, a bill has been drafted to provide for a Government guarantee for 10 years for a plant producing not less than 15 tons of oil daily, limited to Chilean coal owners able to ensure adequate supplies of coal. No action has yet been taken on this bill.

State Control of the Chilean Iodine Industry

According to the journal "Caliche," the iodine industry in Chile is to become a State monopoly. The distribution of orders among the producers, the method of production, and the price are all to be controlled by the State.

The I.G. Farbenindustrie

The synthetic motor fuel produced by the I.G. Farbenindustrie at its Leuna works was used by the winner of two races at a meeting held by the German Automobile Club on October 17.

A report of the recent meeting of the board of the I.G. Farbenindustrie states that production and output during the past year have increased, and business in all departments, including that of synthetic petrol, is excellent. The conclusion of negotiations between the I.G. Farbenindustrie and the Norwegian Hydro-Elektrisk Kvaelstov concern was announced.

It appears that the Norwegian company, which, it is stated, can supply electric power for the synthesis of nitrogen products more cheaply than any other similar firm outside Germany, is to treble its production of synthetic nitrogen products; the company is negotiating a loan of over \$20,000,000 in New York. The agreement with the I.G. provides for co-operation of the technical and sales departments of the two concerns and for the exchange of shares. The report also states that the use by the I.G. of brown coal instead of Ruhr coal for nitrogen fixation has appreciably reduced manufacturing costs.

Two employees of the I.G. Farbenindustrie have been poisoned at the trust's Offenbach-am-Main factory, owing to an escape of phosgene gas. The I.G. announces that the phosgene escaped from a leaky cylinder, and that the manufacture of phosgene was authorised by the Inter-Allied Military Commission of Control because it was needed for the production of dyestuffs. According to *The Times*, however, it has been stated in Offenbach that the container was one of two bought for research work, and the gas has never been manufactured at Offenbach or used for dye manufacture there. Phosgene gas is one of the poison gases used in warfare on account of their potency as lung irritants.

COMPANY NEWS

IMPERIAL CHEMICAL INDUSTRIES, LTD.

An interim dividend has been declared on the ordinary shares for the year ending December 31, 1927, at the rate of 3% actual, less tax. The ordinary shares issued, amounting to about £30,000,000, are entitled, after a payment of a cumulative dividend at the rate of 7% on the preference capital, to a non-cumulative dividend at the rate of 7% per annum, and to two thirds of the surplus divisible profits.

BELL'S UNITED ASBESTOS CO., LTD.

An interim dividend has been declared on the old ordinary shares, Nos. 1 to 140,000 and Nos. 200,001 to 353,532 of 1s. per share, being 5% (actual), less tax, on account of the current year. In raising the interim dividend from 2½% to 5%, the directors state they are merely reverting to their practice prior to 1921, and it is no indication that an increased total dividend for the year will be paid.

ANGLO-PERSIAN OIL CO., LTD.

After placing £1,300,000 to the various reserves and providing £450,000 as extra depreciation, payment has been recommended of a final dividend of 7½% less tax, on the ordinary shares, which, with the interim payment, makes the year's dividend 12½%, compared with 17½% for the previous year. The sum of £2,246,879 has been carried forward, subject to excess profits duty.

BURMAH OIL CO., LTD.

An interim dividend of 10%, less tax, has been announced, being the same as for the previous year.

ERINOID, LTD.

A final dividend has been recommended of 4% (actual), less tax, making 7%, less tax, compared with a total dividend of 10% for the previous year.

BRITISH CELANESE, LTD.

A decision of the Arbitration Court in Brussels has given the Tubize Company, states *The Times*, the right to use "Celane" processes in Belgium and other European countries. The Board of British Celane Ltd., announces that the decision only affects certain Continental rights which were never in the possession of the company, but belong to the Dreyfus-Clavel group. The decision, therefore, does not in any way affect British Celane, Ltd., or its exclusive rights for the manufacture and sale of "Celane" in Great Britain and throughout the British Empire with the exception of Canada.

BRITON FERRY CHEMICAL AND MANURE CO., LTD.

The report for 1926 shows a considerable diminution in profits compared with 1925, due to the fact that industries upon which the company is dependent for the sale of its manufactures were disorganised or entirely closed down for about eight months. After providing £8844 for debenture redemption and charging £3000 for depreciation, there remained a credit balance, including the balance brought in, of £5664, compared with £11,414. The directors decided to pay, on March 15, the dividend on the preference shares, less tax. Since resumption of ordinary trading conditions a steady expansion in the demand for acid has been experienced.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned. Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Sal ammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength, 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 80/82%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS
 Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton. C.o.R. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s. £50 per ton, according to quantity.

Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide. 2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep. 6s.—6s. 3d. per lb.

Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime. Brown, £9 10s.—£10 per ton. Good demand.
 Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal. £6—£9 per ton, according to grade and locality. Foreign competition severe.

Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.

Red Liquor.—9d.—10d.

Wood Creosote.—1s. 9d. per gal., unrefined.

Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.

Wood Tar.—£4—£5 per ton.

Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 7½d.—8d. per lb. Crude 60's, 2s. 3d.—2s. 5d. per gal.

Acid Cresylic, 99/100.—2s. 11d.—3s. per gal. 97/99.—2s. 4½d.—2s. 5½d. per gal. Pale, 95%. 2s. 3d.—2s. 4d. per gal.

Dark, 90%. 1s. 9d.—1s. 10d.; 95%. 2s. 1d.—2s. 2d. per gal.

Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.

Benzole. Crude 65's, 9½d.—9¾d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 6d. per gal., ex works in tank wagons.

Toluole.—90%. 1s. 4d.—1s. 8d. per gal. Pure, 1s. 6d.—2s. per gal.

Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 4d.—1s. 5d. per gal.

Creosote.—Cresylic 20/24%—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7¾d. per gal. ex works. Salty, 7d. per gal., less 1½%.

Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.—10d. per gal. Solvent 95/160, 10½d.—1s. 4d. per gal. Solvent 90/190, 9½d.—1s. 3d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.

Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.

Pitch, medium soft.—84s.—87s. 6d. per ton, f.o.b. according to district. Market firm.

Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180—4s.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.

Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.

Acid H.—3s. per lb.

Acid Naphthionic.—1s. 6d. per lb.

Acid Neville and Winther.—4s. 9d. per lb.

Acid Sulphanilic.—8½d. per lb.

Aniline Oil.—7½d. per lb., naked at works.

Aniline Salts.—7½d. per lb., naked at works.

Anthranilic Acid.—6s. per lb., 100%.

Benzaldehyde.—2s. 3d. per lb.

Benidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—5½d. per lb.

m-Cresol 98/100%.—2s. 7½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—2s. 3d. per lb.

Dimethylaniline.—1s. 11d. per lb.

Dinitrobenzene.—9d. per lb., naked at works. £75 per ton.

Dinitrochlorbenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

α-Naphthol.—2s. per lb. d/d.

β-Naphthol.—10d. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb.

β-Naphthylamine.—3s. per lb.

p-Nitraniline.—1s. 8d. per lb.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb.

R. Salt.—2s. 2d. per lb.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—7½d. per lb.

p-Toluidine.—2s. 2d. per lb., ex works, naked.

m-Xyldine Acetate. 2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 3½d.—2s. 4½d. per lb.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—(Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 4d. per lb. Technical 11½d.—1s. per lb. Good demand.

Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Amidol.—9s. per lb. d/d.

Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.

Amidopyrim.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—9s. 6d. per oz.

Barbitone.—5s. 9d.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—9s. 9d.—9s. 10d. per lb. Bismuth

Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—

8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—

8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb.

Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Sub-

chloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—

7s. 9d.—8s. per lb. Extra and reduced prices for

smaller and larger quantities respectively; Liquor

Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.

—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s.

per cwt., according to quantity, carr. paid any station in

Great Britain in ton lots:

Bromides.—Ammonium.—2s.—2s. 3d. per lb. Potassium,

1s. 9½d.—1s. 10½d. per lb. Sodium.—2s.—2s. 1d. per lb.

Granulated $\frac{1}{2}$ d. per lb. less. All spot. Large quantities at lower rates.

Calcium Lactate.—1s. 2d.—1s. 3 $\frac{1}{2}$ d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.

Chloroform.—2s. 3d.—2s. 7 $\frac{1}{2}$ d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ethers: S.G. 730, 10 $\frac{1}{2}$ d.—1s. 1 $\frac{1}{2}$ d. drums. Other gravities at proportionate prices.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—4s. 9d.—5s. per lb.

Hexamine.—2s. 3d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal. in carboys; Winchesters, 2s. 11d. per gal.; 20 vols., 4s. 3d. per gal. in carboys; Winchesters, 5s. per gal.

Hydroquinone.—2s. 11d.—3s. 2d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate.—B.P.—2s. 1d.—2s. 4d. per lb. (Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—18s.—20s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2 $\frac{1}{2}$ %; Heavy Commercial £21 per ton, less 2 $\frac{1}{2}$ %; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol—A.B.R. recryst., B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.

Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonal.—8s. 9d.—9s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—2s. 6d.—2s. 9d. per lb.

Phenazone.—4s.—4s. 3d. per lb.

Phenolphthalein.—6s. 6d.—6s. 9d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2 $\frac{1}{2}$ %.

Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.

Resorcin.—3s. 9d.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 7d.—1s. 9d. per lb. Crystal, 1s. 8 $\frac{1}{2}$ d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.

Sulphonal.—6s. 9d.—7s. per lb.

Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.

Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—6s. 6d. per lb.

Aubepine (ex Anethole).—10s. 6d. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.

Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.

Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 16s. 3d. per lb.

Coumarin.—9s. 9d. per lb.

Citronellol.—13s. 9d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—6s. 6d. per lb.

Ethyl Phthalate.—2s. 9d. per lb.

Eugenol.—8s. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 15s. per lb. (ex Shui Oil) 10s. 6d. per lb. Linalyl Acetate.—(ex Bois de Rose) 18s. 6d. per lb.—(ex Shui Oil) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 8d. per lb. Vanillin.—17s.—17s. 6d. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—2s. 9d. per lb. Bergamot.—26s. per lb. Bourbon Geranium.—14s. per lb.

Camphor.—75s. per cwt. Cananga, Java, 17s. per lb.

Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d per oz. Citronella.—Java, 1s. 9d. per lb., c.i.f. U.K. port, for shipment over 1928. 1s. 7 $\frac{1}{2}$ d. prompt shipment from Java. Ceylon, Pure, 1s. 8d. per lb. Clove, pure 5s. 3d. per lb.

Eucalyptus, Australian.—2s. 2d. per lb. Lavender.—Mont Blanc, 28/40%, 17s. per lb. Lemon.—7s. 6d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 30s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—9s. 3d. per lb. Peppermint.—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 6d. per lb. Sandalwood—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Dec. 12th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Oct. 27th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Blau, Separating mixtures of gas etc. 26,247. Oct. 4. (Ger., 5.10.26.)

Burn and Lancaster, Mixing-machines. 26,502. Oct. 6.

Delbag-Entstaubung Ges., and Klug. Filters for gases. 26,230. Oct. 4.

Johnson (I.-G. Farbenind.). 26,709. *See* II.

Laing and McCleary. Separation of powdered etc. materials. 26,179. Oct. 4.

Marks (Dearborn Chemical Co.). Fluid-treating apparatus. 26,088. Oct. 3.

Pehrson. Extraction of substances from gases etc. 26,431. Oct. 6. (Sweden, 7.10.26.)

Siemens Schuckertwerke. 26,204. *See* XI.

Ver Mehr. Mixing-machines. 26,588. Oct. 7.

I.—Complete Specifications

16,264 (1926). Lucas. Edge-runner mills. (278,069.)

16,367 (1926). Hillier. Evaporators. (278,075.)

17,040 (1926). Pease. Washing-apparatus involving the intermixing of gases and liquid. (278,105.)

17,897 (1926). Muchka. Heat-exchange apparatus. (272,152.)

21,676 (1926). Sonsthagen. Mixing-machines. (278,152.)

21,933 (1926). Pochin and Pochin. Removing dust from grinding and like machines. (278,156.)

24,625 (1926). Smith and Smith. Mixing-apparatus. (278,177.)

29,626 (1926). Pollak (Trocknungs-, Verschmelzungs- und Vergasungs-Ges.). Annular rotary hearth ovens. (278,207.)

30,910 (1926). Marks (Traylor Engineering & Manufacturing Co.). Ball mills. (278,214.)

3607 (1927). Martinez and Kirk. Crushing and mixing mills of the edge-runner type. (278,236.)

9199 (1927). Industrial Associates, Inc. Spray-drying. (278,263.)

17,100 (1927). Poleo Feuerlösch Apparate Ges. Fire-extinguishing compounds. (273,713.)

22,047 (1927). Hillier. Evaporators. (278,299.)

*21,453 (1927). Pesca. Centrifugal separators and driers. (278,327.)

*25,433 (1927). British Thomson-Houston Co., Ltd. Crucibles. (278,367.)

II.—Applications

Anglo-Persian Oil Co., Ltd., and Wheeler. Treatment of hydrocarbon gases. 26,719. Oct. 8.

Blau. 26,247. *See* I.

Gas Light & Coke Co., Hollings, and Neath. Carbonisation of coal etc. 26,495. Oct. 6.

General Carbonalpha Co. Manufacture of hydrocarbons etc. 26,606. Oct. 7. (Holland, 7.10.26.)

I.-G. Farbenind. Hydrogenation of coals etc. 26,443. Oct. 6. (Ger., 14.10.26.)

Imray (Morgan). Gas-producing plant. 26,322. Oct. 5.

Johnson (I.-G. Farbenind.). 26,065. *See* XII. Manufacture of lubricating etc. oils. 26,332. Oct. 5. Low-temperature carbonisation of fuels. 26,444. Oct. 6. Manufacture of hydrocarbon derivatives etc. 26,445. Oct. 6. Production of combustible gases from granular fuels. 26,707. Oct. 8. Gas producers. 26,708. Oct. 8. Apparatus for purifying gases. 26,709. Oct. 8.

Koppers Co. Vertical coking retort ovens. 26,349. Oct. 5. (U.S., 8.1.27.)

Kulzinski. Distilling solid fuels. 26,583. Oct. 7. (Esthonia, 7.10.26.)

Laing and Nielsen. Distillation of carbonaceous materials. 26,177. Oct. 4.

Masterton. Gas calorimeters. 26,630. Oct. 8.

Salerni. Distillation retorts. 26,488. Oct. 6.

Spencer. Gas-scrubbers. 26,019. Oct. 3.

Turner, and Turner & Co. Gas-producers. 26,165. Oct. 4.

Turner, and Turner & Co. Gas-producers. 26,165. Oct. 4.

Turner, and Turner & Co. Gas-producers. 26,165. Oct. 4.

Turner, and Turner & Co. Gas-producers. 26,165. Oct. 4.

Turner, and Turner & Co. Gas-producers. 26,165. Oct. 4.

Turner, and Turner & Co. Gas-producers. 26,165. Oct. 4.

Turner, and Turner & Co. Gas-producers. 26,165. Oct. 4.

16,452 (1926). Bereslavsky. Motor fuels. (258,550.)

18,631 (1926). Puening. Carbonising coal. (258,942.)

617 (1927). Kay. Apparatus for cracking oils. (276,947.)

2574 (1927). Tormin. *See* X.

3429 (1927). I.-G. Farbenind. Catalytic oxidation of carbon monoxide. (265,624.)

3477 (1927). Jansen. Cracking hydrocarbons. (278,235.)

*20,866 (1927). Sundin. Producing carbonic acid gas. (278,304.)

*24,120 (1927). I.-G. Farbenind. Manufacture of motor fuels. (278,341.)

*25,631 (1927). British Thomson-Houston Co., Ltd. Anti-sludging means for oil. (278,365.)

*25,861 (1927). Patentakt. Gröndal-Ramen. Manufacture from bituminous shales of a product for dry distillation. (278,378.)

IV.—Applications

British Alizarine Co., Ltd., and Barnard. Manufacture of dyestuffs etc. 26,380. Oct. 6.

Carmmael (I.-G. Farbenind.). Manufacture of substituted indoles. 26,223. Oct. 4. Manufacture of cyanogen chloride. 26,225. Oct. 4.

I.-G. Farbenind. Manufacture of chlorine substitution products of 1-amino-2:4-dimethylbenzene. 26,483. Oct. 6. (Ger., 6.10.26.) Production of azo dyestuffs etc. 26,565. Oct. 7. (Ger., 22.10.26.)

Soc. Chem. Ind. in Basle. Purifying vat-dyestuffs. 26,482. Oct. 6. (Switz., 6.10.26.)

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Soc. Chem. Ind. in Basle. Purifying vat-dyestuffs. 26,482. Oct. 6. (Switz., 6.10.26.)

VI.—Applications

- Ahnert. Mercerising cotton. 26,112. Oct. 3.
 Heberlein & Co. Treatment of fabrics. 26,213. Oct. 4.
 I.-G. Farbenind. Treatment of fibrous materials. 26,706.
 Oct. 8. (Ger., 22.5.25.)

VII.—Applications

- Carpmael (I.-G. Farbenind.). Manufacture of white titanous acid. 26,224. Oct. 4.
 Lacell, and New Metallurgy, Ltd. Production of chlorides from metallic oxides etc. 26,546. Oct. 7.
 Lambert, Robson, and National Processes, Ltd. Manufacture of sulphuric acid. 26,056. Oct. 3.
 Metallbank und Metallurgische Ges. Producing zinc salts. 26,614. Oct. 7. (Ger., 7.10.26.)

VII.—Complete Specifications

- 16,670 (1926). Smith, and Chemical and Metallurgical Corp. Treatment of lead chloride and winning lead from ores, residues, etc. (278,093.)
 19,323 (1926). Kyber. See IX.
 25,053 (1926). I.-G. Farbenind. Continuous distillation of crude carbon bisulphide. (260,236.)
 5251 (1927). I.-G. Farbenind. Treatment of crude nitrate of soda. (266,735.)
 *24,881 (1927). Fischer. Radioactive material. (278,347.)
 *25,740 (1927). I.-G. Farbenind. Extracting clay etc. with acids. (278,370.)

VIII.—Complete Specifications

- 16,266 (1926). Longenecker. See X.
 18,655 (1926). Duffield. Manufacture of bricks etc. from dolomite etc. (278,120.)
 13,372 (1927). British Thomson-Houston Co., Ltd. Methods of tinting glass. (271,481.)

IX.—Application

- Pontoppidan. Grinding cement etc. 26,689. Oct. 8.

IX.—Complete Specifications

- 19,323 (1926). Kyber. Manufacture of fused cement and gases containing phosphorus. (256,622.)
 29,295 (1926). Forsen. Manufacture of hydraulic cements. (272,163.)
 32,046 (1926). Rutgerswerke A.-G. Wood preservatives. (266,296.)
 2309 (1927). Montan, Inc. Impregnating wood. (265,206.)

X.—Applications

- Coles. Rustproofing wire etc. 26,398. Oct. 6.
 Corson. Alloys. 26,069. Oct. 3. (U.S., 20.10.26.)
 Evans. Treatment of tin scrap. 26,639. Oct. 8.
 Kelly. Alloys. 26,606. Oct. 3.
 Lacell, and New Metallurgy, Ltd. Electrolytic production of metals from their oxides. 26,339. Oct. 5.
 McClusky. Recovery of precious metals from ores. 26,589. Oct. 7. (U.S., 8.10.26.)
 Siemens und Halske A.-G. Manufacture of metallic beryllium etc. 26,442. Oct. 6. (Ger., 7.10.26.)

X.—Complete Specifications

- 16,246 (1926). Mathesius and Mathesius. Manufacturing steel in open-hearth furnaces. (258,835.)
 16,266 (1926). Longenecker. Refractory blocks for metallurgical furnaces. (278,070.)
 16,070 (1926). Smith, and Chemical and Metallurgical Corp. Ltd. See VII.
 22,465 (1926). Vulcan Detinning Co. Electrodeposition of tin. (269,474.)
 22,883 (1926). Kirchhof. Treating aluminium to render it weldable. (278,164.)
 30,094 (1926). Maximoff, Costa, and Krebs. Refining steel and pig-iron. (262,136.)
 2574 (1927). Tormin. Production of coke and ore masses. (265,228.)

- *27,924 (1926). Weishan. Production of soft-iron. (278,303.)

- *25,355 (1927). Corson. Alloys. (278,355.)

XI.—Applications

- Coles. 26,014. See XIV.
 Gore and Upward. Primary electric batteries. 26,092. Oct. 3.
 Lacell, and New Metallurgy, Ltd. 26,339. See X.
 Richardson. Electric etc. furnaces. 26,392. Oct. 6.
 Siemens Schuckertwerke. Electric gas-purifying plant. 26,204. Oct. 4. (Ger., 5.10.26.)

XI.—Complete Specifications

- 10,312 (1926). Fromont. Plates for electric accumulators. (250,985.)
 22,465 (1926). Vulcan Detinning Co. See X.
 32,943 (1926). British Thomson-Houston Co., Ltd. Electric furnaces. (263,857.)
 2663 (1927). British Thomson-Houston Co., Ltd. Electric furnaces. (265,950.)

XII.—Applications

- Böhme A.-G. Treatment of fats etc. 26,573. Oct. 7. (Ger., 25.11.26.)
 Johnson (I.-G. Farbenind.). Separation of oils from mixtures. 26,065. Oct. 3.

XII.—Complete Specifications

- 16,471 (1926). Lüdecke and Lüdecke. See XVIII.
 19,207 (1926). Akt. Forsøksdrift. Extracting oil from the blubber of marine animals. (257,582.)
 20,754 (1926). Downs and Bellwood. Extraction of oil from vegetable seeds etc. (278,145.)

XIII.—Applications

- Bailey. Manufacture of liquid packings, varnishes, etc. 26,307. Oct. 5.
 Carpmal (I.-G. Farbenind.). 26,224. See VII.
 Marks (Alox Chemical Corp.). Artificial shellac. 26,466. Oct. 6.
 Softening-agent for nitro-cellulose coating compositions. 26,467. Oct. 7.

XIV.—Applications

- Coles. Electrodeposition of rubber. 26,014. Oct. 3.
 Dunlop Rubber Co., Ltd., Murphy, and Twiss. Manufacture of transparent vulcanised rubber. 26,280. Oct. 5.
 Imperial Chem. Industries, Ltd., Hailwood, Naunton, and Shepherdson. Introducing chemicals into rubber etc. 26,616. Oct. 7.

- Johnson (I.-G. Farbenind.). Colouring rubber. 26,446. Oct. 6.

- Marks (Rubber Service Laboratories Co.). Vulcanisation of rubber. 26,585. Oct. 7.
 Naugatuck Chemical Co. Vulcanising rubber etc. 26,328 and 26,342. Oct. 5. (U.S., 1.11.26 and 9.12.26.)

XIV.—Complete Specifications

- 16,101 (1926). Liverpool Rubber Co., and Amende. Vulcanisation of rubber. (278,064.)
 23,712 (1926). Hercules Powder Co. Reclaiming rubber and fabric from scrap. (274,797.)

XVII.—Complete Specifications

- 16,471 (1926). Lüdecke and Lüdecke. See XVIII.
 *27,455 (1926). Raffinerie Tirmontaise. Decoloring sugar crystals. (278,302.)

XVIII.—Complete Specifications

- 16,471 (1926). Lüdecke and Lüdecke. Production of glycerin from sugar by fermentation. (278,086.)
 *8535 (1927). Commercial Solvents Corp. Butyl-acetonic fermentation. (278,307.)

XIX.—Application

- Ludwin (Jerabek). Preservation of meats. 26,658. October 8.

XX.—Applications

Böhme A.-G. Production of pyridine compounds. 26,447. Oct. 6. (Ger., 10.11.26.)

(Consort. f. Elektrochem. Ind. Manufacture of acetic anhydride. 26,323. Oct. 5. (Ger., 18.10.26.)

I.-G. Farbenind. Manufacture of condensation products from urea etc. 26,214. Oct. 4. (Ger., 4.10.26.)

Imperial Chem. Industries, Ltd., and Coffey. Manufacture of acyl derivatives of beta-ketonic esters and beta-diketones. 26,475. Oct. 6.

Johnson (I.-G. Farbenind.). Production of solutions of organic compounds etc. 26,705. Oct. 8.

Marks (Alox Chemical Corp.). Oxidation of hydrocarbons. 26,464. Oct. 6.

XXI.—Complete Specifications

11,414 (1926). I.-G. Farbenind. Manufacture of therapeutic agents. (251,651.)

30,216 (1926). Marks (U.S. Industrial-Alcohol Co.). Distillation of alcohol. (278,211.)

*8535 (1927). Commercial Solvents Corp. See XVIII.

*20,353 (1927). I.-G. Farbenind. Manufacture of acetaldehyde. (278,324.)

*25,182 (1927). Deleo-Light Co. Methyl ether. (278,353.)

*26,214 (1927). I.-G. Farbenind. Manufacture of condensation products from urea and an alcohol or a ketone. (278,390.)

XXI.—Application

Halden & Co., Ltd., and Holden. Photographic light-sensitive surfaces etc. 26,653. Oct. 8.

XXII.—Application

Hercules Powder Co. Preparation of nitrocellulose. 26,341. Oct. 5. (U.S., 8.6.27.)

XXII.—Complete Specification

12,908 (1926). I.-G. Farbenind. Treatment of nitrocellulose to render it safe. (252,382.)

XXIII.—Application

Sim. De-aerating feed water for boilers. 26,285. Oct. 5.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Argentina*: Nickel sheets, zinc sheets and ingots, other metal lines, asbestos, galvanised sheets, articles for polishing metals (310); brass bedstead tubes, brass sheets (311). *Belgium*: Vanilla (300). *British India*: Semi-diesel and cold-start crude oil engines (297). *Egypt*: Diesel engine (B.X. 3885). *Holland*: Porcelain and earthenware (303). *New Zealand*: Filtration plant (A.X. 5319). *Turkey*: Cast-iron pipes (A.X. 5332).

Dyestuffs (Import Regulation) Act, 1920

The following statement, relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during September, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee.

The total number of applications received during the month was 651, of which 512 were from merchants or importers. To these should be added 24 cases outstanding on August 31, making a total for the month of 675. These were dealt with as follows:—Granted, 598 (of which 562 were dealt with within seven days of receipt);

referred to British makers of similar products, 64 (of which 48 were dealt with within seven days of receipt); referred to reparation supplies available, two (both dealt with within two days of receipt); outstanding on September 30, 1927, 11.

Of the total of 675 applications received, 612, or 91 per cent. were dealt within seven days of receipt.

Instruments for Collieries

Scientific methods are being increasingly applied in the coal industry, and it is of interest to draw attention to a folder published by the Cambridge Instrument Co. Ltd., which reproduces a number of photographs illustrative of scientific methods as applied to colliery plant, and as used in government and other research stations. Instruments for power plant, coke ovens, experimental explosion chambers, as well as oscillographs, thread recorders, etc., are amongst those illustrated.

A New Dyestuff

The British Dyestuffs Corporation, Ltd., has issued a new pattern card illustrating an addition to the B.D.C. range of acid colours—Lissamine Red T. This colour is particularly suitable for the dyeing of wool hosiery yarns and material for knitting purposes generally, because of its very good penetrating power in conjunction with some fastness to washing.

News from Advertisements

The Department of Scientific and Industrial Research announces that a research chemist is required for work on plasters and other materials used for impressions and models in dentistry (p. vi).

A chemist assistant is required for service in the tropics (p. vi).

A position is available in a laboratory in North-West London (p. vi).

A highly-trained chemist requires a junior partnership in a chemical concern (p. vi).

There are now 122 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

THEORETICAL AND EXPERIMENTAL PHYSICAL CHEMISTRY. By J. G. Crocker, M.A., D.Sc., and F. Matthews, Ph.D., B.Sc. Pp. viii + 581. London: J. & A. Churchill, 1927. 21s.

COLLECTED PHYSICAL PAPERS OF SIR JAGADIS CHUNDER BOSE, M.A., D.Sc., LL.D., C.S.I., C.I.E. Bose Institute Transactions, 1927. Pp. xiii + 404. London: Longmans, Green & Co., Ltd., 1927. 10s.

A DICTIONARY OF APPLIED CHEMISTRY. By Sir Edward Thorpe, C.B., LL.D., F.R.S. Vol. VII. Thalenite—Z, with Index to Complete Work. Pp. viii + 765. Vol. VII. Revised and enlarged edition. London: Longmans, Green & Co., Ltd., 1927. 60s.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN. Edited by Dr. E. Abderhalden. Abt. I. Chemische Methoden, Teil 2, 1. Hälfte, Heft 4 (Schluss). Lieferung 240. Acyllieren. Acetalieren. By J. Halberkann. Pp. 863 + 1138. Berlin: Urban & Schwarzenberg, 1927. 16 m.

LUBRICATING GREASES. By E. N. Klemgard, B.Sc. Pp. 198. New York: The Chemical Catalog Co., Inc., 1927. \$5.50.

CANADA: GEOLOGY, MINES AND METALLURGICAL INDUSTRIES. By W. Malcolm and A. H. A. Robinson. Pp. vii + 214. Prepared for the Second (Triennial) Empire Mining and Metallurgical Congress. Dominion of Canada, Department of Mines, 1927.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW
SERIES

LONDON, OCTOBER 28, 1927

No. 43

EDITORIAL

International Chemistry

WE have read with much interest two notes in the News Edition of "Industrial and Engineering Chemistry" on this topic, indicating very plainly the American disapproval of the project for an International Bureau of Chemistry in Paris. The personal view of the Editor of CHEMISTRY AND INDUSTRY may not be of great importance in this connexion, but he is unable to obtain at short notice an official expression of opinion. We think that the procedure adopted by the promoters of the International Office of Chemistry was not the best that could have been chosen, and that the French chemists could have avoided many difficulties had they consulted the chemists of other nations a year earlier than they did. In France there is a close connexion between the government and chemistry; the French government contributes to the expenses of the Union Internationale and of the delegations attending foreign countries. In Great Britain there is no connexion, no contribution of this sort. British chemistry is entirely independent, and we doubt very much if public opinion in this country would favour governments taking a hand in such family matters as documentation, scientific museums, and chemical catalogues. On the other hand, when we reflect on the formation of the Union Internationale we feel compelled to offer a warm tribute to the French chemists for their cordiality and grace in meeting the wishes of the chemists of other nations. The assistance they receive from their government, and their geographical situation, give them an influence and a power which are wholly exceptional, and yet when the British chemists have, on many occasions, put forward propositions not in accordance with French ideas the propositions have been courteously considered and frequently adopted. The French chemists have ideas which differ very much from our own; nevertheless, it has always been delightful to work with them.

Better Concrete

The production of better concrete from normal Portland cement concerns all chemical manufacturers

who lay their own concrete, but, in addition, as a demonstration of the value of research upon a material which has been extensively used in constructional work for over a century, it is of interest to all who profess and call themselves chemists. Rapidly hardening concretes and concretes possessing other special characteristics such as resistance to alkali attack can be made with the aid of the newer aluminous cements, special Portland cements and other materials, but the common Portland cement, much more generally used, may be made to give better concretes than were obtained a few years back or, alternatively, equally good concretes at lower costs.

It has been conclusively shown that the amount of water used per unit weight of cement is the main factor which determines the quality of the final concrete, and the water-cement ratio law appears to have proved in its application that water is the most important single factor in the production of concrete of high strength. It has been put to us in this way: The addition of each pint of water above the proper amount has the same effect upon the strength of the concrete made as leaving out a quart of cement.

What, then, is the water-cement ratio law. Simply this, that thousands of experiments carried out by numerous investigators and confirmed in large-scale practice have proved beyond reasonable doubt that each bag of cement must be mixed with a definitely-ascertained amount of water. For concrete showing a compressive strength of 2000 lb. per sq. inch at 28 days, 6.75-7.5 gals. of water must be taken for every bag of cement. For concrete of a strength of 3000 lb., 5.5-6.0 gals. of water must be used, whilst as the required strength at 28 days rises, the amount of water to be used falls in a degree which may be ascertained from published tables. Good concrete can, of course, be made by more or less haphazard methods, but far more cement than is really necessary will almost invariably be used. By setting the water-cement ratio law at the base of mixing, equally

strong concretes can be made with assurance and economy.

It is not the place to enter into details of the application of the water-cement ratio law, but one or two points may be mentioned if any semblance to an outline of procedure is to be achieved. The sand and gravel aggregates used with cement in the production of concrete usually contain some water, which must be taken into consideration. If, for instance, the so-called 1:2:4 mix is being made, a cubic foot of cement—one bag—becomes associated with 2 cubic feet of sand and 4 cubic feet of gravel. Now a cubic foot of "dry" sand contains 0.2 gals. of water and a cubic foot of damp sand contains 0.6 gals. of water. Similarly, a cubic foot of "dry" and damp gravel contain respectively 0.0 and 0.1 gals. of water. Since, then, in all, a bag of cement must be mixed with 7 gals. of water in order to produce a concrete attaining a strength of 2000 lb. per square inch in 28 days, and since in the two cubic feet of, let us say, damp sand there are 2×0.6 gals. of water, and in the four cubic feet of damp gravel there are 4×0.1 gals. of water, or a total of 1.6 gals. of water in the combined damp aggregates the actual amount of mixing water must obviously be $7.0 - 1.6$ or 5.4 gals.

Further, the workability of the mix is of moment to the practical man, and attention must be paid with some care to this phase of concrete making. Some classes of work require a more plastic mix than others. Thus in general construction work a reasonably plastic mixture is needed in order to allow the concrete to be placed in the "forms" or around the reinforcing bars. Concrete for roadway construction can be made much drier, whilst in the manufacture of concrete blocks or tiles still less water is commonly employed so that the moulded article will "stand up" when removed from the machine. If we were to attempt to sum up the difficult question of workability in a single sentence we should say that the great essential is to use as nearly the correct amount of water demanded by the water-cement ratio law as is possible without sacrificing general workability. The relative amounts of fine and coarse aggregates may be varied, and, in short, the experience of the practical mixer may be relied upon to give the best "mix," containing the greatest possible amount of aggregates consistent with workability, density, and the most suitable amount of water.

We have been assured by ultra-conservative practical men that "the thing is impossible," and, indeed, it may often appear so at its first trial, but a survey of the specialised literature which has appeared in the last year or two seems to show - it is with some trepidation we write this as mere lookers-on—that the water-cement ratio law is essentially practicable. Much helpful information has been published and the successes of many contractors, particularly we suppose in America, where the law was discovered and first applied, leave no doubt in our mind that a new practical and economical method of making good concrete has been evolved. The water-cement ratio law is worthy of careful examination by all interested in the making of concrete.

THE GROWTH OF THE SCIENTIFIC TEXTBOOK

By JOHN E. CHANDLER

To write an article on the evolution of the scientific textbook would probably take more space than the Editor of this JOURNAL would care to give to the subject, as it would require some research into the origins, and also the use made, of the writings of those who spoke with a certain knowledge of the subject they practised in their day. It is therefore my intention to deal with the growth of some of the more modern books, and to show that the progress in the various sciences is made obvious by the books which deal with the subject.

There is one book which for many generations has been the favourite of the medical student, Henry Gray's "Anatomy, Descriptive and Surgical." The first edition of this wonderful work was published in 1858, and in those days was a bulky volume of 750 pages, but the illustrations were so remarkably good that many of them form the basis of the illustrations in the edition on sale to-day. The illustrations in this work when first published contained a certain amount of colour, and numbered in all 363. During the 69 years since this work was published, it has gone through twenty-three editions, and is now a volume of 1400 pages and 1294 illustrations, of which 616 are coloured. What an amount of knowledge has been gathered together by the various Editors since Gray's death in 1861 is represented in the additional pages and illustrations the work now contains.

Another instance with which the readers of this JOURNAL are more intimately acquainted, is Sir Edward Thorpe's "Dictionary of Applied Chemistry," which was first published as a work of three volumes. The first volume appeared in 1890, and volume three in April, 1893. This edition was several times reprinted, but a new edition was launched in 1912 in five volumes, in which the compiler said that during the last twenty years chemistry had advanced at a rate and to an extent altogether unprecedented in its history, or, indeed, in the history of any other science. Accordingly, in the attempt to make the new edition reasonably adequate as a presentation of contemporary knowledge, it had been found absolutely necessary to enlarge greatly the original scope of the book. Again the science has developed at such a rate that a new edition has now been published in seven volumes, and Sir Edward Thorpe, in introducing the first volume of the new edition, said: "It has become a truism to say that applied chemistry has exercised a profound influence on the character and direction of the war. It is equally true that the war has exercised a great influence on applied chemistry. It has led to an enormous expansion, more or less permanent, of certain branches both in this country and abroad. New products have been made, new processes have been devised, and established methods have been improved and extended." We know that what Sir Edward said was quite true, and naturally it affected the larger part of the articles in his great work. It is regretted by all scientific workers that Sir Edward Thorpe did not live to see the publication of the sixth and seventh volumes of his Dictionary, though, as a matter of fact, the articles were practically all in his

hands at the time of his death. One of the features of this new edition is the inclusion in the last volume of a detailed index of the whole work. It is interesting to note that the final revision for the press of the last two volumes was carried out by Dr. H. Forster Morley, who was one of the joint editors of the last edition of Watts' "Dictionary of Chemistry," another work which went through many editions, and has been reprinted on many occasions.

One of the great features of recent day scientific literature is the introduction of "Monographs" on the branches of the various sciences. The first issued in this country was a series of Monographs on Biochemistry, edited by Dr. R. H. A. Plimmer and Sir F. G. Hopkins. Sir Edward Thorpe edited a long series of books, as Monographs on Industrial Chemistry. Professor Starling had a series on Physiology, and Professor Findlay edited a series on Inorganic and Physical Chemistry. In the world of Physics, Sir J. J. Thomson, O.M., F.R.S., with Dr. Frank Horton, edited a series of Monographs on Physics. One of the first volumes of the series was: "Positive Rays and their Application to Positive Analyses," by Sir J. J. Thomson himself. There were other volumes on "Photo-Electricity," "Relativity and the Electron Theory," "Emission of Electricity from Hot Bodies," "Modern Seismology," etc. These various monographs were a great help to the student who wished to work up a certain subject and did not wish to wade through a complete treatise to get the matter he specially required.

If we go further back, we find in 1870 a series of text-books was arranged under the title of "Textbooks of Science," first edited by Professor T. M. Goodeve, but the active editor for many years was Charles W. Merrifield, F.R.S. This series was originally sold at 3s. 6d. each, and it was stated that the origin of the series was a report of the Public Schools Commission and of the Schools Inquiry Commission, as well as evidence taken before several Parliamentary Committees, who endeavoured to show that there was a want of a good series of text-books in science, thoroughly exact and complete, to serve as a basis for the sound instruction of artisans, and, at the same time, sufficiently popular to suit the capacities of beginners. The foundation of the Whitworth Scholarship was said to be in itself an evidence of the recognition of that want, and the reason for the production of a series of chemical and scientific works adapted to that purpose. That this series was of value at the time is evidenced by the fact that many of the books in this series are being used to-day. It was in this series that Professor J. Clerk Maxwell's famous classic "Theory of Heat" was issued.

It was also in the 'sixties and 'seventies of the last century that Professor John Tyndall, F.R.S., was issuing his marvellous series of text-books which were pioneers in the subjects with which they treated. His "Heat Considered as a Mode of Motion," his Lectures on Sound, Light, and other subjects, were also read by the general public.

There were other series of text-books of a more or less elementary kind; the London Science Class Books, edited by G. Carey Foster, F.R.S., and Sir Philip Magnus,

contained books, many of which are in use to-day. "Astronomy," by R. S. Ball, F.R.S., and "Geometry," by Professor O. Henrici, F.R.S., were two very popular volumes in the series.

The popular series of Science Primers edited by Professor Huxley, Sir H. E. Roscoe, and Professor Balfour Stewart were known to many students in the latter quarter of the last century, as they are known to the students of to-day.

Perhaps the most important work that is now being written is the monumental work of Dr. J. W. Mellor, who has recently been elected a Fellow of the Royal Society. This work, known as "A Comprehensive Treatise on Inorganic Chemistry," is already announced to run to 13 volumes. It is a work which aims at giving a complete description of all the compounds known in inorganic chemistry, and, wherever possible, these are discussed in the light of the so-called physical chemistry. In this work the student will find the growth of the leading principles and doctrines traced from their appearance as hazy and vague conceptions, and he can perceive that present-day chemistry is but a stage in the wonderful process of evolution. The teacher can use the work by selecting special sections for collateral reading by his students, and the research chemist will find general summaries with bibliographies that will save him many months of searching. The volumes already published contain about 1000 pages in each, and each page contains many hundreds of words. This work is the more remarkable as it is the work of one man. His other works, "Introduction to Modern Inorganic Chemistry," "Modern Inorganic Chemistry" and "Higher Mathematics," are known to all students of the science.

A book I remember very well is the translation of Ganot's "Éléments de Physique." This work was edited by Dr. E. Atkinson, who at the time was Professor of Experimental Science in the Royal Military College, Sandhurst. Many editions of this book were published, as were also that of the same author's work on Natural Philosophy. I think I am right in saying that this book was more or less superseded by the late William Watson's "Textbook of Physics," "Intermediate Physics," and "Textbook of Practical Physics." Ganot's illustrations were all of a pictorial nature, and many of them were used in various books by several publishers for a number of years. Watson illustrated his book by diagrams, and treated his subject more mathematically.

What the late Sir Edward Thorpe did for chemistry Sir R. T. Glazebrook has done for applied physics. His Dictionary is published in five volumes, and covers the ground in a comprehensive manner.

How the growth of a subject affects the text book is shown in a remarkable manner in Prof. E. C. C. Baly's work on Spectroscopy, which was first published in 1905 in a crown 8vo volume of 580 pages. Prof. Baly has just prepared a third edition of his work, which is to run to four demy 8vo volumes, the third volume of which has just been issued and alone runs to 540 pages. No doubt similar instances can be found in other subjects.

If one takes the trouble to go through the catalogue of British Scientific and Technical Books prepared by a committee of the British Science Guild, of which

Sir Richard Gregory is chairman, it will be at once realised that it is impossible in a short article to mention more than a few of the books which have made history in the science with which they deal. Around the majority of the books there is, no doubt, a story which would make interesting reading. Probably a few of them have been written in a similar way to the late Miss Acton's "Modern Cookery." Miss Acton first offered to the publishers a volume of poems, and the publisher, wishing to pacify the lady, regretted he was unable to publish her verse, but suggested she should write a cookery book, little thinking he would ever hear of her again. She took his advice to heart, prepared a cookery book, which had a life of over fifty years!

THE REVIEWING OF BOOKS

Books, dreams, are each a world, and books, we know,
Are a substantial world, both pure and good;
Round which, with tendrils strong as flesh and blood,
Our pastime and our happiness may grow.

How should we judge the merits of a book? To begin with, we must consider what sorts of books we have in mind, and for our present purpose we will confine our remarks to scientific books, omitting even from these the books which are not intended to be read, and are merely handy museums of scientific facts. Macaulay was of opinion that "the first rule of all writing—that rule to which every other is subordinate—is that the words used by the writer shall be such as most fully and precisely convey his meaning to the great body of his readers." We have no doubt that in many respects this is an admirable rule, but there are occasions when it should be disregarded. The first requisite, perhaps assumed by Macaulay, is that the book is readable: however many faults of style, of grammar, of taste, and so on the book has, if it is readable that is the great thing; many unreadable books could be written which were free from every fault except that they were uninteresting. Take our anonymous correspondent, CALORIFER, as an instance; he fills his writing with pitfalls for the unwary, so that reading his passages is like an obstacle race; he dilutes his facts with great masses of extracts from "The Hunting of the Snark," so that the facts are surrounded by an indefinable wrapping, resembling the solvation cloak covering the poor naked little ions in a solution; he has other characteristics of which he is proud; pleasant enough it is to hear folks speak of our virtues, but in our secret hearts 'tis of our faults we are proud. Nevertheless, the effusions of CALORIFER are readable. His sins were scarlet, but his books were read, as Belloc, or some one else, wrote. CALORIFER and LUCIFER are now getting ready for the fray, rather like Strachan and Chatham, a little slow in getting to grips with each other, still we are hopeful. Is the Lucifer who writes to us a follower of that shining Assyrian prince of whom the hexameter was written: How art thou fallen from Heaven, O Lucifer, son of the morning? Or is our Lucifer the follower of the Prince of Darkness? We do not know.

Whether fulness and precision are of more consequence than readability we may leave to others to decide. All will agree that the three qualities should be present, and that the proportions vary with the taste and age of each reader. When we were twenty or so and study-

ing for some examination or other we preferred books from which all extraneous matter was eliminated; even in those days, even with the steep cliff of an examination looming in front of us, we found both delight and profit in reading such books as Tyndall's Sound, Cooke's New Chemistry, and Maine's Ancient Law. From the time when we students attain years of discretion we steadily grow wiser; we want fewer facts and more explanations in the books we read. We may have struggled for years with an overwhelming mass of ill-digested facts; the wisdom which adversity has bred teaches us to know where to find our facts rather than to know the facts. The critic who is judging of the merits of a scientific book must therefore consider whether the book is a cram book or a study book; whether it is a hat-stand capable of containing a great number of hats or whether it is just a heap of hats.

Literature is highly conventional; poetry is exceptionally conventional. Many centuries ago some poetic shepherd, some Robert Burus, living in Crete or Sicily or Lesbos, wrote pastoral poetry; this inspired others to imitate him, and we have a long series of poets who have closely followed the classical pastoral style, including Theocritus, Virgil, Spenser, Milton, Wither, and Tennyson. Their very phrases have been copied, translated, altered and compressed until we are driven to believe that there is nothing spontaneous in any of the pastoral poetry now extant. The little short, trifling essays, first employed, so far as we remember, by Montaigne, were followed by Steele and Addison, and since their time by scores of great writers and small writers, so that now each daily paper and each weekly journal finds it necessary to observe the convention. Don Quixote and Gil Blas were the prime causes of Tom Jones, Humphrey Clinker, Tristram Shandy, Moll Flanders, Pamela, Evelina, Rob Roy, Esmond, and Bleak House. The trifling essays are a modern invention; the cistern of knowledge is in the case of most men soon emptied; the supply of airy badinage is not a cistern; it resembles rather the oil supply in Texas or the volcanic steam at Larderello. The editor must therefore be economical of his facts; as soon as he ceases to write trifles he writes lies, and such lies. The editor has merely to choose an evening when frost and mud and snow and rain proclaim the jocund spring, and sit, choked up with fame and sea-coal fires, busy with his soft pipe and more than human port, as Milton has it, wrapt in a pleasing fit of melancholy to meditate his next week's effusion. In the summer you cannot bar his constant feet to trace the woods and lawns by living stream at eve; give him a few shelves full of poetry, a few shelves full of scientific books, and a few friends who are experts in the science, and he can carry on week after week and year after year.

Chemistry wants a few more really readable and really accurate chemical books. There are a few, but as yet no one has attained so striking a popularity as to start a fashion. Chemistry in the XX Century, we think, is very good; Andrade's sixpenny book on the atom shows that this subject can be accurately treated in popular and charming language; we are confident that combustion, explosion, catalysis, hydrocarbons, and biochemistry can be similarly treated so soon as a few people set a good example.

THE FERTILISER INDUSTRY

The Imperial Agricultural Research Conference visited the nitrogen-fixation works of Synthetic Ammonia & Nitrates, Ltd., at Billingham, on October 18. Sir Alfred Mond, chairman of Imperial Chemical Industries, Ltd., was to have received the Conference, but in his absence on account of indisposition, Lt.-Col. Pollitt, D.S.O., took his place and read Sir Alfred's address.

Sir Alfred first explained that the need for synthetic nitrogenous fertilisers had been long felt, and quoted the presidential address to the Society of Chemical Industry nearly 40 years ago, in which his father, Dr. Ludwig Mond, emphasised this need. He then described how the great Billingham factory began, and mentioned their difficulties, the eventual solution of which was one of the most brilliant triumphs of British engineering and chemistry. They were not content with setting themselves the ambitious task of supplying the whole Empire with fertilisers. They had a large experimental agricultural station of their own, and were anxious to co-operate with similar institutions throughout the Empire.

Sir Alfred then showed that the war was fought on Chilean nitrate as far as this country was concerned. Any failure to keep open the long sea route would have meant irrevocable national disaster. The very processes used to convert nitrate of soda into explosives in the war, which were all worked out and carried through by the Company, were difficult, trying to a degree in their initiation, and quite uneconomical. This state of affairs could never happen again. In the event of any future danger to the Empire, that organisation would have no difficulty in rapidly and economically producing the essential raw materials of explosives: ammonia and nitric acid.

Some of the other activities on that site were of interest to agriculturists. The mechanisation of agriculture was proceeding apace. As they went through the works they would be struck with the continuity and mechanised character of the processes employed. It might happen that the chemical industry would be called upon to provide large centralised plants for agricultural operations, such as the drying and baling of grass, and if they ever were asked to do so, their general experience of the handling of materials of every description would be invaluable, and was at their service.

Britain had become over-industrialised. She had lost the balance between agriculture and industry. He felt that the fertiliser industry would help to restore the balance between industry and agriculture to equity. The extended use of fertilisers such as they were now beginning would play a large part in encouraging agriculture and thereby assist in increasing the prosperity and cohesion of the Empire. As the world continued year by year to absorb the vast and ever-increasing output of synthetic nitrogenous fertilisers, it was evident that they would not remain content to produce a quantity which, though large in itself, was small in comparison with the world's output and the requirements of the Empire. They would not be content with merely participating on the basis of their present production. Additional units were to be erected immediately. They would endeavour to keep pace with the increased

Imperial and world demand. Foreseeing the possibility of these great developments, they recognised that a selling organisation must be formed on such a scale that it would be capable of handling not only existing supplies of fertilisers, but also the potentially vastly greater quantities which they expected to make. The consequence of this had been the formation of Nitram, Ltd., which combined all the previous existing selling organisations with the additional help which they had been able to give. New knowledge and new sources of power must, however, be made known before they were widely used, and therefore Nitram, Ltd., determined that, side by side with the large selling organisation which it had formed, there must be a no less large and world-wide organisation whose business it should be to make known the uses and values of the new synthetic fertilisers. The admirable service instituted by the British Sulphate of Ammonia Federation formed the nucleus of this advisory service of Nitram, Ltd. This service was rapidly growing: already it had a large staff of district advisers located in all parts of England, Scotland and Ireland, whose sole duty it was to give free and disinterested advice to farmers on the use of fertilisers— not only nitrogenous fertilisers, but fertilisers of all kinds.

Nitram, Ltd., had also established a research station, where problems relating to the use of fertilisers and to the feeding of stock were to be investigated. One of the most important subjects which would be undertaken at the research station was the experimental enquiry as to the synthetic fertilisers most suitable to the British and overseas requirements, for it was evident that the synthetic manufacturing activities of Billingham were not likely to be confined to the manufacture of simple nitrogenous fertilisers, such as sulphate of ammonia, but would extend to the production of what may be called dual and triple fertilisers. There would be sulphate of ammonia or synthetic nitrate or urea, etc. to supply the nitrogen requirements of the soil; there would be ammonium phosphate for the soils which needed both nitrogen and phosphates; and there would be complete chemical compound fertilisers, containing the three chief plant foods, to be used by all who cultivated the land intensively.

Great prosperity would come to those countries which were first to seize and apply the new and great opportunities which presented themselves now that the synthetic manufacture of fertilisers was an established fact. Nitram, Ltd., therefore felt that it had not only a commercial duty to fulfil, but also a national duty. For this reason the energies of its staff were being directed especially to the agriculture of England, Scotland and Ireland. It was clear that with these new resources at its service, British agriculture was furnished with the powerful means of reinforcement in the struggle which it had been waging for years with manifold adversities. All must hope that plentiful supplies of synthetic fertilisers would help agriculture to maintain the struggle so that when world conditions become more favourable, prosperity might once again smile on the most essential of all British industries. Concluding, Sir Alfred Mond pointed out that mankind was at the cross roads. To those who had vision and the

opportunity of applying that vision to national and imperial problems the opportunity awaited, and it must be seized. Science applied with vision could increase the natural wealth of the world, and could inaugurate that reign of peace and prosperity without which our present civilisation would go backwards instead of forward.

A WORD TO "CALORIFER"

By "LUCIFER"

I have read, with more amusement than illumination, "Calorifer's" effusion in CHEMISTRY AND INDUSTRY upon the subject of Bone and Townend's book. I do not propose saying anything either about the book, for that will take care of itself, or yet about the experiments recorded therein, for in the long run they will prevail against mere assertions devoid of any experimental basis.

Seeing, however, that "Calorifer" has quoted Francis Bacon's aphorism concerning the choice of words, I feel moved to say that his style of argument provides an admirable illustration of the truth of the following passages in the "Novum Organon":—

"The human Intellect, in those things which have once pleased it (either because these have been received and believed, or because they delight,) draws also all other things to vote with and consent to these—and though the weight and multitude of contrary instances be the greater, yet either it does not observe them, or despises them, or draws distinctions, and so removes and rejects them—not without great and pernicious prejudice—in order that the authority of those previous conclusions may remain unshaken. . . . But in Philosophy and the Sciences this evil creeps in far more subtly—for there anything which has once approved itself to man corrupts all other things (even though they be far surer and more powerful) and reduces them under itself. Furthermore, even though this satisfaction and vanity, of which we have spoken, were absent, yet such is the peculiar and perpetual wandering of the human Intellect, that it is more moved and roused by affirmatives than by negatives. Whereas properly it ought to be just to both, nay even, in the framing of any axiom, the force of the negative instance is the greater."

Again, "The human Intellect is not of the nature of a dry light, but receives a tincture from the will and affections; which generates accordingly knowledge *ad quod vult* (according to its own wishes), for what a man would rather was true, that he the more readily believes. And so it rejects what is difficult, being impatient of inquiry; what is sober, for it straitens hope; the deeper things of nature, for it is superstitious; the light of experience, for it is arrogant and proud,

I also, like Prof. Bone, am a humble Baconian in believing that "the subtilty of Nature far surpasses the subtilty of sense and intellect," and that "*Anticipations* are far more powerful in winning assent, than *Interpretations*; since, being gathered out of a few instances, and these too for the most part those which occur familiarly, they forthwith dazzle the intellect, and fill the imagination; whereas, on the other hand, *Interpretations*, being gathered widely from things very various and far separate, cannot suddenly strike the intellect; so that necessarily

they must seem, as harsh and discordant opinions, almost like mysteries of the faith."

It seems to me that "Calorifer" exalts vain ratiocinations above experiments, and that he ought to read more carefully what the experimentalists say about their methods and discoveries. For I would rather trust the judgment of a man who, following experience, daily brings his mind in contact with realities than of one who, making no experiments, indulges his mind in wild guesses and conceits, which are apt to breed vanity and impatience.

As for "Calorifer's" friend the Sage of Lewisham, I have long suspected him of being at core a medievalist; and when, the other day, he advocated the shutting up of the laboratories and the settlement of these matters intellectually, he stood self-revealed as one. For some years past he has been out against the "modernists" in chemistry, among whom Prof. Bone is numbered. It seems to me he might be better employed by the Church to confute the "false and heretical teaching" of the Bishop of Birmingham. For a man who can argue so learnedly about the supposed chemical function of "hydrone" (steam) in flames, even where the spectroscope entirely fails to reveal it, ought to be a doughty champion of the "real presence" against our "modernist" Bishop. I have yet hopes of hearing him preach in St. Paul's, if the space is not too confined.

CANADIAN INDUSTRIAL NOTES

The four leading wallpaper companies, Reg. N. Boxer Co., Ltd., the Watson, Foster Co., Ltd., Stauntons, Ltd., and Colin McArthur & Co. Inc., operating in New Toronto, Toronto and Montreal, have been acquired by the Wallpaper Manufacturers Ltd., and incorporated as the Canadian Wallpaper Manufacturers, Ltd., with a capital of \$3,725,000. The parent British company will assist with technical knowledge and experience. There will be no public financing.

The Montreal Coke & Manufacturing Co. (subsidiary of Montreal Light, Heat & Power Co., and the Koppers Co., of Delaware) has purchased a 70-acre site at Ville La Salle, adjoining the gas-works of the M.L.H. & P. Co., and will erect coke ovens having an annual capacity of 350,000 tons of coke and 6,500,000,000 cb. ft. gas. The total capacity of the two gas and coke-producing establishments will be approximately 450,000 tons of coke and 9,000,000,000 cb. ft. gas.

Scholler Bros., of Philadelphia, will establish a large factory at St. Catharines, Ont., for the manufacture of soaps and compounds employed in the textile industry.

The maple products of Canada during the 1927 season show a considerable increase in quantity compared with 1926:—Maple sugar, 9,831,697 (7,137,303) lb., valued at \$1,365,045 (\$1,320,837); maple syrup, 2,154,705 (1,746,570) gals., valued at \$3,569,766 (\$3,575,538). The total maple sap products yielded \$4,934,811, of which \$3,105,924 is credited to the province of Quebec. The New England States manufacturers of maple products have appealed to the U.S.A. Tariff Commission for an increase in duty to protect them against the competition of the Canadian producer.

REVIEWS

A DICTIONARY OF APPLIED CHEMISTRY. By SIR EDWARD THORPE, C.B., LL.D., F.R.S. Revised, and enlarged edition. Vol. VII. Pp. viii + 768. London: Longmans, Green & Co., 1927. Price 60s.

The appearance of this last volume of Thorpe's Dictionary will stir the same thoughts among the multitude who pursue a chemical calling. First, the sadness of his not having lived quite long enough to see the completion of his last great task. Then the sense of the loss that we have sustained by the death of a leader disinterestedly devoted to our science and its causes, distinguished by ability and achievement, and memorable most of all to those who knew him by his qualities as a man. His vital energy, incisiveness and thoroughness, his scrupulous honesty, his instant fiery reaction to any stimulus of offence—all these things combined to give him a very remarkable personality and presence. His old teacher, Sir Henry Roscoe, in his characteristic way, summed it up by, at one period, always referring to Thorpe as "the electric spark."

Thorpe's achievements in the realm of chemical literature were abundant. Some had their day and ceased to be—though in some cases the day was long. But his tastes and skill went beyond the limits of textbooks, and there remain to us standing additions to our chemical libraries, notably the volume of "Essays," in which his interest in history and his capacity in *belles lettres* are admirably displayed.

There are probably many, like the present writer, in whom the very mention of a chemical dictionary raises something like a groan. The word is, perhaps, ill-chosen, for the emotion is born of wonder and sympathy. To an ordinary man, wrestling with his personal ration of weekly and monthly chemical literature and all at sixes and sevens with his noting of things that interest him, the task of editing a dictionary—unless it be one of expletives—seems something altogether behind the beyond. Yet the thing is done and often well done, and let us be thankful that there are those who can and will do it. For we need these dictionaries—they are indispensable. We hear that the article on this or that is meagre or inaccurate; in our own particular bit of theory we find there is quite notable fault. Especially do we hear that in the description of manufacturing processes the really important things are not there, not so much because they are unknown to the writer as because they cannot be divulged. Such is the hypercriticism by which the dictionary writer is always assailed.

Sir Edward Thorpe's habits of mind and character qualified him in an exceptional degree for the task of writing a dictionary. His long experience and wide interest in the science enabled him to find the writers that were wanted; his acute sense of order, his instant punctuality, and the nicety of his literary skill all combined to give him an equipment for the work in hand such as comes to very few chemists. The reality of his editing is well known to contributors. A sufficient example may be quoted where in the revision of an article a contributor desired to introduce a slightly better and larger diagram. Thorpe assented, in his own clear handwriting, by return of post, remarking that

the change would incur a slight deletion in the text—47 (or some such prime number) of words. The suggested 47 verbal victims were accordingly marked in red ink on the text enclosed. To have done what Thorpe did and as he did it, in the remoteness of South Devon in years past the allotted span, is surely something very notable—something that cannot be contemplated without a profound sense of admiration and respect.

The concluding volume now before us was, we are told, well on its way at the time of Sir Edward Thorpe's death. For its completion there was, fortunately, in Dr. Foster Morley another veteran of the select body of dictionary makers. We are sure Sir Edward Thorpe could not have wished for a better substitute, and Dr. Morley deserves our gratitude. The same is true of Miss Micklethwait, who has accomplished the task of making a good index to the whole work.

The review of a dictionary by an ordinary mortal cannot very well go beyond generalities. It can certainly be said that the present volume contains some very interesting articles. The alphabetical arrangement does not carry with it any descending scale of interest in the topics. Even under W we have water, whiskey and wine. A careful perusal of some of the articles on subjects with which the reviewer is least ill-acquainted fully warrants him in saying that the high standard of former volumes is fully maintained. There are, of course, omissions, as, for example, in the case of water, where there is no mention of hydrone or hydronol. This may, perhaps, cause a cyclonic centre to develop over S.E. London, moving in due, or undue, course towards Finsbury Square. But on matters of fact no fault is likely to be found.

Thorpe's Dictionary of Applied Chemistry had its origin in the great work of Henry Watts, first published in 1875, which had become the standard dictionary for the whole range of chemical science. There existed, alongside of Watts', Muspratt's "Chemistry, Theoretical Practical, and Analytical," and Dr. Üre's Dictionary of Arts, Manufactures and Mines. All three works had become antiquated beyond the stage of easy revision, and on the death of Watts, who had actually begun upon the task, changes of plan were made whereby the publishers decided to bring out a new edition of Watts in four volumes, under the editorship of Dr. Foster Morley and Mr. Pattison Muir. The first volume appeared in 1888 and the last in 1894. At the same time it was decided to bring out a dictionary of applied chemistry in three volumes under the editorship of Sir Edward Thorpe. The first volume appeared in 1890, and the last in 1893. The work at once found wide acceptance. A new edition was commenced in 1912 in five volumes, and completed in November, 1913. The publication of the third edition in seven volumes was commenced in 1921, and has now been completed. The volumes average 750 pages, containing about 920,000 words per volume. In 15½ years (March, 1912—October, 1927) twelve volumes have been published (i.e., at the average rate of one in fifteen months), containing over eleven million words. This shows the labour needed by editor, writers, and

publishers to keep pace with the unprecedented advance in applied chemistry in the last fifteen years. In that period over 46,000 volumes of the Dictionary have been sold.

Such is the history of the work which we now see completed in its third edition. The writer of this notice rises from his little task with grateful recollections. He was in early life presented to Henry Watts, affectionately named by Roscoe "the dictionary," and had possessed the work since 1874. In Thorpe he had an early benefactor and a life-long friend, a man from whom there was much to learn both in work and ways, a chemist who unswervingly trod the true path of science.

ARTHUR SMITHIELLS

A COMPREHENSIVE TREATISE ON INORGANIC AND THEORETICAL CHEMISTRY. By J. W. MELLOR, D.Sc. Vol. VII. Ti, Zr, Hf, Th, Ge, Sn, Pb, Inert Gases. Pp. x + 977. London: Longmans, Green & Co., Ltd., 1927. Price 68s.

In this volume, the latest addition to his monumental text book, Dr. Mellor deals with titanium, zirconium, hafnium, thorium, germanium, tin, lead and the "inert gases." The book is divided into eight chapters: one chapter being devoted to each of the above-named elements the actual spacing being as follows: Ti, 96 pages; Zr, 67 pages; Hf, 7 pages; Th, 79 pages; Ge, 21 pages; Sn, 208 pages; Pb, 401 pages, whilst the "inert gases" occupy 62 pages. The method of treatment in each chapter is similar to that which the author has adopted in the earlier volumes of the series, and which experience has shown to be highly satisfactory.

The task of the reviewer of such a work is not easy if justice is to be done to the author, and as the present volume is too heavy to be handled in comfort for arm-chair fireside review, the method adopted has been to put the work to practical test in a laboratory especially concerned with at least two of the important elements dealt with by the author. It can be said that after a period of some weeks exposure to this somewhat critical test, the work has stood the trial in a most satisfactory manner, and no higher tribute can be paid than this. It must not be understood that errors have not been detected or that portions have not been found wanting, but it can be said that such faults as have become apparent are trivial when contrasted with the vast scope of the work, and tend only to bring out in greater relief the bold lines on which Dr. Mellor has conceived his work. The imperfections which close examination has revealed may be likened to rough chisel marks often apparent on large pieces of statuary—visible only at close quarters and in no way detracting from the general scheme to adopt a simile which recently appeared in a literary contemporary.

The wide range of literature covered by the author has compelled him to adopt a staccato style of expression, although it is of interest to note that the Mellor of "Modern Inorganic Chemistry" has refused to act as a mere recorder of published literature, and at times asserts himself, as is evidenced by the occasional appearance of passages written in the attractive narrative and critical style which is peculiarly his own. It is not to be expected that the much-condensed summaries will

receive universal approval, and many authors will feel sore when they find some lengthy thesis summed in three or four words. Such compression is, however, inevitable, and as compensation the author has supplied complete references so that the original work can be consulted.

The chapters on titanium, zirconium, and thorium illustrate the rapid developments which are taking place in connexion with these elements and the growing industrial importance of their compounds, whilst the chapters on tin and lead form in themselves a complete reference work on the subject. From the industrial point of view it is a little disappointing that the sketches are wholly diagrammatic in character, and that modern processes are frequently dismissed with less consideration than the older obsolete processes. The important alloys into which tin and lead enter receive much attention, but it is impossible in this connexion, as in many others, for the author to evaluate the contradictory statements which exist in literature.

Close inspection reveals more evidence of hasty proof reading than is apparent on casual examination, and it would seem that many of these errors would have been avoided had the author been able to have his various chapters read over by collaborators having special knowledge of the particular element under discussion: future editions would benefit by the adoption of some such method.

The present volume is a worthy successor of the earlier volumes and it is likely long to remain the standard English reference work of its kind.

Dr. Mellor is to be congratulated on having enriched chemical literature, and it is hoped that the criticisms which have been made will prove of some use in the preparation of subsequent editions. The book is full value for money—the references alone making it a sound investment for even those only remotely concerned with the materials included within the scope of the work.

C. A. KLEIN

CHEMICAL REVIEWS, Volume III, February, 1927. Number 4. Pp. 322—445. Published quarterly for the American Chemical Society. Baltimore, U.S.A.: The Williams and Wilkins Company; London: Baillière, Tindall and Cox, 1927. Price 23s. 6d., post free, per annum.

The final part of Vol. III of "Chemical Reviews" contains five papers on "The use of X-rays for the discovery of new elements," "The present status of turbidity measurements," "The interaction of electrolytes with non-electrolytes," "Immunologically specific polysaccharides" and "The principal chemical researches on cod liver oil." These papers illustrate the wide diversity of subjects covered by the reviews, since, whilst everyone will be interested in the first paper, which was written in response to a special request by the editor, it may very well happen that the mathematical symbols of the second and third papers will be quite unintelligible to organic chemists or biochemists, who will turn first to the two final papers of the volume. This mutual incomprehensibility (notice the appropriateness of the 8-syllable word) is one of the bewildering features of modern chemistry which it is wise to recognise, but

unwise to encourage. In the present instance it appears that the editors may have been too lenient in allowing the contributors to write for a small fraction only of the chemical world, since the articles obviously fail (where the Annual Reports of the Chemical Society succeed) in presenting material which can be read with understanding by the average chemist. If, as is apparently the case, the articles are contributed gratuitously, it is easy to understand the origin of this failure, since a busy worker, who can afford to spend time in propagating the results of his own specialised investigations, can scarcely be expected to devote his energies to a more popular (and therefore much more difficult) exposition of progress in a wider field. If, therefore, the reviews are to maintain their usefulness, it seems essential that funds should be placed at the disposal of the editors which would enable them to invite contributions on topics which are selected on account of their interest to the general reader, as well as on account of their more special interest to the contributor.

COLLECTED PAPERS OF SIR JAMES DEWAR. Edited by LADY DEWAR, with the assistance of J. D. HAMILTON DICKSON, H. M. ROSS and E. C. SCOTT DICKSON. With two supplementary papers not heretofore published, and an appendix and indexes. Vol. I. Pp. xxii + 674. Vol. II. Pp. ix + 675—1489. Cambridge: The University Press, 1927. Price, for the two volumes, £4 4s.

Students of chemistry and physics will welcome with warm appreciation these volumes in which the scientific papers of Sir James Dewar are republished in collected form. The record which they present cannot fail to be a source of inspiration to younger workers, and the wonderful versatility of the author is manifested by the wide range of subjects the knowledge of which has been enriched by his work.

Although he will always be chiefly known for his experimental investigations lying in the borderland between physics and chemistry, several of his earlier papers deal with carbon compounds and are of no little interest to the student of the earlier history of organic chemistry. To his first paper (1867) "On the oxidation of phenyl alcohol (phenol)" he appends the description of "a simple mechanical arrangement to illustrate structure in the nonsaturated hydrocarbons," the carbon atom being represented by a pair of thin metallic bars loosely clamped together at their middle points. With these models he shows seven different methods of representing the compound C_6H_6 , and the sixth of these is the benzene formula with the *para*-bond now associated with his name. In 1868 he exhibited to the British Association at Norwich the model devised by Kekulé to give a fuller representation of the structure of carbon compounds than could be achieved with plane formulæ. "Carbon, with its four atomicities, [was] represented by a small sphere with four equal wire arms joining the centre of the sphere with the angles of an imaginary tetrahedron." This was six years before the enunciation of the theory of the asymmetric carbon atom by van't Hoff and Le Bel. Also in a paper communicated to the Royal Society of Edinburgh in 1870 he proposed the formula now generally adopted for

pyridine, the same suggestion having been made about the same time by Körner, his fellow-student under Kekulé at Ghent.

The breadth of his interests is further shown by his biological papers with Macfadyen, and the experiments carried out with Macfadyen on the effects of extreme cold on bacteria; the long series of papers presenting the account of the spectroscopic work conducted with Prof. Liveing (which are printed in title only as they have already been published in collected form) reveals yet another side of his activities.

His memory, however, will always be chiefly associated with his brilliant investigations in the field of low temperatures which formed by far the greater part of his scientific work, and which are so extensive as to render any detailed reference to them here impossible. It is a boon to have the memoirs in which these are described gathered together in connected form, so that the reader can more easily trace the manner in which each achievement paved the way for the next: liquid air, liquid hydrogen, solid oxygen, solid hydrogen, and those devices, the vacuum flask and the charcoal vacuum, without which some of the most important physical investigations of recent times could not have been carried out. One has throughout the impression that his results were obtained with the simplest possible means, and over all his work there is the mark of experimental genius and of an intellect extraordinarily acute.

The book has been admirably printed by the Cambridge University Press, and its two fine volumes form a fitting monument to the great investigator whose achievements they record.

W. H. M.

A TEXT-BOOK OF INORGANIC CHEMISTRY. By A. F. HOLLEMAN, D.Sc., F.R.S.E. Seventh English revised edition, issued in co-operation with H. C. Cooper. Pp. x + 541. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. Price 17s.6d.

The reviewer need not recommend Prof. Holleman's book; it has already recommended itself to the extent of 32,000 copies in a space of 26 years. Since the appearance of the sixth edition, in 1921, it has filled out a little here and there without much altering its familiar general appearance. Certain sections, for instance those dealing with colloids, atomic structure, etc., have been rewritten, and other portions of the text have also been subjected to revision. The stated composition of "English shillings" is flattering, but no longer correct.

A. A. E.

CHEMISTRY. By PERCY E. SPIELMANN, Ph.D. Pp. ii + 80. Benn's Sixpenny Library, No. 104. London: Ernest Benn, Ltd., 1927. Price 6d.

It is a commonplace that the non-scientific public is profoundly ignorant of the principles of chemistry; it is equally true that there is little reason why everybody should be a chemist. Nevertheless, a bird's-eye view of the nature and scope of a science is bound to be of considerable interest, and some profit, to any normally inquisitive, broadly-educated person. When a demand exists for information, such as is given in this little book,

as it properly should and undoubtedly does (even were it only to provide a horizon for the better perspective of the chemical "stories" which from time to time appear in the daily press), there is every reason why it ought to be met in an authoritative and attractive manner. The task of presenting in simple, yet sufficiently accurate, terms a statement embodying the development and fundamental principles of chemistry, its application to human affairs, its outstanding successes and its major problems, and the direction of its progress is never an easy one. In the present instance it has been well and truly performed. In addition to its value as a kind of "visiting card" for the science of chemistry, the book affords information concerning the profession which aspirants thereto, as well as their parents, should find useful. The reviewer, at any rate, considers it a remarkably good sixpennyworth!

A. A. E.

OUTLINES OF EXPERIMENTAL CHEMISTRY. By E. B. LUDLAM, D.Sc., M.A., F.R.S.E., and H. PRESTON, A.R.C.Sc. Book I, pp. xv + 64 + viii; Book II, pp. viii + 65-148 + viii. Third edition. London: Edward Arnold & Co., 1927. Price, I, 2s.; II, 2s. 6d.

This book, which is stated to be based on the experience gained from 16 years' use of the former edition, presents a scheme which endeavours to steer a middle course between the instructional and the research methods of teaching chemistry in schools. Part I, intended for the lowest forms which are doing practical work only, and Part II, covering the practical work required for the various School Certificate Examinations, together form Book I, whilst Part III, for pupils taking the Higher Certificate, or Inter B.Sc. Examination, and Part IV, dealing with qualitative analysis, are published together as Book II. Questions are freely interpolated so as to avoid the danger of inaccurate conclusions being reached as a result of an experiment, and to provide a stimulus to individual thought. The proof of the pudding is, of course, in the eating, but should the course fail to achieve marked success with pupils of average intelligence, appearances will have been very deceptive.

A SURVEY OF AMERICAN CHEMISTRY. Volume I. Edited by W. J. HALE and C. J. WEST. Pp. 257. New York: Chemical Catalog Co., Inc., 1927. Price \$2.00.

The limitation (in scope, and, therefore, in usefulness) of a survey such as this is all too obvious to chemists, who are accustomed to assess the progress of any branch of their science without reference to political or geographical frontiers. The survey deals essentially with investigations in pure and applied chemistry which, between July 1, 1925, and July 1, 1926, were described in publications originating in the United States of America, and with processes patented in that country. There are occasional references to work published elsewhere, but one or two chapters, particularly that on cellulose, are distinguished by a somewhat wider vision. Whilst the utility of the compilation is still further depressed by the omission of an index, its interest, and in particular its stimulus, remain unaffected. The thirty-four chapters deal authoritatively with almost

every phase of the subject, and include definite indications of the lines along which further progress is probable or desirable. The chapter on co-operative research between industries and universities merits special attention.

ORGANIC CHEMISTRY. Designed for Students in Applied Biological Fields; Agriculture, Home Economics, Medicine, Dental Science, Pharmacy and Veterinary Medicine. By FRANK E. RICE, Ph.D. International Chemical Series, edited by H. P. Talbot, Ph.D., Sc.D. Pp. ix + 303. London: McGraw-Hill Publishing Co., Ltd., 1927. Price 12s. 6d.

This book has been written for the benefit of those who, like physicians, agriculturalists and pharmacists, require some knowledge of organic chemistry as it bears upon their respective subjects, without studying it in such detail as is necessary for the professional chemist. From its special point of view the book may be pronounced very satisfactory. It is not so long as to be wearisome to those who do not require much detail. It is also clearly written, and the condensation of the purely chemical part and the selection of special subjects for mention seems to be happily accomplished. The general get-up of the book is excellent, the shape is satisfactory, the paper is good, the printing is admirable, and the binding is attractive. The text is illustrated with a number of half-tone blocks, some of which are appropriate and useful, such as, for example, Fig. 13, showing the production of rubber from a tree; Fig. 22, representing calf skins before and after tanning; and Fig. 25, indicating how gull nuts are produced. Several others, however, hardly justify the space they occupy; Fig. 8, for example, represents a 12,000-gal. tank for the purpose of storing alcohol, but which, for all that can be gathered from the picture, might be storing any other liquid. Similarly, in Fig. 18, it seems doubtful whether a scheme illustrating the production of cinematographic film gains anything from the pictures of a number of bottles stated to contain certain ingredients. But this is perhaps captious criticism.

The book has been brought well up-to-date without being thereby rendered unintelligible. An early chapter deals with the structure of organic compounds from the octet point of view, and modern methods of preparation are usually mentioned. At the end of each chapter a few topics are suggested for further study. The book, considering the limitations set upon it from the beginning, should prove distinctly useful.

T. S. PATTERSON

ELECTRO-ORGANIC CHEMISTRY. By C. J. BROCKMAN. Pp. xi + 381. New York: John Wiley & Sons (Inc.); London: Chapman & Hall, Ltd., 1926. Price 25s.

Professor Brockman has succeeded in collecting together a very considerable amount of material on processes of electrolytic oxidation and electrolytic reduction. Already, in 1908, Dr. Brand published a monograph nearly three hundred pages long restricted to consideration of the electrochemical reduction of nitro-compounds alone, thus it is not difficult to imagine that contemplation of a book on electro-organic chemistry is a somewhat arduous undertaking. The book is naturally

divided into two divisions dealing with anodic and cathodic processes respectively. Apart from a few "Americanisms" such as on p. 197, "The chemical acumen of Haber asserted itself in the solving of this problem. He figured that if the nitrosobenzene—" and a few statements which require a certain mental effort in order to understand what is actually intended, such as on p. 276, "There is practically no addition of hydrogen to an unsaturated acid on a smooth platinum, and slightly less reaction at a smooth copper or lead cathode," the statements in the book are clearly expressed. Attention is drawn to the industrial importance of many of the processes and the technical value of reactions which might be effected by electrolytic methods if only the conditions of reaction were known.

It is a pity that Dr. Brockman has not included in the volume any serious theoretical considerations. It is certainly true that we know very little about this subject, but even this should be pointed out so as to encourage research into the why and wherefore of electrolytic oxidation and reduction. Whilst the method of graded potentials in oxidation processes and the regulation of reduction by the choice of metals with different hydrogen overpotentials are standard methods of operation in these electrolytic processes, we still do not know how these processes actually operate—why, for example, the oxidation rates of the fatty acids are all different, or whether the mechanism of reduction of a double bond or nitro-group can be considered analogous to the well-known reversible quinone-hydroquinone systems. To those who are interested in these matters numerous experiments are detailed in this volume, extension and repetition of which cannot fail to provide material from which interesting conclusions could be drawn. The book is replete with references and well printed.

E. K. RIDEAL

STATISTICAL MECHANICS WITH APPLICATIONS TO PHYSICS AND CHEMISTRY. By R. C. TOLMAN, Ph.D. American Chemical Society Monograph Series. Pp. 334. New York: The Chemical Catalog Company, Inc., 1927. Price \$7.00.

Present-day mathematical physics is a matter of statistical theory. The laws of nature are essentially statistical in character. Thus the theory of spectra presents us with a series of electronic orbits of greater or less probability, and the intensities of spectral lines are determined by the respective statistical probabilities of electronic excursions between these orbits. To take a more homely example. The difference of pressure between the upper and lower faces of a brick at rest in still air is not constant and equal to the theoretical head, but is a statistical effect, the actual difference of pressure varying between wide limits. Calculation shows that for a single instant in $(10^{10})^{10}$ years the excess pressure on the lower face may be sufficient to sustain the weight of the brick! Were our perception of minute intervals of time sufficiently refined, this striking phenomenon might be observed. We would direct the attention of levitators to the theory.

In the present work the theory of statistical mechanics is treated in a logical fashion, special attention being given to the physical implication of the concepts employed

rather than to mathematical subtleties. Considerable mathematical knowledge—about up to the standard of an honours degree—is required of the reader. Sections are devoted to classical statistical mechanics, the quantum theory, application to molecular processes, the rate of physical-chemical change. All parts of the subject are well treated, and the whole forms an extremely valuable survey of knowledge available upon the subject. Original contributions by the author comprise a new treatment of the principle of microscopic reversibility, the equipartition law, and the method of introducing the quantum theory.

The book is well produced and is well printed on good paper. There is not a single illustration. Adequate name and subject indexes are provided. The price cannot be considered excessive. We commend the work to all equipped with the necessary mathematical knowledge.

J. S. G. THOMAS

- (1) **ATOMIC THEORY. AN ELEMENTARY EXPOSITION.** By A. HAAS, Ph.D., translated by T. VERSCHOYLE, M.C., Ph.D. Pp. xiv+222. London: Constable & Co., 1927. 10s. 6d.
- (2) **THE STRUCTURE OF THE ATOM.** By PROF. E. N. DA C. ANDRADE, D.Sc., Ph.D. Third edition, revised and enlarged. Pp xviii + 750. London: G. Bell & Sons, Ltd., 1927. 30s.
- (3) **THE MECHANICS OF THE ATOM.** By PROF. M. BORN. Translated by J. W. FISHER, B.Sc., Ph.D., and revised by D. R. HARTREE, Ph.D. International Text-Books of Exact Science, edited by Prof. E. N. Da C. Andrade. Pp. xvi+317. London: G. Bell & Sons, Ltd., 1927. 18s.

The above books are placed in order of increasing difficulty. All three deal with the development of atomic theory from the point of view of the physicist.

(1).—Professor Haas gives an elementary account of the theory of the hydrogen atom, Röntgen rays, the theory of the elements, and the general theory of spectra and of atomic structure. The systematic treatment of the subject makes the book an excellent student's textbook, and one that should appeal to those who, without possessing any great knowledge of science, wish to learn something of atomic theory.

(2).—The first edition of Prof. Andrade's book was reviewed in this JOURNAL in 1923 (p. 992). The present edition, however, fulfils its claim to be a new book because the text is largely rewritten, and now extends to more than double the number of pages of the previous editions, with a corresponding increase in the number of diagrams and plates. New chapters have been written dealing with multiplets and the anomalous Zeeman effect, and with quantum theory and wave theory: and new discussions appear on critical potentials, Saha's theory of ionisation, and Born and Landé's work on the elasticity of solids.

Prof. Andrade is to be congratulated on his success in the difficult task of keeping his book up to date: his subject matter is largely in a state of flux, and he has performed a very real service to all those interested in atomic structure by writing, in his attractive style, such an authoritative book.

(3).—Prof. Born attempts a deductive treatment of

atomic theory by referring the facts of atomic physics to their underlying mechanical principles. The book can be read with profit only by one who is well equipped mathematically, and who is already familiar with the subject of atomic physics, say to the extent of having mastered Prof. Andrade's book.

JOHN A. CRANSTON

ELEMENTARY PRACTICAL PHYSICAL CHEMISTRY. By J. F. SPENCER, D.Sc., Ph.D. Pp. viii + 263. London: G. Bell and Sons, Ltd., 1927. Price 5s.

In arranging a course of practical instruction in physical chemistry, the choice of experiments is limited by the cost of the apparatus which must be provided, and by the fact that each experiment must be such as can be completed within a specified period of time. If such instruction is attempted in schools, these difficulties become particularly prominent, and so-called practical work is apt to degenerate into watching demonstration experiments performed by the teacher. In the present volume Dr. Spencer sets out to show how much useful experimental work can actually be done by elementary students in spite of the limitations of time and money. He describes over a hundred experiments, the majority of which require only simple and relatively inexpensive apparatus and can be carried out by students whose work in the laboratory is limited to periods of an hour and a half. In order to cover a wide range of subjects, the author has not hesitated to include some purely qualitative experiments to illustrate important physico-chemical principles. This is a sound plan, for so far there has been a tendency to exclude such experiments from a physical chemistry course without finding a place for them in other courses, with the result that important subjects such as osmotic pressure, electrolysis, and the whole of colloid chemistry have often been entirely neglected on the practical side. Experimental details are clearly described and the introductory matter which precedes each group of experiments is sufficient to draw attention to the principles involved without attempting to usurp the function of a theoretical textbook. The diagrams are well drawn and are adequate for an easy understanding of the text. The use of the terms "sulphur" and "nitrogen" cannot be commended, and writing equations relating to gas volumes in terms of temperature on the Centigrade scale instead of on the absolute scale merely makes them look complicated without having any corresponding advantage. The book can be recommended not only as a manual from which experiments suitable for school courses can be selected, but also as the basis of the first half of a systematic degree course in practical physical chemistry.

H. J. T. ELLINGHAM

THE INDUSTRIAL CHEMISTRY OF THE FATS AND WAXES. By PROF. T. P. HILDITCH, D.Sc. With an introduction by Dr. E. F. ARMSTRONG, LL.D., F.R.S. Industrial Chemistry Series, edited by E. de Barry Barnett. Pp. xvi + 461. London: Baillière, Tindall & Cox, 1927. Price 18s.

Prof. Hilditch's scientific attainments, his long and successful experience in the Crossfield laboratories and works at Warrington, culminating in his appropriate appointment some two years ago to the Campbell Brown

Chair of Industrial Chemistry at Liverpool University, have equipped him in a unique manner for the task of writing the volume now under review, and he is to be congratulated on the general level of excellence he has reached in it. The scope of the book is quite good, and due balance and proportion have been maintained in allotting the amount of space devoted to each of the various sections into which the book is divided. An agreeable feature of the book is the absence of laboured details respecting out-of-date chemical ideas, technically valueless or commercially impossible manufacturing operations or matters having now only historical interest.

The chemical aspect of the subject is well treated, all the more recent advances, both purely chemical and physico-chemical, being considered, and only such attention is paid to the details of analysis and identification as is necessary for a proper understanding of the subject. The distribution and output in nature of the fats and waxes is first considered, then a necessarily lengthy account of the more common fats and waxes follows, after which the author proceeds to an account of the industrial methods of extraction and refining of fats. Fat-hydrogenation, fat-splitting or hydrolysis, the consideration of butter margarine, hard, and edible fats generally receive due consideration, after which the author deals in turn with the soap industry and the physico-chemical aspect of soap boiling, the manufacture of candles, and the production of glycerin, concluding with a number of chapters dealing less exhaustively with the "drying" of fatty oils, fatty oils and waxes in the paint, varnish and linoleum industries, together with a brief account of sulphonated oils, wool oils and fatty lubricants. Throughout one is conscious of the author's very close acquaintance with the raw materials and the operations involved in the industries he has described.

Prof. Hilditch is not too happy about the use of the word "oil" as applied to fatty oils, and in spite of his efforts to the contrary the word obtrudes throughout the book, and he seems no more able to avoid its use than the unfortunate Mr. Dick was able to avoid references to King Charles's head. The expression "fatty oil" which seems preferable to "liquid fat," avoids any of the misunderstanding which may occur through the use of the word "oil" alone.

Amongst points calling for criticism one may mention the statement that the strength of the caustic soda solution in the neutralisation of fatty oils is 60° Tw (p. 196): surely this is exceptional, the usual range being 14° to 34° Tw according to the nature and quality of the oil. Speaking of the Bolton and Lush continuous process of fat-hydrogenation, the author says, "Whilst it is hoped that this method will also avoid filtration of the hardened fat". It is unfortunate that before committing himself to this expression of opinion he did not trouble to enquire, when he would have found experience triumphant over hope. At no time has recourse to filtration been necessary with either of the two plants operating this process in England, and one of the plants has been in operation for five years. The author's estimate (p. 351) of the British production of crude glycerin (80% glycerol) as about 25,000—30,000 tons per annum is indeed on a very generous scale: 15,000 tons is an estimate much closer to exactitude.

Prof. Hilditch has given us a very readable and extremely useful book, which has been carefully indexed, though it is a great pity that numbered references have not been given in the text: the growing habit of grouping together lists of original papers and patent references at the end of a long section without clear numerical references in the text is one to be deplored, and if this growing practice becomes general such lists will be almost useless to the reader. Dr. E. F. Armstrong, in a brief though appropriate introduction, gives the book his blessing.

H. M. LANGTON

GOTTLÖB'S TECHNOLOGY OF RUBBER. Authorised English edition, translated and revised from the German edition of 1925 by JOSEPH L. ROSENBAUM, M.Sc., M.I.Chem.E. Pp. xvi + 350. London: Maclaren & Sons, Ltd., 1927. Price 42s.

The first edition of the late Kurt Gottlob's "Technologie der Kautschukwaren" appeared during the war (1915), and for this reason seems to have passed unnoticed in this country. When the second (German) edition was submitted to the reviewer he formed the opinion that, particularly in view of the paucity of modern literature dealing with rubber manufacture, it was a work to be cordially welcomed, and certainly merited translation. Messrs. Maclaren are fortunate in having found in the person of Mr. Rosenbaum a translator who not only possesses the technical qualifications necessary for this class of work, but is capable of rendering the foreign idiom in corresponding and not literal English. The work, which contains numerous illustrations and diagrams, is divided into two parts, namely: (1) on "The general technology of rubber"; and (2) covering "Selected chapters on the special technology of rubber goods." In both sections a wise process of devolution has been applied, various subjects being dealt with by specialists under the general editorship of or in collaboration with the author. Thus the chapters on "The examination of raw rubber" and the "Chemical analysis of vulcanized rubber" are by Prof. E. Kindscher; the "Mechanical testing of soft rubber" is written by Prof. A. Schob; Dr. Schmelkes is responsible for "Accelerators"; and K. Miksch in association with Dr. Gottlob cover "Rubber heels and soles" and "Proofed cloth." Other special branches of manufacture dealt with and regarding which the literature has hitherto been meagre are: "Rubber toys," by Dr. Dorogi; "Manufacture of rubber shoes," by E. Herbst, and "Dipped goods," by E. Herbst and the author. Dr. Gottlob's scientific and technical qualifications were of such a high order that a work of outstanding merit was to be expected from him. It may be fairly said that anticipations in this regard have been realised, and that the author's objects in writing the book have been attained. These objects, as stated in the translator's preface, are as follows: "In the first place the work is for the scientifically educated technologist who is desirous of entering the rubber industry. To such a man it presents in concise and systematic form the underlying scientific bases of the industry, and also the general factory operations, emphasising these latter by a series of specially chosen examples. Secondly, it is to meet the needs of the man who is already engaged in the rubber industry, but who is

desirous of becoming acquainted with the scientific foundations of his daily work and with the results of the most recent investigations on the chemical and physical properties of the principal raw material. Lastly, the book is offered in the hope that it will serve the needs of the vast army of people who, though neither rubber manufacturers nor rubber scientists themselves, have a direct interest in the material as consumers of, or dealers in, rubber or manufactured rubber goods." The work may be regarded as "up-to-date" inasmuch as the author searched the literature up to the middle of 1924, and the translator has drawn attention, in his preface, to more recent developments. With regard to the illustrations, representations of English and American machinery have wisely been substituted for the Continental types depicted in the original wherever this was practicable. Gottlob's "Technology of rubber," should certainly find a place in the library of all those interested in rubber.

PHILIP SCHIDROWITZ

TEXTILE BLEACHING, DYEING, PRINTING AND FINISHING MACHINERY. By A. J. HALL, B.Sc. Pp. xvi + 320. London: Ernest Benn, Ltd., 1926. Price 50s.

This book is the first, as far as the reviewer is aware, in which an attempt has been made to describe the construction and performance of machinery employed to-day for bleaching, preparing, dyeing, printing and finishing textile fabrics, yarns and fibres. The book appears to be mainly concerned with the cotton industry, and in the reviewer's opinion it would have been better to have confined the work to this branch only. It is perhaps advisable to include in literature of this kind the technical terms that are chiefly used in the trade. For example, p. 18 deals with sewing for the production of a tubular fabric for certain operations; this is known generally as "bagging." The section on indigo dyeing machines does not mention the hawking machine, which is the main machine used for the dyeing of woollen and worsted fabrics with indigo. The term "oxidant" (p. 98) is used by the author in dealing with the production of aniline black; it is not a nice term. In the section dealing with mercerisation (p. 104), a short statement is given of the heat of reaction of caustic soda and cellulose. This is very scrappy, and unless given more fully, from both theoretical and practical views, is of practically no value. Many machines are described for the dyeing of loose fibres and yarn, but there is no mention of the Obermaier and the Klauder Weldon machines, which were the first of the percolation and rotary types of machines for these purposes, and which are still largely employed in the industry; others could be mentioned that are employed for the dyeing of wool. The term skein is used in this book in connexion with machines for treating yarn in hank or skein form. The term skein is mainly used for silk and artificial silk, and the term yarn mainly for cotton, woollen and worsted material. Such valuable machines as the Schlumpf and the Hunsong are not mentioned in the section on yarn dyeing.

No reference is made to the warp dyeing or mercerising machine, in spite of the fact that mercerisation is more uniform in warp than in hank mercerisation, and also that the majority of dyed cotton warps are dyed in rope

form. The book is well provided with splendid illustrations, and may fill a gap in textile literature. A book of this kind would have been much more valuable if the author had considered the demands made upon the machines from a theoretical as well as a practical standpoint. The technologist would then refer to the book to a far greater extent than he does to manufacturers' catalogues.

L. L. LLOYD

TITANIUM—WITH SPECIAL REFERENCE TO THE ANALYSIS OF TITANIFEROUS SUBSTANCES. By WILLIAM M. THORNTON, JNR. American Chemical Society Monograph Series. Pp. 262. New York: The Chemical Catalog Co., Inc., 1927. Price \$5.00.

This book is a welcome addition to the scanty literature dealing with titanium. The main title, "Titanium," is likely to prove misleading, for over two-thirds of the book is devoted to matter falling under the sub-title; thus, the book is divided into four parts. Part I, Introductory, pages 21–82, being divided into four chapters: I, "The discovery of titanium," II, "The occurrence of titanium in nature," III, "The general chemistry of titanium," IV, "The industrial applications of titanium and its compounds." Part II, "The detection and estimation of titanium in its various associations," occupies pages 83–222, containing four chapters, whilst Part III, "Reagents," covering five pages, consists of Chapter X concerned with "the preparation of certain reagents," and Part IV is a collection of notes and references occupying some 26 pages.

Notwithstanding the small compass into which the author has compressed the material included in Part I, he has compiled a most interesting and valuable account of an element the compounds of which are slowly assuming technical importance. Titanium is no longer regarded as a "rare" element—indeed, as the author shows, ". . . titanium is nearly one third as plentiful in nature as magnesium, and the ratio of titanium to phosphorus and sulfur is more than five to one and nine to one respectively, in spite of the fact that these three elements are usually considered common."

The author stresses the ubiquitous character of the element and its ready accessibility, and makes it clear that up to the present the technical utilisation of titanium compounds has been comparatively insignificant. The present uses of titanium compounds are stated to be (in descending order of importance), pigments, alloys in metallurgy, dyes, mordants, bleaching agents etc., refractory materials, smoke screens, incandescent media for lighting purposes, cement, gem stones, abrasives, catalysts, ink, medicinal preparations, nitrogen fixation, phosphorus pentoxide, and applications in pure science.

In the analytical sections of the book the author has provided a mine of useful information for those who are concerned with titanium and its compounds, and who are familiar with the many difficulties attending the analysis of certain materials which contain this element.

The work will prove invaluable to all connected, even in a remote way, with titanium or its compounds, for it is the only compilation of its kind, and with the growing technical importance of these materials, will become a standard reference work which should stimulate investiga-

tions into the possible development of a most interesting but hitherto only partially explored field of chemical industry.

In subsequent editions the author might, with advantage, endeavour to preserve a more even balance between the technical and analytical sections of his work, for the latter is somewhat heavy and loaded with unnecessary detail, e.g., the sketches on pages 155 and 159 of a specific gravity apparatus, a pycnometer, a steel mortar, and an agate mortar do not add to the value of the work. These are but minor blemishes in a book which can be thoroughly recommended, and the author is to be congratulated on his work. Particularly valuable are the complete notes and references forming Part IV.

C. A. KLEIN

OIL AND RETORTABLE MATERIALS. A HANDBOOK ON THE UTILISATION OF COAL, TORBANITE, CANNEL AND OIL SHALE. By GEORGE W. HALSE, B.Sc. Pp. vi + 146. London: Charles Griffin & Co., Ltd., 1927. Price 7s. 6d.

So frequently have we read, in the daily as well as the technical press, of the folly of polluting the atmosphere with smoke, that our content as we sit by our coal fires must be disturbed with misgivings. Yet many of us accept our petrol from the ubiquitous pump without realising how great a national problem the supply of fuel oil now presents, and how intimately connected it is with the reasonable use of coal. The author of this book has endeavoured to describe, in a manner which will interest the non-technical mind, the essentials of the various processes for the manufacture of liquid fuels, so that the reader may be in a position to gauge correctly many of the reports which are made from time to time with reference to new developments, and to view the situation in its true perspective. The developments of the coal and petroleum industries are briefly traced, and the manner in which oil has replaced coal, largely owing to the obvious advantages of an oil fuel, and the remarkable advances made in the design of the internal combustion engine, are described. Attention is directed to possible supplies of fuel oil obtainable by treating such materials as coal, shales, cannels, lignites and torbanites. The nature of these materials, and their mode of formation and occurrence, are separately discussed, and their correlation is attempted. The author then proceeds to describe, in an elementary manner, the meaning of carbonisation or "retorting," dealing with the desiderata of any particular system designed primarily for the production of oil by this means. In conclusion, the chemical characteristics of the distillates so obtained are detailed. Mention is also made of other processes for the production of liquid fuel, such, for example, as that of Bergius and of such fuels as "Synthol," power alcohol, and "Natalite."

To give a true presentation of scientific matter which appeals to an unscientific reader is admittedly difficult. In this direction the book would gain considerably by a more orderly arrangement of the material and an increased simplicity in the manner of its presentation. The illustrations are not particularly illuminating.

A. McCULLOCH

FERTILISERS AND SOIL IMPROVERS. By W. GARDNER. Pp. viii + 184. London: Crosby Lockwood & Son, 1927. Price 7s. 6d.

This book—by the author of "Chemical synonyms and trade names"—is one of the series of Lockwood's Manuals for Trade, Craft and Industry. Within recent years the difficulty of choosing a suitable fertiliser has become greater owing to the development of the fertiliser industry, the improved methods of production, the introduction of new products, and the increased knowledge of the part which the fertiliser plays in plant economy. The author wisely discusses "the soil and soil conditions" before dealing with the various manures. These are "considered under the heading of the constituent for which the particular material is valued" and short "general" notes, dealing with the function of nitrogen, phosphorus and potassium in plant nutrition, precede the descriptions of the simple substances containing these elements.

The classification adopted by the author is pleasing because of its simplicity and, although there is slight overlapping, yet this does not in any manner lessen its attractiveness. A useful chapter is included on "lime" in its various forms, and too great importance cannot be attached to this particular feature—the modern tendency in agricultural practice being to place more importance on liming in plant husbandry. From the chapters on the "valuation of manures" and the "application of fertilisers," a grower can obtain concise information regarding the fundamental principles of purchase and use.

Much valuable information has been brought together, and this compact book will aid farmers and gardeners and those who are studying agricultural or horticultural science. The volume can be recommended to anyone desirous of possessing a handy book of reference.

D. N. MCA.

NATURAL AND SYNTHETIC RESINS. By T. HEDLEY BARRY, ALAN A. DRUMMOND, M.Sc., and R. S. MORRELL, M.A., Ph.D. Oil and Colour Chemistry Monographs, edited by Dr. R. S. Morrell. Pp. vii + 196. London: Ernest Benn, Ltd., 1926. Price 21s.

This book deals with resins from the point of view of their use in the manufacture of varnishes. It consists essentially of a general summary of their properties together with brief descriptions of either their origin or their methods of preparation.

Numerous references are given to a fairly extensive literature, and the book should serve very well as a "key" to more detailed information. It must be confessed, however, that the book lacks originality, and shows little evidence of either critical thought or ripe experience having been brought to bear on the subject. It would appear to suffer from multiplicity of authorship; the story is not properly connected and not well balanced. Of 111 pages dealing with natural resins, one half of them are devoted to turpentine, rosin, and shellac. A chapter of five and a half pages, headed, "Spirit varnish resins" contains three pages on Malayan damar, only one and a half pages on all other varieties of that resin, and but one page on

spirit varnish resins other than damar. Only two pages are devoted to the interesting and important Japanese lacquer. The desirability of dealing with "Hardened rosin," in Part II of the book is debatable, but at all events one begrudges the space of twelve pages devoted to this subject, out of a total of 69 pages on synthetic resins. The two chapters on "Phenol-formaldehyde resins" and "Causes of resinification," respectively, are quite good and decidedly the best in the book.

Altogether, considering the high price charged and the undeniable qualifications of all three authors, we have to confess to some disappointment on reading this book.

THE ANALYSIS OF PIGMENTS, PAINTS AND VARNISHES. By Dr. J. J. FOX O.B.E., and T. H. BOWLES. Oil and Colour Chemistry Monographs, edited by Dr. R. S. Morrell. Pp. x + 179. London: Ernest Benn, Ltd., 1926. Price 16s.

It is probably correct to say that many people have felt the need for an authoritative and up-to-date British volume dealing with the chemical analysis of pigments, paints and varnishes. If this be so then it can undeniably be granted that this volume satisfactorily supplies that want. The fact must be emphasised, however, that the book is in no sense a complete guide to the technical evaluation of pigments, paints and varnishes, but deals almost solely with methods available for the chemical analysis of these materials.

The volume is not overburdened with alternative methods, but is confined in the main to those which the authors have found to be most suitable in the Government laboratories. Some of these methods have not been previously published.

The greater part of the book, viz., 123 pages, is devoted to the examination of individual pigments, and most of the latter seem to be adequately treated. The so-called "lake pigments," however, constitute a serious omission. Whilst there is something to be said for the authors' view that readers should refer to books on dyestuffs for methods of identifying the dyes used in lake pigments, yet we think the value of this book would have been considerably increased if this class of pigment had not been quite so summarily dismissed by them.

The two remaining chapters deal respectively with "the analysis of mixed paints" and "the examination of varnishes." Both chapters are all too short, but, with the exception perhaps of that part headed, "treatment of extracted pigment," it would not be fair to criticise the authors on that account.

THE SCIENCE OF ROADMAKING. By J. W. GREEN and C. N. RIDLEY, with a foreword by Prof. I. MASSON, M.B.E., D.Sc. Pp. xv + 138. London: Crosby Lockwood & Son, 1927. Price 10s. 6d.

The authors have endeavoured to cover a very large subject in the space of 138 pages. The 12 chapters into which the book is divided deal with (a) bitumens, asphalts, and bituminous sand carpets; (b) tar, pitch, and tarmacadam; (c) sett, woodblock, and india-rubber paving; and (d) cement, concrete, and concrete roads.

It is clear that in the limited compass of a book of this size all these sections cannot be covered completely, and the necessity for condensing the matter has led, in a few instances, to some vagueness. For instance, in the chapter on "Concrete roads" it is stated that "the strength of concrete varies directly with the percentage of cement in same." This may be true assuming all other factors are constant, but it may be misleading to an uninformed reader. The fact is that with an increase of cement the amount of water required for a workable mixture can be reduced, and the strength of the concrete increases as the ratio of water to cement decreases.

The authors have, however, succeeded in achieving their object, viz., "to throw some light in dark places on the materials and methods of road-making."

They state in the preface that, as far as they know, "this is the first British book on the subject." This statement, in the writer's opinion, is unfair to the many British authors who have written on the various aspects of road construction. The context to the above statement refers to the difference between British and American nomenclature. The section of the book on bitumen clearly defines the present British practice. The whole question of the nomenclature of bituminous substances, however, is in the melting pot. The subject was discussed at the fifth International Road Congress held in Milan and Rome, and more recently an International Committee on the Standardisation of Nomenclature and Tests of Road Materials has been sitting in Paris. In this country the question of tests and nomenclature of bituminous substances is occupying the attention of the Institution of Petroleum Technologists. When the divergent views held by the various countries are harmonised, some revision of this section of the book will probably be necessary.

A chapter is devoted to tests on tars and bitumen, but no reference is made to the fact that (a) methods of testing bitumen have been standardised by the Institution of Petroleum Technologists, and (b) the Ministry of Transport specification relating to the tar treatment of roads contains test methods for tar. This omission will, no doubt, be remedied in a subsequent edition.

The above criticism does not detract from the merit of the book, which is nicely arranged and well written, and should be in the hands of all who wish to take an intelligent interest in the construction of good roads.

R. G. B.

FOUR THOUSAND YEARS OF PHARMACY: AN OUTLINE OF PHARMACY AND THE ALLIED SCIENCES. By C. H. LAWALL, Ph.M., Ph.D., Sc.D., F.R.S.A. Pp. xv + 665. London: J. B. Lippincott Co., 1926. Price 25s.

The chief English work dealing with Prof. LaWall's subject is Wootton's "Chronicles of Pharmacy," published in 1910, and now unfortunately out of print. Although this may be supplemented by reference to Netter's translation (1889) of Peters' "Pictorial History of Ancient Pharmacy and Medicine," there is obviously room for a further work of the kind in the English language. The author's main object in undertaking

his task was to meet the need for students of pharmacy "to know something of the history of general science and of some of the professions, arts, and sciences particularly related to pharmacy, and of concurrent events in general history as well." The field covered is thus extensive, particularly as pharmacy is so closely associated in its historical development with medicine and with chemistry.

The book traces the progress of pharmacy from ancient times until the present day, and it may be commended as giving a balanced and generally accurate account of the subject. It is surprising, however, that the author, neglecting the recent researches of Ruska, Holmyard, and others, refers to Geber as a semi-mythical character who may have lived—*pace* Campbell Brown—in the eleventh century.

The author, who does not disdain the split infinitive, writes in a very pleasant style, which will enable his English readers to overlook occasional Americanisms such as "the world was made safe for astronomy by Copernicus"; Robert Hooke "made the wrist watch safe for humanity"; and Antony Leeuwenhoek "was the proprietor of a dry goods store."

The account of the development of pharmacy in America contains much information which is not readily accessible elsewhere. It is interesting to learn from this section of the book that within the past ten years the entrance requirements of the American Association of Colleges of Pharmacy have been advanced from "none" to "four years of high school," and that the baccalaureate and doctorate in pharmacy call for a four-year and a seven-year course, respectively. America is evidently bent upon making pharmacists safe for the world. Nevertheless, in spite of educational progress, "the pharmacist of 1801 was a craftsman who was dependent upon his own resources and his own ingenuity for most of his chemicals and preparations, while his professional descendant, at the end of the same century . . . reared in the lap of comparative luxury . . . instead of devoting his spare time to increasing his professional and scientific work, followed the line of least resistance, which is the line of merchandising."

The book contains 64 interesting full-page illustrations, most of which are photographic reproductions of pages of old pharmaceutical works. There is also a chronological table and a useful bibliography of some 150 titles; by an oversight, Wootton's "Chronicles" has been omitted from the latter, although it is quoted in the introduction. The text is well printed and remarkably free from misprints and minor errors: among these may be noted "Einseideln" for Einsiedeln (p. 239); "Marggraff" for Marggraf (p. 363); "Weiglieb" for Wiegleb (p. 364); and "Hennel" for Hennell (p. 471). Finally, who is in the right concerning Daffy's Elixir? According to Conan Doyle ("Micah Clarke," chap. ix), Mistress Mary Clarke put a small phial of this preparation into the barrel of Micah's left pistol on the twelfth day of June, in the year 1685; the present author, however, ascribes this "celebrated nostrum" of compound tincture of senna to "the first decade of the eighteenth century."

JOHN READ

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The date on which the review appeared is given in brackets at the end of each entry

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- PROCEEDINGS OF THE OPTICAL CONVENTION, 1926.** Part I. Pp. ix+491; Part II. Pp. vii+493-1051. London; Optical Convention, 1926. Price £3. (Aug. 5, 1927.)
- REYMOND, A.** Translated by Ruth Gheury de Bray. History of the Sciences in Greco-Roman Antiquity. Pp. x+246. London: Methuen & Co., Ltd., 1927. Price 7s. 6d. (June 10, 1927.)
- RUSSELL, Sir E. J.** Soil Conditions and Plant Growth. Fifth edition. Pp. viii+516. London: Longmans, Green & Co., Ltd., 1927. Price 18s. (July 15, 1927.)
- THAYSEN, A. C., and H. J. BUNKER.** The Microbiology of Cellulose, Hemicelluloses, Pectin and Gums. Pp. viii+363. London: Humphrey Milford, Oxford University Press, 1927. Price 25s. (June 3, 1927.)

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SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, is now ready.

The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

GLASGOW SECTION

The opening meeting of the session was held, jointly with the Chemical Engineering Group and the Glasgow Section of the Institute of Chemistry, on Wednesday, October 19, in the Cadoro Restaurant, Glasgow. Mr. S. H. B. Langlands, Chairman of the Section, presided.

Interesting papers on "The desiccation (De Vecchis) process of beet sugar manufacture," and "the drying plant used" were given by Messrs. C. Scott Garrett, M.B.E., D.Sc., F.I.C., and G. W. Riley, M.I.Chem.E. As advance proofs of the papers for use of members only had been distributed, Dr. Scott Garrett confined his remarks to the more salient features of the process and to a brief description, illustrated with lantern slides, of the plant.

The De Vecchis process for the manufacture of sugar from sugar beet differed, he said, from the process now in use in that the sugar beet after being washed and sliced into cossettes is subjected to a drying process. Fresh beet would not keep, and had to be extracted when harvested, resulting in an intensive campaign occupying here about three months of the year, or less in warmer climates.

In the defecation of the juice, a unique feature of the De Vecchis process is the addition of superphosphate to neutralise the excess of lime and decompose any calcium sucrose formed.

Other advantages mentioned were the increased amount and quality of the exhausted pulp due to its albumenoid content, the fertilising value of the press cakes due to the contained phosphates, and especially the non-putrescible nature of the effluent which made its treatment a relatively simple and inexpensive matter.

The discussion which followed was exhaustive, and many questions, together with studied criticism of the process, were put forward, particular attention being paid to the whole economic position of the manufacture of sugar from sugar beet.

The thanks of the meeting were conveyed to the lecturers by Prof. Wilson, Chairman of the Glasgow Section of the Institute of Chemistry.

In reply to greetings conveyed by Mr. H. J. Pooley, Hon. Secretary of the Chemical Engineering Group, the Chairman expressed the pleasure which the Glasgow Section had in the presence of so many friends from England, and said that he hoped in the future that there might be more frequent interchange of lectures among the various Sections.

NOTTINGHAM SECTION

The first meeting of the session was held jointly with the Midlands Section of the Society of Dyers and Colourists, on October 19, at University College; Mr. Pentecost in the Chair. Mr. John Allan (Messrs. Joseph, Crosfields, Ltd.) read a paper on "Soaps in textile industries."

Mr. Allan said that soaps, which as used are essentially the sodium and potassium salts of fatty acids, are made from a large variety of fatty substances. Yet only a very few fatty acids were concerned with soap-making. Of these fatty acids some were saturated, the most important of which were lauric, myristic, palmitic and stearic, whilst the most important unsaturated acids were oleic, linoleic, and linolenic acids. In soap-making a detailed knowledge of the properties of the sodium and potassium salts of these acids was desirable.

The "sodium" soap of lauric acid produced a voluminous lather very readily, with the formation of very large bubbles which were very prone to collapse. As one passed up the series to palmitic and stearic soaps, the volume of the lather and size of the bubbles diminished, but the texture of the lather was finer and more permanent. The lathering properties of a soap could not be taken as a measure of its cleansing power; thus the lathering properties of saponins were inferior to soap in cleansing power.

The properties of a soap were mainly determined by the constituents of the soap, and specific properties might be given for special purposes. Some soaps produced a slimy lather, which although soluble could be removed completely from the fibre only with difficulty. Mr. Allan referred to the work of McBain, who, he said, attributed the detergent action of the soap to the formation of a colloid aggregate micelle of high ionic mobility. The electrically-charged aggregate might facilitate the loosening of the dirt, which was then adsorbed on the micelle. The method of estimating the detergent efficiency of a soap by the degree of lowering of the surface tension gave only approximate values.

Soap was used in the textile industry to remove impurities etc. from raw materials, to remove added fatty matter, to facilitate mechanical treatment, in the dye-bath to increase dye-penetration, and in the finishing of many goods. The importance of the complete removal of the soap from the fabric before storing was emphasised. Soap left in the fabric might cause serious damage, as the fabric might acquire an undesirable odour, owing to oxidation and decomposition of the soap. It appeared that the oxidation is greatly stimulated by the presence of small quantities of highly-unsaturated substances which are themselves first oxidised and then function as oxidation catalysts. As an example, Mr. Allan stated that the colouring matter of palm kernel oil was readily oxidised, after which the oxidation product was capable of stimulating the oxidation of other constituents. These products of oxidation were often resinous in character and adhered tenaciously to the fabric. Again, any residual soap might become carbonated by the carbon dioxide of the air, free fatty acid being liberated. Mr. Allan concluded by emphasising

the necessity for the use of soft water in the treatment of fabrics in which soap was a factor.

A good discussion followed, in which the Chairman, Prof. Pyman, F.R.S., and others took part.

CALENDAR OF FORTHCOMING EVENTS

Oct. 28.—Coke Oven Managers' Association. Visit to H.M. Fuel Research Station, East Greenwich, by the courtesy of Dr. C. H. Lander.

Oct. 28.—Institution of Chemical Engineers, at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1, at 6.30 p.m. Public Lecture by Sir William Bragg, K.B.E., F.R.S., on "Crystallisation."

Oct. 28.—Society of Chemical Industry, Liverpool Section. The University, Liverpool, at 6 p.m. Presentation of Leverhulme Prize and Society of Chemical Industry Prizes. "Merseyside and chemical industries," by Dr. A. Holt.

Oct. 28.—Society of Chemical Industry, South Wales Section. Joint meeting with the Local Section of the Institute of Chemistry, Thomas's Cuff, High Street, Swansea, at 7.30 p.m. "The manufacture of dyes," by D. H. Hey.

Oct. 31.—Society of Chemical Industry, Yorkshire Section. Joint meeting with the Institute of Chemistry, Leeds Area Section. The University, Leeds, at 7.15 p.m. "Flame," by O. C. de C. Ellis.

Oct. 31.—Chemical Industry Club, 2, Whitehall Court, S.W.1, at 8 p.m. Annual General Meeting.

Nov. 1.—Society of Chemical Industry, South Wales Section. Technical College, Cardiff, at 7.30 p.m. "The care of the eyes in industry," by T. Lewis.

Nov. 2.—Society of Public Analysts, Ordinary Meeting. St. Mary's Hospital, W.2, at 8.15 p.m. (1) "The biological tests for blood," by Sir W. Willecox. (2) "The technique of the precipitin test and its forensic value," by G. R. Lynch. (3) "The use of the blood grouping reactions in forensic investigation," by F. C. Martley. Informal Dinner at 6.30 p.m. at 178, Piccadilly, W.

Nov. 3.—Chemical Society, Ordinary Scientific Meeting. Burlington House, Piccadilly, W.1, at 8 p.m. (1) "Complex salts of nickel with various aliphatic diamines," by F. G. Mann. (2) "Mechanism of the formation of citric and oxalic acids from sugars by *Aspergillus Niger*," by T. K. Walker, V. Subramaniam and F. Challenger. (3) "The complex cyanides of molybdenum," by W. R. Bucknall and W. Wardlaw. (4) "Parachor and chemical constitution. Part VI. Some cases of supposed ring-chain tautomerism," by F. B. Garner and S. Sugden.

Nov. 3.—Society of Chemical Industry, Bristol Section. The University, Woodland Road, Bristol, at 7.30 p.m. "The manufacture of viscose artificial silk," by H. H. S. Clotworthy.

Nov. 4.—Society of Chemical Industry, Manchester Section. Blackfriars House, Blackfriars Street, Manchester at 7 p.m. Jointly with the Manchester Sections of the Institute of Chemistry, Society of Dyers and Colourists, and the Manchester Literary and Philosophical Society. "Some new principles in chromotherapy," by Prof. A. G. Green.

Nov. 7.—Society of Chemical Industry, London Section. Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "Recent advances in the hydrogenation of oils." General introduction by E. R. Bolton. Part I. (a) "Selective hydrogenation," (b) "Melting point of hydrogenated oils," by K. A. Williams. Part II. "Hydrogenation of fatty acids and neutral oils," by R. G. Pelly. Part III. "The activity of a nickel catalyst," by E. J. Lush.

CHEMICAL SOCIETY

The first ordinary scientific meeting of the session was held on October 20, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., occupying the Chair. The President referred with regret to the deaths of 11 Fellows; he also read a resolution of the Council expressing regret at the death of Prof. Svante Arrhenius, a distinguished Honorary Fellow, and appreciation of his important contributions to chemical knowledge, the company present standing. It was announced that the jubilee dinner of the Institute of Chemistry would be held in London on December 15, and that the ordinary Scientific meeting arranged for that evening would be abandoned. A ballot for the election of Sir J. J. Thomson, O.M., F.R.S., as an Honorary Fellow will be held on November 3. The President read an address which will be presented at the Marcelin Berthelot Centenary celebrations in Paris on October 23-26, the Society being represented by the President, Mr. A. Chaston Chapman, and Prof. C. S. Gibson. Fellows were invited to attend a lecture entitled "Crystallisation," by Sir William Bragg, K.B.E., F.R.S., before the Institution of Chemical Engineers on October 28 at 6.30 p.m., at the Institution of Civil Engineers, Great George Street, S.W.1.

Prof. T. M. Lowry read the following papers :-

Studies of Dynamic Isomerism. Part XXIV. Neutral Salt Action in Mutarotation. [With G. F. Smith.]

(a) ALTHOUGH the mutarotation of glucose is catalysed by acids and bases, as well as by water, it is not affected appreciably by neutral salts of the type of sodium chloride.

(b) Definite catalytic activity has been detected, however, in (i) the undissociated molecules of a strong or weak acid, (ii) the anion of a weak acid, (iii) the cation of a weak nitrogenous base.

(c) The catalytic coefficients of these components are $[HCl]$ about 0.5, $[NH_4] = 0.0011$, $[HAc] = 0.0065$, $[Ac] = 0.069$.

Studies of Dynamic Isomerism. Part XXV. The Mechanism of Catalysis by Acids and Bases.

1. THE catalysis by acids and bases of prototropic change and of hydrolysis is interpreted in terms of an electrolytic theory, according to which a flow of valency-electrons through the molecule is produced by bringing a proton-donor and a proton-acceptor, or a proton-donor and a hydroxyl-donor, into contact with the two terminals of the labile complex.

2. An explanation is given of the parts played, in the catalysis of isomeric change, by (i) neutral water, (ii) the molecules of a strong acid, and (iii) the anions of a weak acid, (iv) the cations of a weak base. The ineffectiveness of metallic cations in isomeric change, and of the anions of an acid in hydrolysis are also accounted for.

Dr. E. K. Rideal inquired to what extent Prof. Dawson and the author had made out a definite case for a catalytic activity of the undissociated molecule of acetic acid. It appeared that the development of the theory of catalysis in solutions had arrived at the point

where it could be stated fairly definitely that the mechanism involved the formation of a quasi-compound between reactant and catalyst, and that this compound was in mass-equilibrium with the reactants. Thus $[A, B]_{AB} = k[A]f_A[B]f_B$, whence the velocity of the reactions, assumed to be proportional to the concentration of the quasi-compound, would be given by $dx/dt = k[A, B] = k'([A][B]f_Af_B)/f_{AB}$. Such a formulation of the mechanism had been tested by Brönsted and his co-workers, and had also been examined by Bjerrum. It fitted the facts better than the two older views, which could be expressed by the equations: $dx/dt = k[A][B]$ and $dx/dt = k[A][B]f_Af_B$. For acetic acid the hydrogen ion concentration at equilibrium is defined by the mass law: $[H^+] = ([HAc]f_{HAc})/(f_H[Ac]f_{Ac})$, and neglect of the activity coefficients might cause considerable errors in the evaluation of the hydrogen ion concentration which was required for testing the reaction velocity equation of Brönsted and Bjerrum.

Prof. Lowry replied that Dawson's work had shown that the main facts of catalysis by acids could be explained without replacing concentrations by activities which appeared to involve relatively small corrections. Experiments on mutarotation had confirmed this result. As regards the inactivity of neutral molecules, which Brönsted had postulated, it was noteworthy that neutral water is an excellent catalyst for mutarotation, although it contains only a trace of free ions. At the isoelectric point 99.9% of the mutarotation is due to neutral molecules, which are therefore the chief catalytic components in the system.

Dr. J. D. A. Johnson described :-

10-Chloro-5 : 10-dihydrophenarsazine and its Derivatives. Part V. The General Method of Synthesis and Determination of Constitution. [With C. S. Gibson.]

THE synthesis of 10-chloro-5 : 10-dihydrophenarsazine by preparation of diphenylamine-o-arsinic acid by two methods, and subsequent ring closure is described (cf. J., 1926, 452). This method has been successfully applied to the synthesis and determination of the constitution of 10-chloro-4-methyl-5 : 10-dihydrophenarsazine, 7-chloro-7 : 12-dihydroisobenzophenarsazine, 12-chloro-7 : 12-dihydrobenzophenarsazine, 10-chloro-4-nitro-5 : 10-dihydrophenarsazine, 10-chloro-3 (or 1)-nitro-5 : 10-dihydrophenarsazine and 10-chloro-2-nitro-5 : 10-dihydrophenarsazine. The intermediate compounds and the corresponding phenarsazinic acids have been isolated in each case. Through the synthesis of the above nitro-compounds additional light has been thrown on the nitration of phenarsazinic acid.

Whilst N-methyldiphenylamine-o-arsinic acid has been prepared, attempts to convert it into 10-chloro-5-methyl-5 : 10-dihydrophenarsazine have been unsuccessful.

Prof. C. S. Gibson briefly indicated the scope of the series of investigations of which this paper forms a part.

Mr. E. J. B. Willey discussed :-

Active Nitrogen. Part IV. The independence of the glow and chemical properties of active nitrogen:

SPECTROSCOPIC and critical potential measurements suggest that active nitrogen is atomic in nature, and

possesses a heat of formation of about $2-2.5 \times 10^5$ g.-cal./g.-mol., whereas the author's experiments have indicated that metastable molecules with an energy of only about 45,000 g.-cal./g.-mol. are involved.

The luminosity of "active" nitrogen can be destroyed, by passage through a second weak discharge in a hot tube, without affecting the quantity of chemically-active nitrogen present; moreover, considerable chemical activity can be conferred on nitrogen by the action of an uncondensed alternating current discharge which does not, however, give rise to any luminosity in the gas thus treated.

It is concluded that "active" nitrogen consists of a mixture of a very small quantity of atoms, which on recombination give rise to the luminous phenomena, together with a much larger proportion of metastable diatomic molecules, which are responsible for the chemical activity, but are not luminous. This hypothesis is in agreement with all the observed phenomena connected with active nitrogen, and is paralleled by the behaviour of other elements under the influence of the electric discharge.

CORRESPONDENCE

REMUNERATION TO CHEMISTS—SOME REMINISCENCES

SIR,—Shortly after W. H. Perkin had put artificial alizarine on the market, in the 'sixties, I was introduced to a maker of madder extract (garancine), who also made safflower paste.

He was of opinion that a colouring matter, if not identical with alizarine, could be prepared from naphthalene, following Perkins' scheme. Needless to say, the experiment failed. I made, anyway, a specimen of Roussin's naphthazarine, which pleased Mr. X., who tried it on mordanted cotton.

I was recommended to Mr. X. by a friend, who was aware that I was a voluntary pupil of Hofmann's in 1863-1864.

Mr. X.'s laboratory was merely a long shelf fixed to the wall of a shed. The shed was wet underfoot, and steamy above. I learned that my hours were to be from 6 a.m. to 5 p.m., and the salary £200 per annum. When not experimenting on naphthalene, I was to attend to the garancine and safflower plant.

Asked when I could take up the job, I named a date, and suggested 8 a.m. as a suitable hour to be on the spot, and was met with the remark, "But steam will have been up two hours!" I didn't doubt it, from the appearance of the walls and skylight.—I am, Sir, etc.

P. H

THE VALUE OF A UNIVERSITY EDUCATION

SIR,—We are all much indebted to Mr. McCulloch for his letter in your issue of October 14. It is simply atrocious that any human being should be expected to work under such conditions of appointment; such work might be demanded of a machine, but not of a human being. Might I ask if the name of the firm concerned could not be divulged? It surely deserves publicity.

Yours faithfully,

F. J. WILSON

PERSONAL AND OTHER ITEMS

Imperial Chemical Industries, Ltd., has given £50 towards the establishment of the proposed Chair of Dietetics in the University of London.

The Council of Leeds University has passed a resolution which records its indebtedness to Sir Edward Brotherton for his magnificent gift of £100,000 for a library. The library will be called the Brotherton Library.

Mr. A. W. Folks has been elected Master of the Distillers' Company; Mr. V. Armstrong, Master of the Carriers' Company; and Mr. E. F. Jackson, Master of the Painter Stainers' Company.

Sir Ernest Benn will in future act as managing director as well as chairman of the publishing firm of Ernest Benn, Ltd., and the new deputy-chairman of the company is Mr. G. Robbins, formerly of the *Times*.

Sir William James Larke, K.B.E., has been appointed by Order of Council dated October 5, 1927, to be a member of the Advisory Council for Scientific and Industrial Research.

Dr. J. W. Mellor, F.R.S., Hon. Gen. Secretary of the Ceramic Society, and Principal of the Pottery Department of the North Staffordshire Technical College, was entertained at dinner by the Ceramic Society on October 20, at the North Stafford Hotel, Stoke. During the proceedings, a presentation was made to Dr. Mellor by the Ceramic Society to celebrate his election as a Fellow of the Royal Society. Mr. H. J. C. Johnston, of the Leeds Fireclay Company, the President of the Ceramic Society, presided.

Mr. H. G. Beard, research assistant in the Department of Colour Chemistry of the Technical College, Huddersfield, has been appointed research chemist at Woolwich Arsenal.

Mr. J. Mason, M.Sc., who has been engaged in research work in chemical bacteriology at the University of Birmingham, has been elected to a Faraday Fellowship at St. John's College, Oxford.

Mr. F. J. Blight, who has been head of Charles Griffin & Co., the well-known scientific and technical publishers, since 1899, and has been associated with the firm since even an earlier date, is now retiring.

Mr. J. W. Baker has been awarded the degree of D.Sc. in chemistry by the University of London.

Mr. W. V. Thorpe has been appointed lecturer in biochemistry in the Department of Physiology of the University of Birmingham.

The Institute of Metals is now in its new headquarters at 36, Victoria Street, S.W.1. An additional reading-room and library are now available for members.

The late Mr. J. H. Reynolds, formerly Director of Higher Education in Manchester and principal of the Manchester School of Technology, to whose wisdom and powerful advocacy the present College of Technology owes its existence, left £3042.

The late Mr. J. A. Hine, late H.M. Superintending Inspector of Factories for the North-Eastern Division, left £7114.

The death took place suddenly, at Tiddington, Stratford-on-Avon, on October 22, of Sir Gerard Albert Muntz, Bart., aged 62. From 1896 to 1921 he was managing director and consultant director of Muntz's Metal Company. He made an exhaustive duty of the properties of copper, copper alloys and other non-ferrous metals, and investigated the deterioration of brass condenser tubes and the chemical and electrolytic action of sea-water on sheathing. He was president of the Institute of Metals in 1910-1911, chairman of the Associated Manufacturers of Brass and Copper Tubes of Great Britain, chairman of the Brass and Copper Tube Association, and chairman of the Metallurgical Section of the Department of Scientific Research.

The following have passed the September examinations of the Institute of Chemistry:—Examination in General Chemistry for the Associateship: Macadam, G. H., B.A. (Cantab.); Osborn, H. W., L.; Smirles, W. N., B.Sc. (Lond.); Smith, A., B.Sc. (Lond.); Wilson, H. N. Examinations for the Fellowship:—In Branch D: Biochemistry, with special reference to the Hormones: Fuller, A. T., Ph.D. (Lond.). In Branch E: The Chemistry (including Microscopy) of Food and Drugs, and of Water: Jones, H. H.; Trace, L. H., B.Sc. (Lond.); Turner, C. E. In Branch G: Industrial Chemistry, with special reference to Petroleum Technology: Kelly, C. I., M.Sc. Tech. (Manc.). Chemical Technology of Textiles: Jackson, S. R., B.Sc. Tech. (Manc.). Special Examination in General Chemistry: Beaumont, G. W.

Labour Policy of Imperial Chemical Industries

A conference will be held on October 31 between the chief labour adviser of Imperial Chemical Industries, Ltd., and representatives of the National Union of Drug and Chemical Workers, to discuss the Union's application for the setting up of machinery to deal with questions raised by members employed at the combine's works at Northwich, Middlewich, Widnes, Fleetwood, Blackley, Huddersfield, Billingham-on-Tees, Gateshead-on-Tyne, London and elsewhere.

The Sir John Cass Technical Institute

The 26th session's work of the Sir John Cass Technical Institute was formally inaugurated on October 10, when Sir William Beveridge, Vice-Chancellor of the University of London, visited the Institute, and delivered an address.

The Rev. J. E. Marr, the Chairman of the Governing Body, who presided, said real progress had again been made, and that the Institute's reputation for the teaching of pure and applied science had been enhanced. Many students pursued a course of study with the definite object of graduating at London University, the total number of registered internal students of the University during the past session being 107. Of the 35 students who had been successful at the University examinations, 6 had obtained the degrees of M.Sc. as the result of theses based on research carried out in the department of chemistry. The research carried out by two of the members of the full-time teaching staff resulted in the degree of D.Sc. in statistics of London University being conferred on Mr. A. E. R. Church, B.Sc., M.A., and the

degree of D.Sc. in chemistry on Mr. J. W. Cook, Ph.D., M.Sc., lecturer in organic chemistry.

In the programme of work for the present session, further facilities for study are being provided, of which particular mention was made of the full day courses in Navigation and Seamanship etc., and the additional evening courses in spectroscopic analysis, law as related to industrial chemistry, and economic geology.

Sir William Beveridge, to whom students who had gained special successes during the past session were presented, stated that technical education was primarily the imparting and acquiring of useful knowledge, and this gave man a greater power over the forces of nature, and at the same time an increase in material wealth. He emphasised the importance of brain power and scientific and technical education as factors in the maintenance of our industrial supremacy.

Petroleum in Colombia

It is reported from New York that the President of Colombia has given the Anglo-Persian Oil Company the right to develop all Government oil reserves in Colombia.

Italian Chemical Industry

The Montecatini Società Generale per l'Industria Mineraria ed Agricola, the chief producer of chemicals and allied products in Italy, has recently floated a bond issue of \$10,000,000 in the United States, to find the capital necessary to ensure for developing its mines and plant.

Projected Amalgamation of German Dye Firms

It is reported that important German dye-manufacturing firms, such as the Heyl-Bernger Farbenfabriken of Berlin, the Gutsbrod dye manufacturing concern, the Franz Rasquin Dye Works of Cologne, the Siegle Dye Works of Stuttgart, the Vossen Bros. Dye Works of Aix, and the Schroeder and Tadelmann Co. of Niederlahnstein, are negotiating for amalgamation and the establishment of a German Dye Works Company (Deutsche Farbwerke A.-G.). The company would have a capital of from £750,000 to £1,000,000, and would not be in opposition to the German I. G. Farbenindustrie A.-G., which it was hoped would have a financial interest in the new concern.

New Method for Preparing Water-resistant Colour Lakes

According to a preliminary account (*Chem.-Z.*, Sept. 10) of a new method of preparing water-resistant lakes for lithography, the dyestuff is precipitated with a specially prepared solution of casein triphosphate under varied conditions. So far the method has been used to convert certain substantive dyes, sulphonated basic dyes, azo dyes, and sulphonated nitro dyes into light-fast lakes.

The Photographic Industry in Russia

The French syndicate "SIMP" has obtained from the Russian Government a concession for the manufacture of photographic materials. It is expected that a factory at Podmoskowna will start to produce photographic papers and cinematograph films next year.

Chloramine as a Laundry Disinfectant

According to an order of the Prussian Minister of Public Welfare, there are no objections to the use of chloramine as a laundry disinfectant for white materials.

On the other hand, for coloured materials, wool, and silk it is said to be unsuitable.

Hungarian Bauxite Industry

It is estimated that the newly discovered Hungarian bauxite deposits contain 200 million m. tons, and that the production for 1927 will amount to 250,000-300,000 m. tons. The development of the industry is due to the export to Germany, which amounted to 24,000 m. tons in the first quarter of 1927. The erection of an aluminium factory in Budapest is projected, and research on the preparation of bauxite cement is to be undertaken.

COMPANY NEWS

BRYANT AND MAY, LTD.

A dividend has been declared at the rate of 7%, less tax, for the half-year ended September 30, 1927, on the preference shares, and an interim dividend of 6%, free of tax, on the ordinary shares. Last year's interim on the ordinary shares was 4%. An interim dividend of 5%, free of tax, will be paid on the partnership shares for the half-year ended September 30, 1927.

LAWES' CHEMICAL MANURE CO., LTD.

The report for the year ended June 30, 1927 shows a net profit of £1460, which, with the balance brought forward, makes £4802, which the directors recommend be carried forward.

BUELL COMBUSTION CO., LTD.

This company announces that under the agreement between it and Messrs. Babcock & Wilcox, the latter company has acquired the sole and exclusive right to make and sell all burners and parts and accessories and parts under the patents respectively for use only with water-tube boilers, and the right to use the same with water-tube boilers.

BABCOCK AND WILCOX, LTD.

An interim dividend has been declared of 7%, tax free, on the ordinary shares, which compares with an interim of 5%, tax free, for the previous year.

RHODESIAN AND GENERAL ASBESTOS CORPORATION, LTD.

The ordinary general meeting was held on October 18, Sir Edmund Davis (chairman and managing director) presiding. After briefly reviewing the accounts for the year ended March 31, 1927 (cf. CHEM. AND IND., August 26, 1927, p. 774), the chairman stated that the total Rhodesian production of asbestos for 1926 amounted to 33,344 tons, of which the company's contribution was 26,863 tons. In view of the satisfactory development of the company's property the power plant is to be extended, and when this is in full operation, probably in the second half of 1928, it is estimated that the output will be about 34,000 tons per annum. Since the issue of the report about two months ago, it was found that a larger capital expenditure was necessary, and it was decided to issue the whole of the 50,000 shares now being created.

VAL DE TRAVERS ASPHALTE PAVING CO., LTD.

An interim dividend has been declared of 6d. per share, less tax, on the fully-paid shares, and 3d. per share, less tax, on the partly-paid shares, being at the rate of 5% per annum, the interim for last year being the same.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned. Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

- Acid Acetic, 40% tech.—£19 per ton.
 - Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 - Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 - Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 - Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 - Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 - Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 - Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 - Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 - Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 - Copper Sulphate.—£25—£25 10s. per ton.
 - Methylated Spirit, 61 O.P. - Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 - Nickel Sulphate.—£38 per ton d/d.
 - Nickel Ammon. Sulphate.—£38 per ton d/d.
 - Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 - Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 - Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 - Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 - Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 - Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market. 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 - Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 - Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 - Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.
- #### RUBBER CHEMICALS
- Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 - Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 - Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 - Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 - Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 - Carbon Black.—5½d. per lb., ex wharf.
 - Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 - Chromium Oxide, Green.—1s. 1d. per lb.
 - Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithopone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron." £13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9.—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride. 4d.—7d. per lb., carboys extra.
Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep. 6s.—6s. 3d. per lb.

Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime. —Brown, £9 10s.—£10 per ton. Good demand.
Grey, £14 10s. —£15 per ton. Liqueur, 9d. per gal.
Charcoal. —£6—£9 per ton, according to grade and locality. Foreign competition severe.

Iron Liqueur. 1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.

Red Liqueur.—9d.—10d.

Wood Creosote.—1s. 9d. per gal., unrefined.

Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.

Wood Tar.—£4.—£5 per ton.

Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 7½d. 8d. per lb. Crude 60's, 2s. 3d.—2s. 5d. per gal.

Acid Cresylic, 90/100.—2s. 11d.—3s. per gal. 97/99.—2s. 4½d.—2s. 5½d. per gal. Pale, 95%, 2s. 3d.—2s. 4d. per gal. Dark, 95%, 2s. 1d.—2s. 2d. per gal.

Anthracene Paste.—A quality, 2½d. per unit, 40% £5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.

Benzole. Crude 65's, 9½d.—10d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 7d. per gal., ex works in tank wagons.

Toluole.—90%, 1s. 4d.—1s. 6d. per gal. Pure, 1s. 6d.—2s. per gal.

Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.

Creosote. Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 9d. per gal. Standard specification, 7½d.—7¾d. per gal. ex works. Salty, 7d. per gal., less 1¼%.

Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.—10½d. per gal. Solvent 95/160, 10½d.—1s. 4d. per gal. Solvent 90/190, 8½d.—1s. 3d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.

Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.

Pitch, medium soft.—84s.—85s. per ton, f.o.b. according to district. Market firm.

Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180.—4s.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 9d. per lb.

Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.

Acid H.—3s. per lb.

Acid Naphthionic.—1s. 6d. per lb.

Acid Neville and Winther.—4s. 9d. per lb.

Acid Sulphanilic.—8½d. per lb.

Aniline Oil.—8d. per lb., naked at works.

Aniline.—4s.—8d. per lb., naked at works.

Anthranilic acid.—6s. per lb., 100%.

Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—6½d. per lb.

m-Cresol 98/100%.—2s. 7½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—1s. 10d. per lb.

Dimethylaniline.—1s. 11d. per lb.

Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton.

Dinitrochlorobenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

α-Naphthol.—2s. per lb. d/d.

β-Naphthol.—10d. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb.

β-Naphthylamine.—3s. per lb.

p-Nitraniline.—1s. 8d. per lb.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb.

R. Salt.—2s. 2d. per lb.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—8½d. per lb.

p-Toluidine.—2s. per lb., ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage, paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 4d. per lb. Technical 11½d.—1s. per lb. Good demand.

Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Amidol.—9s. per lb. d/d.

Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton. Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—9s. 6d. per oz.

Barbitone.—5s. 9d.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—9s. 9d.—9s. 10d. per lb. Bismuth

Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—

8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—

8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb.

Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Sub-

chloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—

7s. 9d.—8s. per lb. Extra and reduced prices for

smaller and larger quantities respectively; Liqueur

Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.

—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium. 1s. 9½d.—1s. 10½d. per lb. Sodium.—2s.—2s. 1d. per lb.,

Granulated $\frac{1}{2}$ d. per lb. less. All spot. Large quantities at lower rates.

Calcium Lactate.—1s. 2d.—1s. 3 $\frac{1}{2}$ d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.

Chloroform.—2s. 3d.—2s. 7 $\frac{1}{2}$ d. per lb., according to quantity.

Croosote Carbonate.—6s. per lb.

Ethers: S.G. 730, 10 $\frac{1}{2}$ d.—1s. 1 $\frac{1}{2}$ d. drums. Other gravities at proportionate prices.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—4s. 9d.—5s. per lb.

Hexamine.—2s. 3d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal. in carboys; Winchesters, 2s. 11d. per gal.; 20 vols., 4s. 3d. per gal. in carboys; Winchesters, 5s. per gal.

Hydroquinone.—2s. 11d.—3s. 2d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate.—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P., 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—18s.—20s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2 $\frac{1}{2}$ %; Heavy Commercial £21 per ton, less 2 $\frac{1}{2}$ %; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 8s. 6d.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots.—Red oxide, 7s. 6d.—7s. 7d. per lb.; Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb.; Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb.; Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.

Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonol.—8s. 9d.—9s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—2s. 6d.—2s. 9d. per lb.

Phenazone.—4s.—4s. 3d. per lb.

Phenolphthalein.—6s. 6d.—6s. 9d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2 $\frac{1}{2}$ %.

Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.

Resorcin.—3s. 9d.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 11d.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hypsulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 7 $\frac{1}{2}$ d.—1s. 8 $\frac{1}{2}$ d. per lb. Crystal, 1s. 8 $\frac{1}{2}$ d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.

Sulphonol.—6s. 9d.—7s. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 1d. per lb.

Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.

Aubepine (*ex Anethole*).—11s. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.

Coumarin.—9s. 9d. per lb.

Citronellol.—13s. 9d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—6s. per lb.

Ethyl Phthalate.—2s. per lb.

Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 15s. per lb. (*ex Shui Oil*) 10s. 6d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 18s. 6d. per lb.—(*ex Shui Oil*) 14s. 6d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—16s. 6d. per lb.

ESSENTIAL OILS

Almond.—11s. per lb. Anise.—2s. 9d. per lb. Bergamot.—26s. per lb. Bourbon Geranium.—13s. 6d. per lb.

Camphor.—75s. per cwt. Cananga, Java, 15s. 9d. per lb. Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java, 1s. 9d. per lb., c.i.f. U.K. port, for shipment over 1928. Ceylon, Pure, 1s. 8d. per lb. Clove, pure 5s. 3d. per lb.

Eucalyptus, Australian.—2s. 2d. per lb. Lavender.—Mont Blanc, 28/40%, 17s. per lb. Lemon.—7s. 3d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—9s. 9d. per lb. Peppermint.—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 6d. per lb. Sandalwood—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Dec. 19th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Nov. 3rd. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Allen. Rectifying mixed gases. 26,972 and 26,974. Oct. 11. (U.S., 3,1.27 and 18.2.27.)

Boucherot and Claude. Refrigerating etc. 26,964. Oct. 11. (Fr., 11.10.26.)

- Cross. Muffle furnaces. 26,788. Oct. 10.
 Cuker and Komers. Purification of solutions. 27,347. Oct. 14. (Austria, 14.1.27.)
 Feige. Apparatus for carrying out chemical reactions. 27,441. Oct. 15. (Ger., 15.10.26.)
 Handley. Filters. 27,382. Oct. 15.
 Higgins, and United Water Softeners, Ltd. Apparatus for carrying out reactions involving base exchange. 27,174. Oct. 13.
 I.-G. Farbenind. Catalysts. 27,285. Oct. 14. (Ger., 3.3.27.)
 Nielsen. Production of dry powders from solutions etc. 26,816. Oct. 10.
 Petersen. Means for contacting gases and liquids. 26,852. Oct. 10. (Ger., 21.6.27.)
 Poverud and Sonsthagen. Grinding etc. mills. 27,405. Oct. 15.
 Reavell. Spray-drying plants. 27,304. Oct. 14.
 Selden Co. Catalytic apparatus. 26,925. Oct. 11. (U.S., 27.10.26.)
 Whatmough. Apparatus for production and dispersion of solids in liquids. 27,255. Oct. 14.

I.—Complete Specifications

- 9239 (1926). Bataafsche Petroleum Maatsch., and Moser. *See* II.
 19,226. (1926). Benson. Separation of mixtures of gases. (273,229.)
 20,856 (1926). British Dyestuffs Corp., Hollins, and Chapman. Decolorisation of aqueous liquids. (278,485.)
 28,069 (1926). Masc. Continuously determining quantitatively a given constituent of a mixture of gases. (271,027.)
 32,518 (1926). Vohl & Co. *See* VII.
 *25,967 (1927). La Mont Corp. Effecting heat exchange. (278,704.)
 *26,204 (1927). Siemens-Schuckertwerke A.-G. *See* XI.
 *26,247 (1927). Blau. Separation of mixtures of gases and gases with vapours. (278,712.)
 *26,431 (1927). Pehrson. Extracting suspended or dissolved substances from gases or liquids. (278,722.)

II.—Applications

- Algem. Norit Maatsch. Producing activated carbon. 27,318. Oct. 14. (Ger., 16.10.26.)
 Alox Chem. Corp. Atomisable mobile fuel product. 26,823. Oct. 10. (U.S., 2.3.27.) Producing emulsion from partially oxidised petroleum wax. 26,824. Oct. 10. (U.S., 23.3.27.)
 Atkinson. Recovery of petroleum from oil-bearing sands. 26,800. Oct. 10.
 Corson. Manufacturing hydrocarbons from calcium carbide. 27,198. Oct. 13. (U.S., 14.10.26.)
 I.-G. Farbenind. Heating carbonaceous materials. 27,199. Oct. 13. (Ger., 28.10.26.)
 Johnson (I.-G. Farbenind.). Treating coke oven gas. 27,202. Oct. 13.
 Thornton. Apparatus for detecting presence of inflammable gas. 26,888. Oct. 11.

II.—Complete Specifications

- 9239 (1926). Bataafsche Petroleum Maatsch., and Moser. Manufacture of finely divided substances from natural emulsions or suspensions. (278,395.)
 16,942 (1926). Street and Hey. Purification of waste lubricating oils. (278,434.)
 18,232 (1926). Soc. pour l'Exploit. des Proc. Urbain. Manufacture of active carbon. (255,871.)
 20,960 (1926). Woodall-Duckham (1920), Ltd., Smith, and Finlayson. Manufacture of gas. (278,486.)
 448 (1927). Aluminum Co. of America. Calcining of coke. (269,849.)
 4788 (1927). Synthetic Ammonia & Nitrates, Ltd., and Slade. Steam distillation of coal and the like. (278,577.)

*25,271 (1927). Patentakt. Gröndal-Ramen. Dry distillation of shales. (278,694.)

*25,725 (1927). Soc. du Gaz de Paris. Purification of gas. (278,700.)

*26,583 (1927). Kulzinski. Distilling solid fuels. (278,740.)

*26,606 (1927). General Carbonalpha Co. Manufacture of hydrocarbons and substances containing adsorbed hydrocarbons. (278,745.)

IV.—Applications

I.-G. Farbenind. Manufacture of chlorine-substitution products of 1-amino-2 : 4-dimethylbenzene. 26,937. Oct. 11. (Ger., 11.10.26.) Dyestuffs. 27,293. Oct. 14. (Ger., 23.10.26.)

Johnson (I.-G. Farbenind.). Vat dyestuffs. 26,929. Oct. 11.

IV.—Complete Specifications

11,660 (1926). Morton Sundour Fabrics, Ltd., Morton, Wylam, Harris, and Jones. Dyes and dyeing. (278,399.)
 16,683 (1926). Hooley, Thomas, and Scottish Dyes, Ltd. Production of colouring-matters. (278,417.)
 18,135 (1926). British Synthetics, Ltd., and Higgins. Manufacture of chlorides of ortho-hydroxy-carboxylic acids of polynuclear hydrocarbons. (278,463.)
 7440 (1927). I.-G. Farbenind. Manufacture of vat dyestuffs. (278,651.)

18,150 (1927). Hoffmann-La Roche & Co. Manufacture of alkyl and aralkyl derivatives of diphenolisation. (278,672.)

*26,482 (1927). Soc. Chem. Ind. in Basle. Purifying vat-dyestuffs. (278,728.)

*26,483 and 26,937 (1927). I.-G. Farbenind. Manufacture of chlorine-substitution products of 1-amino-2 : 4 dimethyl benzene. (278,729 and 278,761.)

V. Applications

Courtaulds, Ltd., and Taylor. Manufacture of viscose filaments etc. 26,792. Oct. 10.

I.-G. Farbenind. Manufacture of artificial material from alkyl cellulose. 27,211. Oct. 13. Desulphurising viscose silk. 27,294. Oct. 14. (Ger., 23.10.26.)

V.—Complete Specifications

16,818 (1926). Kaufmann. Preparing cellulose for the manufacture of artificial silk etc. (258,836.)

17,245 (1926). Internat. Sugar & Alcohol Co., Ltd. (Soc. Indus. de la Cellulose). Saccharification of wood. (278,450.)

24,333 (1926). Bemberg A.-G. Producing twisted artificial silk from cuprammonium cellulose solutions. (260,564.)

17,585 (1927). Duhamel, and Comp. Gén. des Industries Textiles. Washing or cleaning wool. (273,755.)

20,798 (1927). I.-G. Farbenind. Application of cellulose ethers or esters. (275,653.)

*24,102 (1927). I.-G. Farbenind. Treatment of hydrated cellulose. (278,684.)

*26,324 (1927). I.-G. Farbenind. Precipitating viscose solutions. (278,716.)

*26,564 (1927). I.-G. Farbenind. Manufacture of cellulose acetate solutions and plastics. (278,735.)

VI.—Applications

Johnson (I.-G. Farbenind.). Production of wetting-agents etc. 27,425. Oct. 15. Dyeing with vat dyestuffs. 27,426. Oct. 15.

Taylor. Machines for bleaching fabrics. 26,999. Oct. 12. Bleaching. 27,020. Oct. 12.

VI.—Complete Specifications

11,060 (1926). Morton Sundour Fabrics, Ltd., Morton, Wylam, Harris, and Jones. *See* IV.

*26,706 (1927). I.-G. Farbenind. Treatment of fibres with aqueous liquids. (278,752.)

VII.—Applications

Johnson (I.-G. Farbenind.). Production of hydrocyanic acid. 27,200. Oct. 13. Production of mixed crystals con-

taining potassium and ammonium. 27,201. Oct. 13. Minimising corrosive action of sulphuric acid etc. 27,427. Oct. 15. Selden Co. Contact sulphuric acid process. 26,928. Oct. 11. (U.S., 24.8.27.)

VII.—Complete Specifications

18,247 (1926). Demann. Neutralising ammonium sulphate crystals. (255,876.)
29,959 (1926). Liljenroth. Oxidising ammonia by means of oxygen. (276,295.)
32,518 (1926). Vohl & Co. Purification of solutions of salts. (263,809.)
5205 (1927). Urbain. Producing hydrogen and phosphoric acid. (278,578.)
*26,614 (1927). Metallbank u. Metallurgische Ges. Producing zinc salts. (278,747.)

VIII.—Application

Amsler-Morton Co., Geer, and Morton. Annealing glassware. 26,821. Oct. 10.

IX.—Applications

Carl and Riedel. Material for road beds, floors, etc. 27,193. Oct. 13. (Ger., 15.10.26.)
Davis. Manufacture of cement etc. 26,980. Oct. 11.
Johnson (Amesite Asphalt Co. of America). Manufacture of road-surfacing materials etc. 27,284. Oct. 14.

IX.—Complete Specification

*25,067 (1927). Internat. Copperclad Co. Building-material. (278,691.)

X.—Applications

Ashcroft. Metallurgy of ores containing tin. 27,422. Oct. 15.
Beatty (Bell Telephone Laboratories). Treating magnetic materials. 27,310. Oct. 14.
Cameron & Son, Ltd. Etchells, and Popplewell. Alloys. 27,419. Oct. 15.
Cross. 26,788. See I.
Duffield. Reduction of ores. 26,812. Oct. 10.
Freier Grunder Eisen und Metallwerke. Cupola furnaces. 27,184. Oct. 13. (Ger., 21.7.27.)
James. Extraction of tin from cassiterite. 27,043. Oct. 12.
Kramer. Metal powders. 26,962. Oct. 11.
Tullis. Aluminium alloy. 26,993. Oct. 12.
Wade (Internat. Nickel Co.). Manufacture of wrought iron 26,966. Oct. 11.

X.—Complete Specifications

8518 (1926). Johnson (I.-G. Farbenind.). Reduction of iron ores. (278,167.)
11,282 (1926). Gravell. Pickling of metals. (278,398.)
16,021 (1926). Bury. Treatment of zinc waste. (278,411.)
16,538 (1926). Hopfelt and Nolden. Coating metals with aluminium or magnesium or their alloys. (278,415.)
16,941 (1926). General Motors Corp. Electrolytic deposition of chromium. (254,757.)
17,017 (1926). Warren, and Precious Metal Industries, Ltd. Producing metallised surfaces on bodies containing sulphur. (278,437.)
17,319 and 23,643 (1926). Smith, Garnett, and Holden. Alloys. (278,454.)
21,622 (1926). Krupp A.-G. Treating low-carbon steel and iron. (274,016.)
4262 (1927). New Jersey Zinc Co. Metallurgical operations. (268,302.)
*26,589 (1927). McCluskey. Recovery of precious metals from ores. (278,742.)
*26,442 (1927). Siemens & Halske A.-G. Manufacture of beryllium or its alloys. (278,723.)

XI.—Applications

George. Electric furnaces. 26,784. Oct. 10. (Fr., 27.10.26.)

I.-G. Farbenind. Electrically insulating composition. 26,977. Oct. 11. (Ger., 6.11.26.)
Imbery. Electric furnaces. 26,755. Oct. 10.
Levy. Electric batteries. 27,337. Oct. 14.
Pink. Dry cells. 27,306. Oct. 14.

XI.—Complete Specifications

16,798 (1926). Silica Gel Corp. Dry charged battery plates. (255,059.)
16,941 (1926). General Motors Corp. See X.
17,214 (1926). Knowles. Electrolytic cells. (278,447.)
*26,204 (1927). Siemens-Schuckertwerke A.-G. Electric gas-purifying plant. (278,710.)

XII.—Applications

Kutassy. Soap etc. 27,402. Oct. 15.
Potts (Furskov). Treating fatty materials. 26,998. Oct. 12.
Soc. Anon. des Distilleries des Deux-Sèvres. 26,935. See XX.

XII.—Complete Specifications

16,844 (1926). Welter. Producing soap (254,755.)
*25,393 (1927). Oel- u. Fett-Chemie Ges. Treating tall oil. (278,697.)
*25,898 (1927). Verein. Chem. Werke. Eliminating the unpleasant smell of glycerin obtained by fermentation. (278,703.)

XIII.—Complete Specifications

18,430 (1926). Acheson. Pigment oil compositions. (265,541.)
31,557 (1926). I.-G. Farbenind. Manufacture of lacquers etc. (262,818.)
*25,390 (1927). Du Pont de Nemours & Co. Preventing livering in pigmented carbohydrate compound compositions. (278,696.)
*26,564 (1927). I.-G. Farbenind. See V.

XIV.—Applications

Goodyear Tire & Rubber Co. Preserving rubber. 27,209. Oct. 13. (U.S., 30.11.26.)
Johnson (I.-G. Farbenind.). Production of a reversible paste from rubber latex. 26,791. Oct. 10.

XIV.—Complete Specifications

*24,625 (1927). Goodyear Tire & Rubber Co. Accelerator of vulcanisation. (278,689.)

XV.—Applications

Ehrenreich. Leather, and process for obtaining same. 23,932. Oct. 11.
I.-G. Farbenind. Manufacture of solutions of gelatin in organic solvents. 27,406. Oct. 15. (Ger., 20.10.26.)

XVII.—Complete Specification

17,245 (1926). Internat. Sugar & Alcohol Co., Ltd. (Soc. Indust. de la Cellulose). See V.

XIX.—Application

Carpmael (I.-G. Farbenind.). Protecting grain in storage from vermin. 26,979. Oct. 11.
Deco, Ltd., and Golding. Milk products. 26,817. Oct. 10.
Krause. Sterilising liquids. 27,050. Oct. 12. (Ger., 14.10.26.)
United Dairies (London), Ltd., and Walker. Liquid food preparation. 26,915. Oct. 11.

XX.—Applications

Daudt. Production of tetra-ethyl lead. 27,330. Oct. 14. (U.S., 15.10.26.) Preparation of tetra-alkyl lead. 27,331. Oct. 14. (U.S., 20.1.27.)
Selden Co. Catalytic oxidation of organic compounds. 26,920. Oct. 11. (U.S., 26.8.27.)
Soc. Anon. des Distilleries des Deux-Sèvres. Separation of fatty acids. 26,935. Oct. 11. (Belg. 23.5.27.)

XX.—Complete Specifications

17,155 (1926). Stickings, and May & Baker, Ltd. Manufacture of organic compounds of arsenic. (278,444.)

17,656 (1926). I.-G. Farbenind. Manufacture of heterocyclic compounds. (258,553.)

18,135 (1926). British Synthetics, Ltd., and Higgins. See IV.

31,751 (1926). Schroder. Manufacture of protective and curative agents from glandular organs. (263,155.)

*25,249 (1927). Merck. Production of a scopolamine preparation. (278,693)

*25,475 (1927). I.-G. Farbenind. Manufacture of condensation products of urea. (278,698.)

XXII.—Applications

Grinstead and Salmon. Explosives. 26,926. Oct. 11.

Imperial Chemical Industries, Ltd., and Jenkins. Nitrocellulose products etc. 26,952. Oct. 11. Nitrocellulose solutions. 27,080. Oct. 12.

Nobel Industries, Ltd. (Du Pont de Nemours & Co.). Nitrocellulose solutions etc. 27,339. Oct. 14.

Williams. Explosives etc. 26,749. Oct. 10.

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number: *British India*: Crockery, earthenware (318); Belting, anti-friction metals, oil engines, leather cloth (319); Humidifying and ventilating plants (320); Measuring steel, paper, glycerin, unsensitised, glazed, photo paper for ferro-prussiate photography (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Burma*: Mining and quarrying machinery (323). *Colombia*: Metal sleepers (C. 2447). *Czechoslovakia*: Hematite iron, ferro-manganese and ferro-silicium (329). *Greece*: Chemical products (335). *Holland*: Perfumery, chemists' and druggists' sundries (336); Red lead (337). *Italy*: Paint, varnish, enamel (339). *New Zealand*: Steelwork (B.X. 3917). *Poland*: Flexible metallic tubing (340). *South Africa*: Sanitary earthenware (326); Soap (B.X. 3901); Electro-plate hollow-ware, electro-plate flat-ware, cutlery, glassware, crockery and aluminium ware (B.X. 3909); Superheater boilers (A.X. 5371). *United States*: Leather (341.)

A New Dyestuff

The British Dyestuffs Corporation, Ltd., has issued a further pattern card illustrating their new chrome colour—Solochrome Yellow 2G, which is applicable to all types of wool materials, especially loose wool and slubbing, where good general fastness is necessary. Owing to the fact that it leaves cotton and silk effects unstained it is of interest for pieces. Its good solubility and levelling power make it suitable for application in various types of circulating machines. Solochrome Yellow 2G is unaffected by sulphuric acid dye-liquors, and is of special interest for use with carbonised materials.

Manufacture of Photographic Plates in Poland

The import duty on glass for use in the manufacture of photographic plates is to be reduced from 25 to 5 zloty

per 100 kg. with a view to encouraging the production of plates in Poland.

News from Advertisements

The University of London announces particulars of the forthcoming Gow Lectures on the Colloid Chemistry of the Rubber Industry, which will be given by Dr. E. A. Hauser, of Frankfurt-on-Main (p. vi).

A chemist, B.Sc., with special qualifications in inorganic and physical chemistry, is required (p. vi).

A junior assistant is wanted for an analytical laboratory (p. vi).

Some second-hand laboratory instruments are required (p. vi).

A highly-trained chemist requires a junior partnership in a chemical concern (p. vi).

There are now 125 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

A DIGEST OF THE LITERATURE ON THE CONSTITUTION OF PORTLAND CEMENT CLINKER. By R. H. Bogue. Paper No. 3. Portland Cement Association Fellowship. Pp. 66. Washington, D.C.: Co-operative Investigations by the Portland Cement Association and the National Bureau of Standards, 1927.

FIRE RISKS IN INDUSTRY. By A. M. Campton, B.Sc. Pp. 21. London: Institute of Chemistry, 1927.

NOXIOUS GASES AND THE PRINCIPLES OF RESPIRATION INFLUENCING THEIR ACTION. By Y. Henderson and H. W. Haggard. American Chemical Society Monograph Series. Pp. 220. New York: The Chemical Catalog Co., Inc., 1927. \$4.50.

THE THEORY OF STRONG ELECTROLYTES. A General Discussion held by the Faraday Society, April, 1927. Pp. 333—544. London: The Faraday Society, 1927. 15s. 6d.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN. Edited by Prof. Emil Abderhalden. Part I. Chemische Methoden, Teil II. Hälfte I, Heft 3. (Lieferung 237.) Alkylieren. By J. Halberkann. Pp. 643—862. Berlin: Urban & Schwarzenberg, 1927. 12 m.

PRELIMINARY REPORT ON THE MINERAL PRODUCTION OF CANADA DURING THE SIX MONTHS ENDING JUNE 30, 1927 (with revised statistics for the calendar year 1926). Canada Department of Trade and Commerce. Dominion Bureau of Statistics. Mining, Metallurgical and Chemical Branch. Pp. 72. Ottawa: F. A. Acland, 1927.

PRELIMINARY REPORT ON THE TREATMENT OF REDGUM OR MARMI KINO (*Eucalyptus calophylla*) FOR THE PREPARATION OF TANNIN EXTRACT. By D. Coghill. Commonwealth of Australia. Council for Scientific and Industrial Research. Circular No. 9. Pp. 14. Melbourne: H. J. Green, 1927.

A SURVEY OF THE TANNING MATERIALS OF AUSTRALIA. By D. Coghill. Bulletin No. 32. Commonwealth of Australia. Council for Scientific and Industrial Research. Pp. 136. Melbourne: H. J. Green, 1927.

REPORT OF THE DIRECTOR OF STORRS AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING JUNE 30, 1926. Bulletin 142. December, 1926. Pp. 167—182. Storrs, Connecticut: Storrs Agricultural Experiment Station.

SOME EFFECTS OF LIMESTONE AND HYDRATED LIME ON BIOCHEMICAL ACTIVITIES IN ACID SOILS. By H. Dorsey. Bulletin 141, November, 1926. Pp. 115—163. Storrs, Connecticut: Storrs Agricultural Experiment Station.

AGRICULTURAL EXPERIMENT STATION, IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS. Annual Report for the Fiscal Year ending June 30, 1926. Pp. 63. Ames, Iowa.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY

CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

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The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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EDITORIAL

Comfort and Fertilisers

SIR ALFRED MOND is surely mistaken in thinking that the richer classes in the Middle Ages were worse off, so far as material comforts are concerned, than the working classes of to-day, and in thinking that the addition of fertilisers to pasture land can have so great an effect as he seems to suppose. So far as the first point calls for consideration, we have a vivid idea of the Middle Ages derived from scenes at the theatre, old ballads and other poetry, and those authentic pictures of Yuletide and so forth which have portrayed the Middle Ages. So strong is our conviction and so confident our belief that we are prepared to put them to the test. We take down a book from our shelf, intending to be perfectly fair and impartial, we admit that it causes us a slight and temporary disappointment, for it tells us that, if we exclude the castles, the habitations in this country in the fourteenth and fifteenth centuries were lacking in floors, ceilings and chimneys, and were so simple in design that two or three active men could build one or two houses in a day; they had no chairs and no tables, and, indeed, nothing to put upon these had they possessed them. This book is obviously not worth pursuing further; we open a second one and find that in the Royal palaces in this country forks were introduced in the reign of Edward II, and we gather that for some time thereafter forks were reserved for the grown-ups, and that the young princes and princesses were expected to use their fingers instead. The rich, it seems, slept naked in their beds; the poor slept in their ordinary clothes; the rich had "fine" underclothing, made of flax woven at home, the poor had coarse underclothing, sackcloth, made of hemp, also woven at home; we feel prickly all over as we think of it; there were no carpets for the majority of the poor or the rich; if they fell ill an experienced

doctor was called in who consulted the stars, and with this guide culled appropriate herbs from the nearest ditch; for six months in the year they had no fresh meat; their food supply was very scanty, and they were rather lucky if, with the assistance of the astrologers, they lived much beyond the age of forty. In the fourteenth or fifteenth century comfort was not appreciated, for it was not known. Robin Hood was as comfortable in the forest as he would have been in his own house. Evidently our small library is very imperfect. We find no books which confirm our clear vision, but a few which throw doubt on it. The matter is, perhaps, worth further search. Merrie England in the Middle Ages no doubt was merrie, but it was neither healthy, nor safe; the prevalence of leprosy and other plagues seems to indicate rather a low standard of comfort. If as the result of further reading we can confute Sir Alfred Mond on this point, we shall do so.

On his second point, the effect of fertilising the pastures and so improving the cattle and sheep, we are even more confident than on the first point. We have seen skulls in museums, have seen the wild cattle at Chillingham and Bewick's engraving of them, and we feel we are on safe ground. Thorold Rogers wrote a book on the History of Prices and Agriculture; it is a standard book, and it should assist us; it does; it tells us that in the middle of the sixteenth century, when the pastures of this country had somewhat improved, cattle for the navy weighed rather less than 4 cwt. each. This looks as if the improvement in the pasture had not improved the beast as an article of food, which is what we expected. The Rev. W. Denton tells us, however, that in the fifteenth century the ordinary weight of cattle was about 320 lb., and that four such beasts and four horses, or, alternatively, eight such beasts, were used to draw one plough. Adam Smith, in his Wealth of Nations, says: "In the reign of Queen Anne, in 1710, when half the stock of the

kingdom were fed on uninclosed commons, the cattle and sheep sold at Smithfield market weighed on an average as follows: beeves 370 lbs., calves 50 lbs., sheep 28 lbs. Now (1795-1800) it may be stated: beeves 800 lbs., calves 148 lbs., sheep 80 lbs., and lambs 50 lbs. The increase is principally, if not solely, to be attributed to the improvements which have been effected within the last sixty years, and the feeding of our young stock in good enclosed pastures instead of wastes and commons." Surely Sir Alfred Mond cannot be right! We find that in 1740 beeves in Forfar weighed about as much as they did in England a century earlier. Of, course, we must remember that in the winter the cattle had little food; they had their meagre pasturage eked out with straw, ivy and tree loppings, and it seems from many books that in the fourteenth and fifteenth centuries the land in England, that is the pasturage and cultivated land, had been exhausted, and even the practice of adding a little marl once in eighty years had fallen into decay. Marl was almost the only manure in this country in the Middle Ages, and the more we look into the facts the more, up to now, we have found that the addition of fertilizers to the ground has been accompanied by the growth in size of both cattle and sheep. We are not yet convinced, only not quite so sure of our original belief. If we find some good evidence in support of it we will publish it. We hope to find it very shortly; there must be another side, the evidence cannot all support Sir Alfred Mond! Perhaps our readers can help us.

University Training in Science

Our readers are at present being asked to consider whether all is well with the training of the industrial chemist. They may like to ponder at the same time the broader question of scientific education in our universities. This subject is brought forcibly to our notice by criticisms contained in the final chapter of a little book entitled "Procrustes, or the Future of English Education," by Mr. Alderton Pink. Mr. Pink regards the future of elementary and secondary education with hopefulness, but concerning university education he has grave forebodings. He recognises with alarm that the scientific spirit is permeating and that scientific methods are moulding all branches of higher learning; and the two salients on which his attack is concentrated are lectures and research.

Lectures should be abolished, he suggests, for books have made them obsolete. Dr. Johnson, a century and a half ago, we are told, emphasised the futility of lectures, which cannot do as much good as the books from which they are taken. College lectures are no better than a gramophone, and their wasteful duplication in many centres might be avoided by the use of wireless. Fortunately, chemistry lectures may have a chance to survive, together with lectures on shoemaking, so long as they are experimental. More to be condemned than lectures, however, is the pursuit of specialised knowledge, *i.e.*, research. "Research" is the name of a powerful god, made in Germany, and the universities are the shrines where its worshippers perform their rites with fiery zeal. For a contribution to knowledge is deemed the beginning of wisdom; knowledge of man's

origin and past, of nature's unusual moods, of new possibilities of atomic combination or disruption. The goal of it all is the Ph.D. degree, and the young man leaves the university fashioned like a Grecian column, very tall, but also very narrow!

Nevertheless, the system succeeds, and that, according to our author, is the pity of it. So a long-suffering community is being supplied with a plethora of mechanical inventions and chemical marvels, and men to work them withal, but these it has neither the time nor the desire to use; whilst the accumulated results of research, even in a single science, are so vast that no mind can grasp them and no system synthesise them. Meanwhile the ideal of a liberal education, in which intellect and emotion, thought and action are held in equipoise, lies buried and forgotten until the day when the present "cult of research has been reduced to absurdity." Such is the criticism; what is our defence?

Lectures must go; research must go; so Othello's occupation's gone. Yet need it be so? Are not lecturing and instruction in research after all the proper functions of a university professor or lecturer? It is true that both functions are seldom exercised in the highest degree by one man. A Huxley is rare, a Kelvin is rare; a combination of the two is more than can be expected within a single personality. If a man cannot lecture it is easy to say that he ought not to be where he is; and his students may be forgiven for praying for his removal to another, if not a higher, sphere. A good lecturer, however, is an inspiration to his students; he makes dry bones live, he infects his class with his own enthusiasm, he is full of wise saws and modern instances, he is a priest who interprets the spirit of his science. It is his personality that counts, his method of setting forth his subject, so that his students see what they never could see and learn what they never could learn without his aid.

Then as regards research; should not all laboratory work be done in the spirit of research? Every chemical experiment done for the first time is an adventure. Students enjoy qualitative analysis because they are finding out things; and quantitative work should provide a more refined enjoyment. Instruction in the methods of research: what is meant by this common phrase? What other than this? Discovery of what has been done by others on the subject, tabulating and co-ordinating their results, devising a plan of campaign, exercising all possible manipulative skill in arranging and carrying out experiments, meditation upon results that by their puzzling character often offer a challenge which the alert mind gladly accepts, and finally the gaining of the victory and the marching home with the spoils.

Is such training narrow; is it not rather an epitome of the methods of dealing with the larger problems of commerce and citizenship, and so may it not become a real part of the making of a citizen? If its end is to be merely the carrying of another stone to the summit of the amorphous pile of accumulated facts of science, then its aim may be intrinsically trivial; but if its end is to be the training of hand and eye and mind for the service of the State, then it furnishes a contribution to our complex life which we cannot afford to lose, even if its benefits to chemical industry are only indirect.

THE CHEMICAL INDUSTRY*

By THE RIGHT HON. SIR ALFRED MOND, BART., M.P.

Imperial Chemical Industries, Ltd., the greatest merger in the history of British industry, is barely nine months old, and is becoming increasingly recognised as one of the main factors in Imperial trade and Imperial industrial relations. It is unnecessary to detail the many advantages of the process of amalgamations in industry. During the last 20 years the economic trend of industries throughout the world has been towards the growth of bigger and bigger units. In America the tendency has developed far more than in this country, and in Germany, owing sometimes to the concurrence, and sometimes almost to the compulsion of the government, cartels have increased in number.

When the strength and advantages of this economic tendency were investigated it was decided that the chief chemical and allied producers in this country should form, not a cartel, but a complete amalgamation or merger. It was felt that successful as the histories of the individual companies had been, and prosperous as the whole industry was under the existing conditions, in order to ensure the supremacy of the British chemical industry throughout the Empire, it should form one indivisible whole, capable of negotiating or combating upon equal terms with the already amalgamated industries in America and Germany.

Any industry which competes in the world's markets must keep up with world economic tendencies. The chemical industry has done so, and will continue to do so. For, by the pooling of financial and other resources, by the pooling of information and research processes, by forming a united front in the markets of the world, in all directions, in industry, in finance, in production, in distribution and in salesmanship, economies could be effected which would increase the prosperity of the industry, increase the prosperity of the consumer, whether intermediate or end, and allow that higher standard of living which all desire to see applied to industrial workers.

The chemical industry plays such an important and predominant part in all industrial developments that the two statements "Chemicals form the foundation of the world's industries" and "The chemical industry is essential to Imperial security" require elaboration rather than justification. The extraordinary amenities and comforts of modern life are so much taken for granted that everyone does not realise the great debt which we all owe to the development of modern industry and the chemical industry in particular.

The standard of comfort enjoyed by the average working man of to-day is greater than that of a wealthy and powerful nobleman of the Middle Ages. Such a state of affairs may well be called a miracle, and it is largely due to the modern industrial system, in which chemicals play such an important part. If we analyse the ordinary doings of the ordinary man throughout the twenty-four hours, we find that all the objects with which he deals and most of the food he eats have come at

some time or other within the province of chemical industry.

Our company can fairly claim to be representative of the industry as a whole. The volume of our production is enormous; in some of our industries such as the alkali trade we discuss our outputs in the terms of hundreds of tons per day. And in those industries such as dye-making, where the tonnages are naturally not so heavy, the output, in its class, is very high indeed. The list of our products if I were to read it to you would take hours. Our four main constituent companies, Brunner, Mond & Co., Ltd., Nobel Industries, Ltd., British Dyes, and the United Alkali Co., Ltd., have a total of seventy-five constituent and associated companies. Our total production amounts to millions of tons per annum, worth scores of millions of pounds in value; our dyes and intermediates total over 5,000 alone, and we make other chemicals and explosives in every imaginable variety. Our consumption of raw materials is enormous, the amount of coal we burn, though you may be assured that every device is employed to do this as economically as possible, runs into hundreds of thousands of tons per annum. Again, we quarry millions of tons of limestone every year.

We employ about 40,000 men, among whom the importance of a small army of chemists and engineers must not be forgotten. We ransack the Universities for talent, and have even been accused of unduly depleting them! Our works are distributed throughout the country, and our selling organisation covers the whole earth. You will find our products in every corner of the British Empire and in remote villages in the centre of China. Our latest selling organisation for fertilisers is very interesting, as it combines an efficient business agency with a research and information bureau. I am alluding to Nitram, Ltd. The production of artificial fertilisers will falsify the prediction of Malthus, and will undoubtedly prevent what would have been a world famine in future years.

Nitram is an organisation of Imperial and world propaganda whose business it is to make known the use and value of the new fertilisers. Already it has a large staff of district advisers in all parts of Great Britain, whose sole duty it is to give free and disinterested advice to farmers not only on nitrogenous fertilisers, but on fertilisers of all kinds.

The alkali trade can fairly claim to be dealing with the raw material of raw materials. The reason that the public is unaware of its extent and importance is that its products have often been used before there is any general interest in the substances produced. Take, for example, the preliminary treatment of cotton, the purification of boiler water, the early stages of paper making—all these operations use alkali in some form or other in the very early stages of production.

Nearly everything, when you go back to it, comes out of the ground. In the alkali trade we begin with common salt, a material of which this country possesses abundance. The largest deposits are situated in Cheshire, which is the centre of the heavy alkali trade. Salt brine is pumped up from the earth and put through an elaborate and continuous series of processes which are mechanised to a very high degree indeed. There are few more

* From an address by The Right Hon. Sir Alfred Mond, Bart., M.P., Chairman of Imperial Chemical Industries, Ltd., read by Dr. F. A. Freeth, F.R.S., in the absence of Sir Alfred Mond owing to indisposition, before the Central Economic League, on October 20, 1927.

impressive sights than the interior of one of these great factories at night: a steady hum of machinery, an astonishingly small number of men, with an output running into hundreds of tons per day from each unit. The alkali industry is also connected with the production of chlorine, the well-known bleaching agent.

There is a very close connexion in the chemical industry between the processes which can make a country prosperous in peace and efficient in war. Consider fertilisers and explosives! The same compound which deals death and destruction can also be a valuable plant food, because in each case it contains that essential body, fixed nitrogen. The explosives industry, of course, is not, as might be supposed, maintained on a basis of preparation for war. The use of explosives in the ordinary arts of peace, coal mining, quarrying, etc., is very great indeed, and our huge explosive works in Scotland and many other places in the country are among our greatest assets.

The fertiliser industry is, as far as we are concerned, a comparatively new one. We have recently erected at Billingham, in the county of Durham, a factory for the extraction and fixation of the nitrogen of the air. This business, as will be shown later, is intimately linked with the future of agriculture in this country. The initiation of this industry has been a brilliant feat of engineering, and one which maintains the traditional high standard of that science in Great Britain. In the past the chemist has probably claimed and received rather more than his share of credit for the success of our industry, which frequently offers greater difficulties to the engineer who puts it into practice than to the chemist who originally worked it out in the laboratory. Good engineering can often turn an unprofitable chemical process into a profitable one.

Our fertiliser process works at extremely high gas pressures, and the technique of handling such pressures not only reflects the greatest credit on those who designed and carried it out, but also affords a means of attacking new problems in similar regions. The artificial production of wood spirit (methanol) is already a fact, and production of oil from coal is another excellent example of the future development of high-pressure technique in this country.

The manufacture of dyes, though originally started in England very soon was captured abroad, and for many years the part played in this important industry by Great Britain was only nominal. To-day this is all changed, and for range, colour, and variety the dyestuffs produced by us will challenge comparison with any others.

The old reproach that the manufacturers of this country are indifferent to science and research is now a thing of the past. Our organisation is not only keenly alive to its necessity and importance, but is actively prosecuting original investigation in every phase of our activities. In this connexion an important point should be emphasised. Research must have an object. There is no such thing as pure research in industry. We have never done any, and will never do so. If you choose to call pure research the investigations of those branches of science from every point of view which are likely to be of benefit to ourselves, my reply would be that, in

that case, we have never done anything else but what you are pleased to call pure research.

The two quotations of chemical achievement of the past which I am about to make to you are interesting, inasmuch as they had a considerable effect on the fate and fortunes of large numbers of mankind, and illustrate the fact that there is practically no vital human need which the chemical industry could not supply if called upon to do so.

During the French Revolution the new, and not then very peaceful, régime was faced with a shortage of soda. Soda is an essential raw material of industry. Any attempt to enumerate its applications would consume the whole of the remainder of our time this morning. If the world were to be deprived of soda to-morrow morning something like industrial chaos would very quickly arise.

Faced with this shortage, the French Government appealed to the patriotism of their chemists, one of whom, Leblanc, discovered his well-known process, using common salt as his raw material. This process saved the young Republic and endured for nearly 100 years, being finally displaced by the modern process, of which the late Dr. Ludwig Mond was the pioneer in this country.

To take a more modern instance, Germany, as we all know, had planned an elaborate national war scheme which naturally included the manufacture of explosives. All the wars of modern times had been fought out with the nitrate fields of Chile as a basis. Germany, realising that she could not hope to maintain the long sea route to Chile, worked out a process using the air we breathe as a raw material for the explosives. This, as we know, did not eventually save her, but it was singularly effective as far as it went.

A minor but interesting application of chemical industrial effort can be found in the motor show at present being held in Olympia. Motoring has become the pastime of the million. The original motor car naturally took a great deal of its colour from the horse-drawn carriage. Its cushions were of leather, and its paintwork was put on in the laborious manner of the older industry. It would be literally impossible to upholster the modern car with leather, whilst the painting of coachwork in the early manner is too expensive for a popular industry. What do we find? Chemical industry has produced a wonderful leather-like material made from semi-nitrated cellulose, and has evolved the same material in a different form as a beautiful hard varnish, admirably adapted to the rough wear of the road.

Turning from the above to a vital matter, the food supply of the world, for several generations civilised mankind has lived on the stored accumulation of centuries lying in the untouched virgin plains of the world. Though not yet exhausted, such supplies are limited, and are not replaceable by nature at the rate at which they are being consumed. Chemical industry has come to the rescue with supplies of fertilisers derived from the atmosphere which, humanly speaking, are illimitable. This country, for example, previously dependent on outside sources of fertiliser, has now developed its own production to an extent which actually enables us not only to supply our own needs, but to export to other nations less fortunately situated than ourselves.

Whilst I should hesitate to predict that this country will ever be independent of outside supplies of food, it may be confidently asserted that the chemical industry will in time put us in a position of reasonable independence with regard to any essential commodities. For example, Great Britain, thanks to its peculiar position and in spite of or rather because of summers such as we have recently enjoyed, is one of the finest grassland pastures of the world. Up till quite recently grass has been regarded as just grass, and no particular attention has been paid to it. It has recently been discovered that if grassland is systematically manured with the artificial fertiliser I have just mentioned, the resultant pasture is extraordinarily rich in the essential foods for cattle. Experiments which have been carried out, among other places, on my own estate have shown that it is possible to raise animals on grass alone which are in equal condition with those fed in the ordinary way which have consumed considerable quantities of imported foodstuffs. And in addition to the above remarkable result, there is every indication that it may be possible to raise a far greater number of beasts per acre than has ever been contemplated before.

Turning to another side of our feeding problems—the necessity for fattening foods—science has recently shown us that materials, such as butter, are essentials for our well-being, and that generally speaking we do not eat enough of them. Formerly we thought that a man was rather like a steam engine—that it was only necessary to provide him with so many calories a day and the human machine would do the rest. The discovery of the vitamins completely destroyed this charming simplicity. Nowadays we know that the vitamins which are contained in butter and similar natural foods play a very great part in our well-being. Now, as you know, an enormous artificial fat industry has grown up in the last twenty years; this fat, though excellent and wholesome food, has not contained those essential ingredients for health to which reference has been made above; the chemical industry is now coming to the rescue, and we are already in sight of artificial vitamins.

As you are aware, we are particularly interested in the utilisation and development of fuel, and I have recently become president of a new institution, the Institute of Fuel, whose aims are to investigate the use of the most vital of our national problems on as wide a basis as possible. In this field also the chemical industry is showing signs of the production of what may be considered miracles in the near future. Besides the well-known problems, such as the proper balancing and co-ordination of power and electrical production, power and ordinary gas, there is the more strictly chemical aspect of the question, such as a universal smokeless fuel and the provision of by-products and petrol substitutes. Within the last few days a speed record has been broken by the use of synthetic petrol.

You have all doubtless read in the public press of the production of oil and petrol from coal. Consider what this may mean to the railways alone in the future. The ordinary express locomotive, magnificent, impressive and attractive as it is, is a shocking sinner as regards the economic conversion of coal into power. The provision of abundant oil at a sufficiently low price and at home

may undoubtedly in time reduce the cost of rail transport and render this country independent in both peace and war of imported oil fuel.

You are probably aware that the future timber supplies of the world are a cause of anxiety to those people whose duty it is to look a long way ahead. If this situation became acute, the chemical industry would undoubtedly come to the rescue with an artificial cellulose substitute.

Most of the greater advances in biology and physiology during the past decade have been made largely with the help of physics and chemistry. It is not too much to expect that such advances will be reflected in the chemical industry. To give an example, we are coming more and more to regard the human body as a complex shifting labyrinth of chemical reactions and secretions. As time goes on, and we get closer and closer to a knowledge of the truth, the industrialist will follow up and will probably extract the essential chemical compounds governing these reactions from animal sources, then later he will prepare them by simpler means; this tendency is now coming forward with insulin. Finally he will synthesise these remarkable materials which may even change the very forms and minds of the human race.

The industry will also naturally play a great part in the prevention of disease. I did not come here to tell you of our own discoveries, but at the risk of being accused of an attempt at a little free advertisement would like to tell you that one of my companies has recently discovered one of the most efficient and complete antiseptics the world has ever seen.

There is practically no need which the chemical industry cannot supply. We may therefore look forward, with confidence, to a future for mankind in which his needs are so obviously met by the chemical industry that he will recognise it as one of the dominant factors of his existence. There is one feature in the situation as regards the future which is uncertain, and is of the greatest interest. The present chemical and, for the matter of that, any other industry depends on what might be called classical science, which has not altered fundamentally for a very long period. For example, a young chemist in 1907 was taught in a very similar manner to his forerunner of 1887. The last twenty years, however, have witnessed an upheaval of scientific thought of the most far-reaching character. At present such new knowledge has not affected the industrial world to any appreciable extent, but if you go back into the past you will always find that a mental revolution has frequently been followed by a physical one. All through last century the triumphs and discoveries of science were followed up in industry. It is therefore not too much to expect that the rapidly-advancing new knowledge will in time be followed up by industrial applications which at present are not even in the speculative stage, and that the future will provide not only a vast increase of those physical amenities which are so characteristic of the present age, but will also produce a change in mental values which will go far to establish a national equanimity. In any such revolution the chemical industry will play a major part, and judging by the success with which it has solved the

formidable problems presented to it in the past, we may look forward to the future with every confidence.

Before concluding a reference must be made once more to the subject of industrial peace, which is easily the most important and fundamental of all industrial problems. Everyone now recognises the insensate folly of continuous industrial warfare, except those who are avowed subverters of the constitution and of the existing social order. Those, I know, it is your whole purpose to combat and defeat.

The chemical industry has had a most fortunate, happy, and friendly past. Over the long period of 53 years there has been no strike, no lock-out, no industrial dispute. The most close and personal contact has happily existed for more than one generation between the captains of the industry and those who work with them. It was stated when the new merger was made that that happy relationship would not be allowed to be altered.

It was only ten days ago that the first instalment of the Labour Programme of Imperial Chemical Industries, Ltd., was announced to the workers and the world. The programme was, in itself, a proof that the same spirit and the same desire still animated those who were charged with the heavy responsibility of the direction of this huge amalgamation, and it was received and accepted as a fruitful augury for the advance of industrial harmony in the new united industry.

The first instalment dealt with five main points, the keynotes of which were personal contact, improved status and increased security, co-partnership in profits, and co-operation.

So important were all questions of labour considered that it was decided to establish a Central Labour Department, under the personal direction of an executive director of the company, who would be assisted by a Chief Labour Adviser and an Advisory Committee to secure the necessary interchange of views between those who form the policy and those who execute it. By a system of works councils, concentric in character, and ranging from the works council of an individual works, through the general works council of a group of works, to the Central Works Council representing the whole of the 40,000 workers in the combine, it was felt that direct personal contact could be maintained between the Board and the individual worker wherever his place of occupation was. The chairman of the Board himself presides over the Central Works Council.

A complaint which has often been raised in industrial relationship concerned the status and security of the worker. By the inauguration of a staff grade of workers, under which all men of five years' service and over would be eligible for promotion to the staff, such men to be paid a weekly wage instead of an hourly rate, and to receive, in addition, a month's notice of termination of employment, payment of wages for holidays, payment of full wages (less National Health Benefit) for all certified sick absence up to six months in any year, it was felt that a concrete instance of increased status and security was being established.

By facilitating throughout the whole combine the acquisition of shares by the workers on preferential terms, all ranks of workers are invited and encouraged to obtain a direct financial interest in the company.

To summarise, the machinery for the ventilation of all potential grievances, the machinery for the free and frank discussion of matters of common interest, the machinery for the co-ordination and unification of labour policy for the worker to advance and become a shareholder in the firm, have already been provided in the chemical industry. There is no doubt that by this means the progress and prosperity of all those engaged, and of the industry as a whole, will be increased, and that the cordial relationship which has existed for so many years will be cemented and strengthened.

The achievement of industrial peace cannot be hastened merely by the desires of enthusiastic amateurs or disillusioned politicians. It can be secured only by the competence and good will of those in whose hands are placed the responsibility for industrial organisation, whether on the side of direction or on the side of labour. There is a new spirit and a new science in the management of the chemical industry. That new spirit and new science is the broad avenue to industrial prosperity and to industrial peace.

AGRICULTURAL RESEARCH

On October 26 Sir Alfred Mond entertained the delegates to the Imperial Agricultural Research Conference to luncheon at the Savoy Hotel.

Proposing the toast of the Imperial Agricultural Research Conference, Sir Alfred Mond said that some less instructed people would probably imagine that conferences of politicians at various times laying down constitutional rules were really of more importance, but those who had inner knowledge knew perfectly well that research, and above all agricultural research, properly carried on and co-ordinated, assisting those all over the vast far-flung territories of the Empire, was more likely to produce results of fundamental and permanent value to all those engaged within the ambit of the British Empire than probably any other form of work that could possibly be done.

The position of agriculture in the world was slowly being recognised. Although it was the most vast industry and the most fundamental industry in the world, it had, on the whole, been carried on without much regard to a scientific basis. Throughout the history of the world it had been looked down upon as a thing which could be carried on by relatively uneducated people, and as being of relatively small importance. If suddenly the agriculture of the world ceased for a very short time, we not having reached the stage of synthetic food production which the future may hold in store, those who had not regarded agriculture in the proper light would be surprised to find what a short time it took before starvation put an end to their earthly career.

He was glad to think that Imperial Chemical Industries, and its subsidiary operating company, Nitram, Ltd., was setting out to render real and, he hoped, increasing service to Imperial agriculture. Under the able guidance of Sir Frederick Keeble, whom he induced to leave the quiet retreats of Oxford in order to engage once more in a more vitalising life, they were now carrying out in co-operation with Government departments, private

growers and commercial corporations, trials of fertilisers in the various parts of the Empire:—

For example, in South Africa trials were being carried on in the Transvaal, Natal, Cape, and Rhodesia; in East Africa, in Kenya, Tanganyika, and Nyasaland; in West Africa, in Nigeria, the Gold Coast, and Sierra Leone; in North Africa, &c., in Sudan and Mauritius; in the West Indies trials were being carried on in Trinidad, Jamaica, and Demerara; in India, in Bombay, Ceylon, and Burma; and also in Palestine, in the Near East, and in Australia. Outside the Empire, trials of fertilisers were being executed in the United States, Egypt, China, Japan, the East Indies, Belgium, and Spain. Both within and without the Empire the crops on which trials were being made were beans, cocoa, coffee, cotton, coconuts, ginger, grass, limes, maize, potatoes, rice, rubber, sugarcane, tea, tobacco, wheat. Many of these trials were designed specially to test the suitability of nitro-chalk for use in tropical and sub-tropical countries. To that end they were making a study of the conditions of soil and climate and temperature throughout the Empire. Evidence had been obtained that this fertiliser was of great value for use within Great Britain, but it would not be produced for export until the results of the trials now being carried out had been received.

Thus they would be able to devise that form of fertiliser best suited to each case.

They were trying out a whole series of new fertilisers in various parts of the world. Arrangements were now being made throughout the Empire, and had already been completed for certain parts of India and in Kenya, for carrying out trials on the suitability of the new fertiliser, ammonium phosphate and nitro-phoska, for use in tropical and sub-tropical agriculture. Representatives of the company were studying conditions in South Africa and Australia with a view to determining to what extent phosphate deficiency and other deficiencies such as potash had been the reason why so little use was being made of nitrogen fertilisers in these countries. Representatives were proceeding to India to investigate the fertiliser position of that country, and to study the best means whereby the company, if called upon to do so, would give effect to the proposals laid before the Royal Commission on Agriculture in India, for a great scheme of co-operation in fertiliser propaganda between the Government of India and this country. Arrangements had also been made for co-operation between the Sudan Government and the company with a view to carrying out fertiliser trials in the Sudan.

They recognised the difficulties of Governments in obtaining from short-sighted Treasuries the necessary funds for carrying out this kind of experimental work, which in its ultimate effect must vastly increase wealth and happiness and economic prosperity, though to those of little imagination it appeared a wasteful means of immediate expenditure. Through their possession of practical imagination, and also owing to their possession of the necessary funds, they were prepared to come in and help, to co-operate, not merely with their knowledge, but also financially. It was a vast and important programme which would take considerable time to work out, although a very good start had been made. They

hoped to be able to solve a good deal by the work of a staff of researchers, economists, and agricultural experts, who by their knowledge, not of one problem but of problems all over the Empire, would be able to give advice and help of a real objective character to others working in the same field.

The importance of the present Agricultural Research Conference was generally recognised and the company had proposed as a means of promoting Empire agriculture the establishment of a Central Imperial body to assist all Imperial Agricultural Departments in all matters relating to fertilisers. The means proposed were, firstly, to issue an authoritative handbook on the planning and recording of field trials and experiments; secondly, the collation and distribution of the results of fertiliser experiments carried out in the different parts of the Empire; and thirdly, the issue of summaries of new knowledge relating to fertilisers.

It seemed that if the proposal were accepted at the Conference, it could best be carried out by co-operation between the proposed Soils Bureau and the representatives of the Ministry of Agriculture, of the Imperial Agricultural Research Conference and of Nitram, Ltd.

They had embarked on what was really a great Imperial mission, not merely with the hope, which he was certain they would achieve, of extending British industry, not merely with the idea of paying some dividend to their confiding shareholders, but still further with the idea of making still more independent and still more self-contained that great economic complex which called itself the British Empire, and which, if united in action, united in work, united in thought, could achieve for itself a position unparalleled among the nations of the world in all the annals of history.

In replying on behalf of the Conference as chairman, Lord Bledisloe said their task was to organise agricultural research within the Empire and to seek the most effective way of carrying its teachings to those to whom they were of importance in their daily task. They must bear vividly in mind in this connexion the work of that, perhaps, greatest of English country squires, Sir John Bennett Lawes, who initiated and became the first manufacturer of artificial fertilisers. He ventured to suggest that Sir Alfred Mond to-day was fulfilling the rôle that Lawes filled fifty years ago. He ventured at Billingham, in the absence of Sir Alfred, to suggest that probably there was no one who combined within himself the rôle of eminent statesman, enthusiastic scientist and leader of industry to the extent that Sir Alfred Mond did. If Sir John Bennett Lawes was the great prophet of phosphates, surely Sir Alfred Mond was to-day the great prophet of nitrate.

But the activities of himself and of his great firm were by no means confined to the synthetic production of nitrate and its various derivatives. He had pointed out that the aim was a very much larger one, that of being in a position to provide the cultivators of the Empire not merely with nitrogenous fertilisers, but with all they required for the chemical nutriment of the economic plants which they raised upon their holdings. Nitrogen was the most important of all plant foods, but in certain parts of our great Empire, and notably in New Zealand and other parts of Australasia, they were suffering from

phosphate starvation. If Sir Alfred Mond and his colleagues would bend their minds to the fertiliser requirements of every type of soil, and every type of economic plant throughout the Empire, they would be fulfilling a most useful and very necessary function.

He was sure they would all agree that the Billingham works, whatever they might be deemed to be from the point of view of the output of important chemical products, were a great masterpiece of engineering as applied to chemical industry. There was no such triumph of engineering in its application to science to be found anywhere in the world. The ultimate aim was to produce human food directly or indirectly from the products of the soil. They were necessary partners in achieving the same goal ultimately, that of winning from the soil of the Empire the largest possible amount of food and other economic products at the lowest possible costs.

"IN CANADA WITH THE EMPIRE MINING AND METALLURGICAL CONGRESS"

By A DELEGATE FROM GREAT BRITAIN

The R.M.S. *Alania* docked at Montreal at about 7 a.m. on Monday, August 22, and the delegates were conveyed at once to the Hotel Windsor, where the opening session commenced punctually at 10 a.m. in the presence of mining engineers and metallurgists from every important country in the Empire and, indeed, from many foreign countries as well.

Sir Robert Horne, as Honorary President of the Congress, made the inaugural speech, which included a masterly summary of the position of the British Empire in respect of the available facilities for the supply of metals. Reminding delegates of the parlous situation which developed shortly after the outbreak of the war — when vital sources of supply either of minerals or of the equally important refining facilities were found to be in enemy or neutral control, Sir Robert set out facts from which he deduced that, except so far as copper is concerned, the present position of the Empire has greatly improved.

The consumption of copper in the world had risen from 1,000,000 tons annually before the war to 1,500,000 tons per annum at the present time, but consumers in Great Britain were at the mercy of the International Copper Cartel, in which the United States had the controlling interest. Nevertheless, progress in Canada and in South Africa was encouraging, and delegates later had an opportunity of seeing at Rouyn how promising the production from north-western Quebec, added to the expected great increase during the next few years from the Frood nickel-copper mine near Sudbury, Ontario, may become.

The world's supply of nickel and of tin was almost entirely under British Empire control, the Province of Ontario having proved supplies likely to last at the present rate of consumption of nickel for at least a hundred years, there being known reserves of 150,000,000 tons of good-grade ore. South Africa, too, had large deposits of low-grade ore. The tin position was interesting as the known reserves were limited, and increased

production at one point was likely to be balanced by decreases elsewhere. Nevertheless, the Empire produced 40% of the present output, and the tin-smelting industry in the East was capable of treating 80% of the world's output of metal, whether originating in the East Indies or in Bolivia. The chrome and cobalt situations were declared to be encouraging.

The metal price situation, however, was a matter for some concern. More metals had been produced during the past quarter of a century than in all preceding ages. High tin prices had brought into production new mines and restarted old ones. The fall in the price of silver resulting from the action of the Indian Currency Commission had destroyed confidence, and the temptation to increased production was therefore tempered by caution.

Turning to coal, Sir Robert declared that the problem of securing a better method of utilisation was important to the Empire, but vital to the Mother Country. There was, however, inspiration in the way our forefathers recovered from the economic aftermath of the Napoleonic wars by the discovery of steam power and the exploitation of coalfields. Britain then made a new start in the world, and retained the lead down to the end of last century. Where can we now turn for a new economic factor which shall rescue the country from the difficulties following the past great war? The answer was to be found, he thought, in two lines of investigation: low-temperature carbonisation, and the treatment of coal with hydrogen at high pressure, the latter having an important relation to the future oil supply of Great Britain and other non-producing countries. He considered that we were in a position to indulge in high hopes of success in commercial operation: the Bergius process converts a larger proportion of coal into oil than some others, and he confidently expected good results from the work now going on in Germany. Success would also mean great things in Great Britain, Australia, and in other parts of the British Empire, which were deficient in domestic oil resources.

Dealing with the question of metallurgical research, Sir Robert referred to the important results attending the introduction of the oil flotation process in lead and zinc reduction. Low-grade ores had been brought into production and old mines brought back into operation. In Canada, particularly, the process had produced very notable advantages. Speaking of the application of electrolysis to zinc production in Canada and Australia, the President instanced the remarkable progress attained by the Electrolytic Zinc Corporation in Australia and the Consolidated Mining and Smelting Company of Canada, Ltd., in both lead and zinc.

In closing, Sir Robert paid a high tribute to the paper which followed, prepared by Sir Thomas Holland, and which in fact constituted the most tangible achievement of the Congress, apart, of course, from the unique opportunity afforded to individuals of discussing technical problems and of seeing the great developments throughout Canada in every branch of mining and metallurgy.

Sir Thomas Holland's paper, entitled "A proposed review of the mineral resources of the Empire," is best summarised by the resolution which accompanied

its introduction, supported as it was by the Institution of Mining and Metallurgy in Great Britain, and carried without dissent by the Congress. The resolution in effect calls for the calling together by the Empire Council of Mining and Metallurgical Institutions of committees of specialists in each of the dominions and larger colonies charged with the duty of reviewing for each country concerned its mineral resources, whether developed, undeveloped, or abandoned, together with its smelting and refining capabilities, having in mind the desirability of accumulating, in addition to the ordinary official statistics of production and movement, the essential data necessary for the formulation of an economic policy, as well as for obtaining the information required to institute measures designed to secure military safety. It was considered desirable that public statistics should be analysed by those who are familiar with the trend of mining and metallurgical development, and who have information which is not available in Government bluebooks regarding minerals that might be worked, or areas that ought to be examined, but under existing conditions are now neglected, frequently owing to the indisposition of some colonial governments to set up adequately equipped geological surveys and to the reluctance in some quarters to facilitate mining operations of any kind owing to their effect on depleted labour markets.

The paper itself was accompanied by four complementary essays produced under the authority of the Advisory Council on Minerals at the Imperial Institute, one on "Empire mining laws," by Mr. G. Stone; another on "Mica," by Mr. G. V. Hobson; another on the "Empire's tin resources," by Mr. R. Pawle; and the last on the work of the Mineral Resources Section of the Imperial Institute being by the Chairman of the Section itself, Sir Richard Redmayne.

It is too early to gauge the practical utility of this discussion from the business man's point of view, but one result of the presentation of this paper by Sir Thomas Holland will no doubt be a more intelligent demand by the interested public upon their respective Governments for the expansion of the existing geological survey and research organisations and a more definitely expressed demand for information of a more complete character regarding the particular country's resources in minerals, and the possibilities of exploitation, having regard to transportation, power, labour, smelter facilities, refining and manufacturing outlets, import and export trade in finished products, etc.

Following upon the official banquet on Tuesday, August 23, the Congress started out on two tours—the one westward to Victoria and back and the other following the same route as Tour "A" up to Cochrane, Ontario, and then striking eastward to Rouyn, Arvida, Thetford Mines, Sydney, and Newfoundland. The writer took Tour "A," but was enabled to inspect at a later date many of the mines and plants previously visited by Tour "B," together with some others not covered by either tour. In an article of this length one must allow it to be assumed that the party was welcomed with open-hearted hospitality at every place at which it touched, and the writer can attempt to deal only very briefly with some of the chemical and metal-

lurgical features associated with the mines, and concentrating and smelting plants visited by either of the two tours.

At Ottawa many took an opportunity of visiting the Chelsea and Farmers' Rapids plants of the Gatineau Power Company, a subsidiary of the Canadian International Paper Company, Ltd. (which has an immense new paper plant near Ottawa at West Templeton, Que.). These two plants, situated on the Gatineau River about seven miles from its confluence with the Ottawa River, are about 7000 ft. apart and work in parallel, power being generated at 6600 volts and stepped up to 110,000 volts for transmission. Chelsea is designed for an ultimate installation of five units of 34,000 h.p., and Farmers' for five units of 24,000 h.p., each having at the moment four units in place. The Gatineau Power Company, however, owns waterpower sites with an aggregate potential capacity in excess of 700,000 h.p., and its minimum present installation in the various plants linked up with its transmission and distribution system is 475,000 h.p., capable of generating from 1929 onwards approximately 2,150,000,000 kw.-hours, or 70% of the output of the Ontario Hydro-Electric Power Commission at the present time.

After technical sessions and a great banquet at Toronto, the Congress proceeded to the great steel plant at Hamilton, where the Steel Company of Canada, Ltd., manufactures most of the heavier products of the industry. The annual capacity of the Hamilton plant is about 290,000 tons, and the output comprises various grades of basic, foundry and malleable pig-iron, produced in two blast-furnaces, one being 73 ft. high and 15 ft. 8 in. in diameter, and the other 90 ft. high and 20 ft. 4 in. in diameter, with three McClure three-pass stoves and five two-pass combination stoves. There is also a large steel plant, rolling mills, and by-product coke ovens. The steel plant comprises eleven basic open-hearth furnaces, ranging in size from 25 to 70 tons capacity each; there is also one 100-ton mixer. The rolling mill equipment includes a 34-inch two-high single stand, reversing blooming mill. There are also billet and sheet bar mills, edging rolls, rod and bar mills, sheet mills, cold roll mills, a galvanising plant, and all necessary auxiliary equipment. The plant has a capacity of 300,000 tons of ingots per annum; 260,000 tons of blooms, billets and sheet bars; 150,000 tons of hot rolled products, including 90,000 tons of wire rods and 45,000 tons of merchant bars, and so on; the sheet mill has a capacity of 15,000 tons of black sheets for galvanising, stamping, forming back plate and blue annealed sheets; a spike mill can produce 93,000 kegs of railway tie spikes. The coking plant is equipped with 80 Wilmotte by-product ovens, having an annual capacity of 365,000 tons of coke; by-product ammonia is recovered as the sulphate, and there is a benzol refinery capable of handling about 2,190,000 gals. of light oils per annum. The company also operates another rolling-mill in Hamilton, the capacity being about 70,000 tons of rolled products per annum. Wire and wire products are turned out by the "Canada" Works, at Hamilton, which can produce 32,000 tons per annum.

(To be continued)

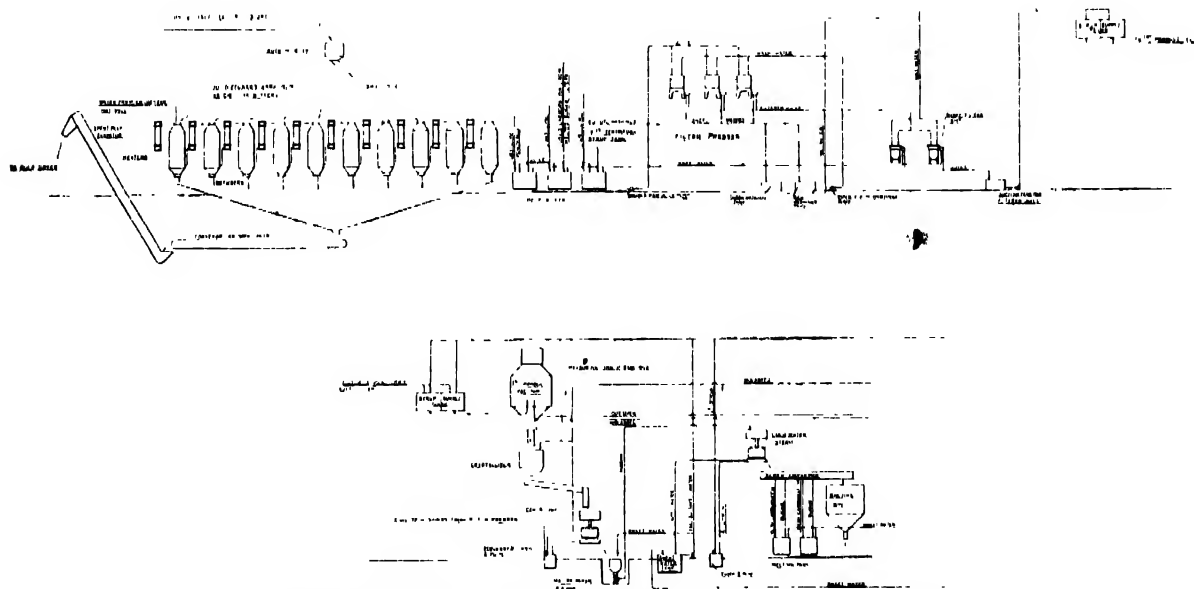
THE DESICCATION (DE VECCHIS) PROCESS OF BEET SUGAR MANUFACTURE*

By C. SCOTT GARRETT, M.B.E., D.Sc. F.I.C.

The process invented and patented by Dr. Inco De Vecchis, of Rome, for the manufacture of sugar from sugar beet differs from the process now in general use in that the sugar beet after being washed and sliced into cossettes is subjected to a drying process. Fresh beet will not keep, and must perforce be extracted when harvested, resulting in an intensive campaign occupying here about three months of the year, or less in warmer climates. Beginning with Schutzenbach in 1837 right up to Lafeuille in recent years, investigators have been unsuccessful in obtaining a process of drying sugar beet, the chief reason being that, through fear of causing alterations in the sugar, they restricted themselves to desiccation at a lower temperature, usually not higher than 50° C. to 60° C. De Vecchis found that, by subjecting

of being stored for a considerable time without deterioration from bacteria, moulds, etc., and have their sugar content quite unchanged. In addition, physical or physico-chemical changes are produced in the cell and cell contents, other than the sugar, which greatly facilitate the subsequent extraction of the latter. These changes have been designated "coagulation of the albumenoid matter," a term which, whilst describing one phase of the change involved, covers other complex changes whose nature is not fully understood, but whose general result is to ease the diffusion of the sugar into warm water and hold back from solution the colloids, albumenoids, and pectic substances.

De Vecchis had to develop a practical system of desiccation conforming to the conditions of his discovery, and



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Juice flow diagram

the slices of sugar beet for a certain time to a temperature between 90° C. to 100° C., it was possible to obtain, simultaneously with the almost complete elimination of the water content, the complete coagulation of the albumenoid substances, which would otherwise pass into the warm water with which the beet is subsequently treated. He found also that the physical modifications of the albumenoid substances became more pronounced as the percentage of water in the slices was reduced until finally, at about 3% in weight, the cossettes have a characteristic appearance, are crisp and brittle, and can be crushed by the pressure of the hand. "Cornification" is the name which he has given to the cossettes at this stage. The cossettes dried by this process are capable

having due regard to economy of performance. After long investigation and trials undertaken at considerable expense, there was finally evolved, in collaboration with Messrs. George Scott & Son (London), Ltd., a dryer which fulfilled all the required conditions and has stood the test of practical working. [A complete description of this plant will be given in the paper by Mr. G. W. Riley.]

DRIED COSSETTES

Dried cossettes containing about 3% of moisture are stable, and can be preserved unaltered practically indefinitely. This has been testified by numerous investigators, such as Herzfeld, Grandeau, Hertzog, Benjamin, and by authorities who have had an opportunity of examining the De Vecchis product. Perfectly sound samples have been in existence for over two years

* Paper read at a joint meeting of the Chemical Engineering Group and the Glasgow Section at Glasgow, on October 19, 1927.

in England. It is probable also that the cossettes will keep perfectly with a percentage of moisture up to 10% or 12%, provided the albumenoids etc. are cornificated, i.e., have lost their hygroscopic power, and the material is sterilised.

This fact allows considerable latitude for their preservation in moist climates. If they are left freely exposed to the air, moisture is taken up until equilibrium is reached between the moisture content of the cossettes and the atmosphere. Cossettes are usually stored in bulk in closed sheds, and whilst the upper surface may hydrate to a small extent (about 5%), experience has proved that such hydration does not extend beyond an inch or two in depth. The material can be transported in bulk if precautions are taken to prevent wetting or undue exposure to damp.

Dried cossettes are from 20% to 25% of the weight of the raw beet, and occupy from 120 to 140 cb. ft. per ton, or about half the volume of the wet cossettes. Coefficients of drying of from 3.8 to 5.8 have been obtained in large-scale practice, but these depend on the quality of the beet dried, its percentage of dry substances, including, of course, sugar—a high sugar content leading to a low coefficient.

Cossettes can be briquetted by the application of hydraulic pressure of from 250 to 300 atmos. The compressed cake occupies about 37 cb. ft. per ton.

So long as the conditions of drying laid down by De Vecchis are adhered to, analysis has shown that there is no loss of sugar, either through caramelisation or degradation to invert sugar. On this point a large number of investigators previous to De Vecchis are unanimous, and their results have not been questioned.

In 1925, MM. Ach. Gregoire and Gaspard examined the process, and from samples obtained at the Loreo factory came to the following, among other, conclusions:—

"There is no formation of inverted sugar at the expense of the saccharose during the process of desiccating the cuttings."

"The yield of marketable crystallised sugar is normal."

Prof. Mezzadrioli made a series of analyses on 166 tons of fresh beet. His results, in one series, are as follows:—

Invert ratio before drying, 1.33%.

" " after drying, 1.36%.

In another his average figures were:—

		Invert	Invert Ratio
Fresh cossettes ..	15.26	0.22	1.44
Dried " "	65.0	0.87	1.34

The slight differences in invert ratio shown are within experimental error.

Dr. M. Frigerio, working under the direction of Prof. Menozzi and Munerati, tested hourly samples of cossettes before and after they left the dryer (allowance being made for the time taken to pass through the dryer), and obtained the following results:—

No	Before Drying		Invert		After Drying		Invert
	Polarisation	Less than			Polarisation	Less than	
1.	12°	"	0.10%		61.20°	"	0.60%
2	11.80°	"	0.10%		60.40°	"	0.60%
3	11.40°	"	0.10%		60.86°	"	0.60%
4	11.00°	"	0.08%		61.80°	"	0.60%
5	11.86°	"	0.10%		60.40°	"	0.60%
6.	11.20°	"	0.10%		61.20°	"	0.60%

These investigators concluded that:—"During drying, the percentage of sugar inverted does not increase, but is maintained within the limits of that contained in the fresh slices only, with an increase in proportion to the percentage of water evaporated."

Our own Ministry of Agriculture and Fisheries sent a commission to Italy in the 1924—5 season, which found with Italian beets at the Loreo factory, that the percentages of invert, sucrose, etc., were as follows:—

	Fresh Beet	Dried Beet
Invert	0.27	1.2
Sucrose	12.8	57.5
Invert ratio	2.11	2.10

In the Progress Report issued by the Ministry in August, 1926, in connection with investigations carried out in the small-scale plant installed at Eynsham, Oxfordshire, the conclusion arrived at was as follows:—

"So long as the temperature to which dried or practically dried cossettes were exposed did not exceed 110° C., it was found that no formation of invert sugar or caramel occurred; it was also found essential to remove the moisture quickly, so that the material was not heated in a moist state for any appreciable length of time. When the duration of drying was reduced to one hour or less, the best results were obtained."

The same report also gives the increase in the invert ratio as 0.12%, which is well within experimental error.

At Sanguinetto, in the present season (1927), tests were carried out on quantities of beet* in three periods, and showed the following results:—

	Before and after drying		Invert	Invert Ratio
	Sucrose	Invert		
	Before	After	Before	After
1st. period (ton 223.3 tons beet)	17.2	66.9	0.12	0.47
2nd " " 96.2 " "	16.2	64.8	0.27	1.10
3rd " " 68.7 " "	16.6	66.1	0.28	1.10
	16.9	66.0	0.21	0.84
			1.24	1.27

This shows plainly that there is no practical difference in the invert ratio before and after drying.

In these quantity tests, the average coefficient of drying was 3.9%, so that the efficiency of recovery of total sugar was 100%. Thus we have:—

Original sugar $(16.9 + 0.21) \times 3.9 = 66.73$.

Recovered sugar $66.0 + 0.84 = 66.84$.

Sir William Pope, having had the results of investigations placed before him, has expressed his opinion that these support De Vecchis' contention that no loss of sugar is involved either by caramelisation, inversion, or from any other cause consequent on the desiccation.

It is interesting to note that the Ministry Report places 110° C. as the upper limit of safety in drying. It is a well-established fact that at 120° C. caramelisation of the sugar is already in progress.

EXTRACTION

The dried cossettes are extracted in the same manner as in the diffusion process. De Vecchis uses a battery of from 10 to 12 lixivators (diffusers) of simple construction. Both open and closed types, with and without reheating devices, have been employed, but the closed

* Exceptional Italian crop due to the very dry season.

reheating type is probably the most satisfactory method, since the quicker extraction increases the purity of the juice by about 0.3% to 0.4% without lowering its strength or increasing the sugar content of the exhausted pulp. With this kind of plant, the extraction temperature is 60°/70° C., the circulation being in one direction only in each lixiviator, and charges are made and drawn at about 12 to 15 min. intervals, giving an extraction time of between 2 and 2½ hrs., and it appears possible to reduce this time. With the open-gravity type, up to 4-hrs. extraction time was found necessary.

• Dealing with Italian beet having under the best conditions about 12% to 13% sugar content and a purity about 80% to 82%, the extracted juice showed a strength of 45–50° Brix, when obtained by open type lixiviation. With the closed type it is estimated that a strength of approximately 60° Brix will ultimately be obtained in normal practice.* This strength obtained by a simple process of extraction is a very great contrast to the dilute juice of about 15–17° Brix, obtained by diffusion of freshly cut cossettes.

Moreover, this De Vecchis juice differs essentially from ordinary diffusion juice both in the amount and in the different physical state of the impurities present. Colloidal gels, gummy and pectic states seem to be reduced greatly, leading to a lowered viscosity so that purification (defecation) and filtration, in spite of its great concentration, becomes a relatively simple matter compared with ordinary diffusion juice.

The word "lixiviation" introduced by De Vecchis emphasises the practical difference from the ordinary process which requires a higher temperature (70°–85° C.) and the inversion of the direction of circulation in each diffuser. Scientifically it is claimed that the difference lies in the absence of any osmotic phenomena in the extraction of the dried cossettes.

Some discussion has arisen whether or not the cells are ruptured during the desiccation process. This does not seem at all probable, for if anything like complete cell rupture had taken place one would not expect a limiting strength to the extracted juice such as found in practice. Moreover, the extracted cossettes would in all probability be a shapeless mass of pulp, which is not the case. De Vecchis does not make the claim of cell rupture, although he states that this is possibly present to a slight extent.

EXHAUSTED PULP

The exhausted pulp retains its cossette form and is similar in appearance to the ordinary diffusion exhausted cossettes, and, like the latter, can be either used locally in the wet state, or pressed, dried, and marketed.

In normal working the pulp is extracted to the same degree as in the ordinary diffusion practice. The British Commission found 0.18% sugar at Loreo. There is, however, a difference between this pulp and that obtained from the ordinary process, for since the albumenoid matter of the beet is coagulated by the desiccation and so rendered insoluble, it remains in the exhausted pulp, imparting to it a higher feeding value from its greater nitrogen content.

Experiments by Prof. Mezzadrolì showed that whilst Italian diffusion pulp contained about 4.5%, De Vecchis

* Obtained this season at Sanguinetto.

pulp from the same source contained 7% of dry matter, both reckoned on the wet pulp. The De Vecchis wet pulp averaged 80% and the diffusion pulp averaged 90% of the weight of the fresh beet, so that expressed on the original beet weight the dry matter in the pulp was, for De Vecchis pulp 5.6%, diffusion pulp 4.05%. The difference of 1.55% indicates nitrogenous matter which has not passed into the juice as impurities, and which enhances the quality and quantity of the exhausted pulp by-product.

WASTE WATERS

The "petit-caux" or drain waters from the diffusers do not contain albumenoid matter, and therefore, if these waters are efficiently separated from traces of exhausted pulp, they can be passed to the drain without fear of subsequent decomposition or putrefaction taking place owing to the action of bacteria on the nitrogenous matter. In view of the recent outcry in England against the pollution of streams by drainage from beet sugar factories, this is very important. In Italy the Ministry of Health exempt all De Vecchis factories from any treatment of their waste waters. Strong nitric acid, trichloroacetic acid, alcohol or other ring tests can be used to establish the absence of albumenoid matter in waste liquors or lixiviation juice.

LIXIVIATION JUICE

In the ordinary diffusion process the thin juice obtained from the diffusion battery shows approximately the same purity as the original beet, the increase in purity between diffusion juice and pressed juice usually ranging from 0.2% to 0.5%, but in the De Vecchis process there is a considerable increase in purity.

The Government Commission in 1924 found when the factory were using very poor beet at the tail end of the season the following results:—

	Sugar %	Purity %
Original beet	10.4	72.7
Juice—Dec	7	75.59
" " 8	31.45	70.19
" " 9	30.32	76.32
" " 10	29.5	77.21
At Sanguinetto in 1926, with late harvested beets:—		
Original beet	12.5	76.4
Juice	—	78.8

At Sanguinetto, in August, 1927, with normally harvested beets:—

Original beet	Purity	Lixivated juice
Sugar %	Purity %	Purity %
16.2	82.8	86.0
15.9	85.0	86.7

In the primary stage, therefore, of the De Vecchis process there is an increase in the purity of from 2.5% to 3.5%. The Eynsham experimenters have found the same phenomenon.

DEFECATION

The defecation of this juice, owing to its improved viscous properties and freedom from albumenoid matter, is a simple process indeed compared with the multiple carbonatation and sulphitation processes required to purify ordinary diffusion juice. All that is necessary is the addition of 0.25% calculated on the weight of fresh beets for purities superior to 80%, and for inferior purities about 0.30% of lime as milk of lime. This is

carried out in open vessels fitted with agitating gear and heating coils, the temperature being raised to 80° C.

Approximately twice the percentage of superphosphate (14/16% P_2O_5) (calculated as the lime) is then added, and the temperature raised to 90/100° C. At this point alone in the process is there evolution of ammonia, and the amount is slight. It arises from the small amount of soluble nitrogen compounds present, which are decomposed by the lime and heat. The addition of superphosphate to neutralise the excess of lime and decompose any calcium sucrose formed is another unique feature of the De Vecchis process. The amounts of lime and superphosphate required are very small in comparison with both the weight of the beet and the amount of lime used in the diffusion process, where up to 3% lime on the weight of the beets is necessary. In consequence, the defecated liquor in filtration gives only about one fifth to one sixth the amount of filterpress cake.

FILTRATION

Filtration is easy in consequence of the absence of viscosity and freedom from albumenoid, pectic and gummy substances. Hard granular cakes are obtained which are readily washable, a system of washing being used whereby the wash liquor going forward into the juice is of sufficient strength that there is no appreciable lowering of the strength of the defecated juice. The presence of siliceous sand in the superphosphate contributes to the formation of a suitable filtering mass.

Owing to the relatively small amount of solids in the solution being filtered (one fifth or one sixth of the amount obtained in the diffusion process) it is not necessary or desirable to wash the cakes free from sugar to the same extent, that is, the washed cakes could contain five to six times as much sugar as the washed diffusion cakes without incurring a greater sugar loss at this point. As a matter of fact, there is less loss of sugar in the De Vecchis cakes than in diffusion cakes. Working on 166 tons of beet, Prof. Mezzadrolì found 3% sugar in the filter cakes, which were 2% of the weight of the beets, giving, therefore, an actual loss of sugar of 0.06 to 0.07%, whereas in the ordinary cakes containing from 1 to 1½% of sugar and weighing 10 to 12% of the original beet, the loss of sugar is between 0.10% and 0.18%. These press cakes, containing a large proportion of calcium phosphate, are valuable fertilisers, and by their sale as such will return a proportion of the expense of the defecation. The phosphate exists as bicalcium phosphate, which is considered the best form for vegetable fertilisation. Analyses showed that the amount of phosphorus as pentoxide which was soluble in ammonium citrate or water and ammonium citrate varied from 8.44% to 9%.

EPURATION

The increase of purity as shown analytically for the De Vecchis defecation is not so great as that obtained by the ordinary process, because in the De Vecchis extraction there has already been a purification of 2.5 to 3.5%. The total purification, in extraction and simple defecation together quite equal that produced in the

diffusion process by carbonatations, sulphitations, etc. After passing through a Danek safety filter, the liquor is ready for crystallisation. The following table gives the results of tests in this connection:—

Lixivation juice				Defecation juice				Rise in purity
Brix.	Poin.	Purity	State	Brix.	Poin.	Purity	State	
44.2°	36.4'	82.3%	acid	4.3°	36.3'	84.4%	alk.	2.1
47°	31.8'	77.5%	acid	41.5	33.8'	80.7%	0.05%	3.2
16°	—	78.8%	acid	45°	—	81.8%	0.06%	3.00
46.80°	30.16°	83.60%	—	48.60°	41.91°	86.23%	—	2.63
—	—	86.0%	—	—	—	88.90%	—	2.90
—	—	86.7%	—	—	—	89.40%	—	2.70

Thus, increases of purity due to defecation vary from 2% to 3.2%. In all, lixiviation and defecation together produce from about 5% to 6% or more increase.

It must be clearly understood that this epuration of 5–6% is only possible with low-grade beets. In countries where the beet has an original press juice purity of 86/87%, a lower percentage epuration overall will be experienced by both processes.

CRYSTALLISATION

In the purified juice, after passing the safety filters, is dissolved all the second-product sugar, which brings its strength to 60° Brix. or over. It is now pumped directly to the vacuum pans and concentrated to crystallising point. The massecuite is discharged to the crystallisers and then centrifuged, giving the first-product raw sugar.

Analyses of first massecuites for purity are not strictly comparable with defecated juice, as in continuous working for refined sugar they necessarily contain some second-product sugar, which has been remelted, as well as centrifugal syrup. With this reservation, figures of first massecuites obtained from low-grade material, giving a defecated juice of about 81% to 82% purity are given below:—

	1st product massecuite		
	a	b	c
Brix	92.68	93.6'	92.68'
Sucrose	82.8%	84.8%	83.5%
Invert	—	—	—
Purity	80.3%	80.3%	80.0%
Alkalinity	0.04%	0.02%	0.00%
Ash	2.7%	2.20%	—

With beets of original purity about 83% and defecated juice of 88% to 89% purity, massecuite purity will be 92% or higher.

The refining of the raw product and the further treatment of its mother-liquor syrup are carried out in the normal way. Any successful and economic method of refining raw beet (diffusion) sugar or raw cane sugar is equally applicable to raw De Vecchis process sugar.

The molasses yield from the De Vecchis factories working on Italian beet and producing white refined sugar is quite normal—if anything, a little lower than that obtained by the diffusion process for that grade of beet. From beets of 74% to 76% purity, 6% molasses on the weight of raw beet was obtained at Loreo, whilst a diffusion process factory gave 6½% molasses on the same raw beet supply.

Samples of molasses in last season's work at Sanguinetto showed (on 250 tons):—Brix. 80.6°, sucrose 46%, purity 59.7%, ash 5.7%.

The following are analyses, made in London, of both

the raw sugar and the finished sugar on samples taken from the Loreo factory.

	Brown sugar	White sugar
Sucrose ..	96.6%	99.8%
Moisture ..	2.00%	trace
Ash ..	0.45%	0.05%
Invert ..	nil	nil
Undetermined ..	0.80%	0.15%
	Good smell.	No raffinose.
	Colour somewhat deep.	

At Sanguinetto in the last season :—

	1st product raw sugar			White sugar		
Sucrose ..	99.2%	98.5%	98.7%	Sucrose	99.0%	
Moisture ..	0.6%	0.55%	0.5%	Moisture	traces (0.05%)	
Clendment of refined sugar ..	93.2%	93.75%	93.7%	Ash ..	0.01%	
				Invert ..	—	
				Raffinose	—	

In the diffusion process the thin juice has to be concentrated in multiple effect evaporators before being sent to the vacuum pans with a normal concentration of about 65° Brix., though this is usually 60° Brix. Defecated and filtered juice obtained by the De Vecchis process has normally a concentration of 50° Brix., and may reach 60° Brix. This concentration is further increased by the addition of second-product sugar, green syrup from the refinery, and it is therefore fed directly into the vacuum pan without intermediate evaporators. Even if the concentration is slightly below normal at this point, it is found that the extra work required to be done in the vacuum does not justify the installation of pre-vacuum pan evaporators to bring the concentration to 65° Brix.

In the ordinary process during evaporation ammonia gas is evolved from the nitrogen compounds present in the juice, in spite of its repeated epuration. These compounds can be traced to those large-molecule albumenoid bodies present in ordinary diffusion juice, which require the involved system of epuration practised by that process before they are obtained in a form in which they are decomposed and eliminated by heat. The actual amount of such bodies in ordinary diffusion juice as it arrives at the evaporator is small (about 2—4 cwt. NH_3 per 1000 tons of beet), but it is of great importance that it should be eliminated if only by reason of its molassagenic effect. Sometimes this ammonia evolution calls for special treatment in the multiple effect evaporators. The De Vecchis juice being free from albumenoids gives not a trace of ammonia when concentrated in the vacuum pans, whatever delicate tests may be applied to discover its presence, thus establishing the claim that the quality of this juice is very different from ordinary diffusion juice. Its presence is not, therefore, exhibited in due proportion in figures of purity between the two systems.

ADVANTAGES OF THE PROCESS

By drying the cossettes and rendering them stable and storable, the extraction can be carried out at any time or continuously throughout the year. With continuous working for the same production of sugar, therefore, a De Vecchis plant need only be of one third the capacity of a similar plant using the ordinary system. As, however, the beets are dried only during the beet harvest, the De Vecchis process requires the same size of washing and slicing plant as the ordinary process,

and, in addition, the drying plant and storage accommodation for two thirds of the beet supply in the shape of dried cossettes.

The points in favour of the continuous production of sugar are regulation of supplies according to the demands of the sugar market, and continuous employment at the factory for the operators. As the expense of producing and storing dried cossettes is less than the expense incurred in producing the raw sugar, less money is locked up when the demand for sugar is reduced.

It is not considered an economic proposition to erect a diffusion factory where the prospective supply of beet in the neighbourhood does not amount to 75,000 tons per harvest, certainly not under 50,000 tons. Now, the De Vecchis factories, by reason of their more economical production, can be of smaller total capacity, factories of 20,000 to 25,000 tons per annum being possible, as they are in Italy. Further, it is not always possible to obtain in one compact locality a beet acreage capable of producing 75,000 to 100,000 tons of beet per harvest, and in such cases supplies may have to be drawn from uneconomic distances. With the De Vecchis system, however, a washing and slicing plant, coupled with a drying unit, could be installed in the outlying acreage, and the dried cossettes transported to the factory, saving thereby (owing to the decreased weight) about four fifths of the freightage. Thus, regions which are perfectly good for beet growing, but are too small to support a factory, can be brought into the scheme of beet production and combined to supply or augment the local supply of a large central factory. Such an auxiliary could be installed in a region where a harvest of about 7500 tons of beet was available, and the possibility of this being done by co-operative endeavour of the growers themselves is quite feasible. The system then has a claim to assist in the extension of sugar beet cultivation and to alleviate conditions for growers badly situated with respect to outlets for their beet.

Other advantages mentioned are the increased amount and quality of the exhausted pulp due to its albumenoid content, the fertilising value of the press cakes due to the contained phosphates, and especially the non-putrescible nature of the effluent which makes its treatment a relatively simple and inexpensive matter.

ECONOMICS

Italian conditions differ from English on account of the cheapness of their labour, their cheap supplies of electric power, and their extraordinarily low building costs. A comparison, however, is valid, and whilst exact figures of cost of production cannot be given, the difference can be indicated.

In the subsequent remarks the English equivalent is based on the rate of exchange existing at the time. In 1925—26 the national price for beet was 107 lira, or 17s. 10d. per ton. During that season the De Vecchis Loreo factory paid its growers 125.4 lira, or 20s. 10d. per ton. As the working showed that the yield, which was normal for the Italian beet used, of marketable sugar was 1 ton per 10.8 tons of beet, this amounted to 32s. 5d. extra per ton of sugar produced. The

Sanguinetto factory also can pay growers a better price for their beets and, being thus assured of supplies, is this year doubling its capacity.

Under English conditions, after the experience gained at Eynsham, the Ministry of Agriculture has drawn up estimates of working cost under different scales of operation. Thus:—

Scale	Cost per ton sugar		
	£	s.	d.
100,000-tons factory ...	4	7	6
25,000-tons factory ...	5	8	2

The cost per ton of sugar is taken on a 13.25% extraction, and is exclusive of the cost of the fresh beet and depreciation, but includes all other overhead and standing charges.

The capital cost of De Vecchis installations in this country compiled from the estimates of responsible manufacturers and contractors, can be given as follows:—

	25,000 tons	50,000 tons	100,000 tons
	£	£	£
Plant and erection	46,200	73,700	115,500
Dryers and erection .. .	15,000	25,000	50,000
Buildings and erection, including roads, rails, silos, flumes, &c. .	36,720	59,220	99,300
Total	97,920	157,920	264,800

Allowing, therefore, depreciation at 10% increases the cost of production for a 25,000-ton plant to £8 6s. 11d., and for a 100,000-tons scale to £6 7s. 3d. per ton sugar.

It is difficult to obtain really reliable figures of costs from the English diffusion factories, and figures have been given of from £10 to £15 per ton. We desire, however, a contrast with a successful and well-run factory, where the cost represents a minimum, and have been given such a figure for a 100,000-ton factory of £6 per ton, excluding depreciation. The published cost of erecting such a factory is not far off £400,000, and on the same yield of sugar, depreciation at 10% would add another £3 to the cost.

Compared with the De Vecchis process on the same scale, this amounts to an increased cost of 52s. 9d. per ton of sugar, or, with the smallest scale factory, 13s. per ton of sugar. If the cost of production under the two systems were the same, there would still be a considerable advantage to the new process, owing to this decreased capital expenditure for the same output of sugar. In Italy the difference in capital outlay on factories under the two systems has been placed at about 3 or 4 : 1, but we see from the figures already given that in England the ratio is about 40 : 26.5. The reasons for this reduction of capital expenditure lie in the simplified extraction plant in continuous working, which reduces the size of the extraction and refining plant to roughly one third of that of a diffusion plant of the same capacity, in the elimination of lime kilns, carbonatation plant, sulphitation plant, and multiple-effect evaporators. The washing, slicing and reception equipment will be the same for both plants, whilst the De Vecchis plant

require dryers and a cossette store as items which are not represented in diffusion plants.

De Vecchis has drawn up the following comparison for 100,000-ton plants operating in England.

	Diffusion process	De Vecchis process
	£	£
Beets at 54s. per ton .. .	270,000	270,000
Fuel	10,800	12,900
Wages and salaries .. .	28,250	22,200
Rates, fares and insurances ..	8,000	5,000
Office expenses .. .	2,000	1,800
Consumable stores, bags, limestone, superphosphate .. .	25,500	15,100
Sundries	3,000	1,150
Brokerage	5,000	5,000
Bonus to growers .. .	12,000	12,000
Excise tax	80,000	80,000
Incidental	7,000	5,000
Depreciation (10%) .. .	40,000	26,500
	£500,350	£465,150
Difference		£35,200

With a production of 13,000 tons of sugar, the difference amounts to 51s. 2d. per ton of sugar.

One item, fuel, is increased, due to the desiccation operation, which requires approximately 600,000 calories (kilogram calories), 2,400,000 B.Th.U., per ton of beet. As the air is heated to a very moderate temperature, a fuel of low calorific power and small cost can be employed; in this particular case, residual smalls of gas-oven coke, which—while it has a calorific value of 5500 to 6000 C. units (10,000—11,000 B.Th.U.)—generally costs less than half the price of high calorific value fuel normally used in sugar factories, the prices being:—Small coke, 12s. to 13s.; ordinary factory coals, 26s. to 30s. per ton, delivered at the factory. This reduces the fuel cost for drying to about 5 to 5½%. and since, for all the remainder of the work, the fuel consumption is restricted to another 4½% to 5% as a maximum, it may be concluded that the greater consumption of coal by the De Vecchis process amounts to the difference between the total of these, 9½% to 10½%, and about 8% or 8½%, which is consumed in the best-equipped and most scientifically-run factories of the normal type producing refined white sugar. On the other hand, many diffusion factories have fuel consumptions of 10% and over. Finality has not been reached in the economy of fuel in the drying process, and it may be possible to recover some of the heat lost in this process.

RELATION TO DIFFUSION PROCESS

The De Vecchis process should not be considered as a possible rival to the diffusion process, but rather as a process which, grafted on to the older process, could double or treble the annual output of these factories. To double the output of a factory capable of handling 100,000 tons of beet by the ordinary process practically the whole plant must be duplicated, involving a capital outlay nearly equal to the original cost of the factory. Working, however, in conjunction with the De Vecchis system, after it has completed the normal campaign, the same extraction and refining plant for treating the dried cossettes, with possibly only minor alterations of pipe work, can be used. The duplication of reception, washing and cutting plant and the installation of the driers and stores could be carried out at a lower capital outlay than

would be involved in the alternative method. Thus, we may roughly estimate :—

	£
To duplicate original 100,000 plant completely (as against £400,000 original cost)	300,000
To instal duplicate reception, washing and cutting plant	40,000
(New) dryers and cossette storage	60,000
Total ...	£100,000

The advantage, therefore, to the factory, is a doubling of output for only 25% increase of capital.

BET SUGAR MANUFACTURE AND THE SUBSIDY

Since the grant of a heavy Government subsidy on sugar manufactured from home-grown beet, some fourteen to fifteen factories have been erected, and there are several more projected, whilst the beet acreage has risen to 200,000 acres. The subsidy declines in two three-year periods from £19 10s. to £13 and £6 10s. per ton of sugar. The present campaign is the last of the £19 10s. subsidy, and no provision is made for the 1934-35 season. If we take one of the oldest, largest, and most successful factories as an example, we may arrive at some conclusion as to whether or not the industry will survive the subsidy. On last year's working the trading profit, not including overhead charges or depreciation, was £307,000, whilst the subsidy was £505,000. About one third of the subsidy is returnable as Excise duty, so that the net subsidation was £337,000. Without the subsidy there would have been a trading loss of about £30,000, which amounts to 3s. 9d. per ton on the 160,000 tons of beet worked. Putting depreciation at £45,000, overheads, including income tax at £60,000, and dividend at £90,000, gives another 24s. 3d. per ton of beet, making in all 28s. per ton.

To maintain the present position, therefore, when the subsidy is removed, the cost of beet must drop by 28s. per ton to 30s. per ton, since the grower at present receives about 58s. per ton. The average of yield is about 8.5 tons of beet per acre, giving at the present price about £24 10s., of which about £18 10s. is swallowed up in costs, whilst at 30s. per ton the return would be £12 15s. Even if by good cultivation and other improvements the yield can be made equal to the high German yield of 10½ tons when the return becomes £15 7s. at a selling price of 30s. per ton, there will be no profit to the farmer.

Although isolated cases occur in which the sugar content of the beet reaches 21%, the average is about 17%, which compares favourably with that of the best beet grown abroad. At present every per cent. over 15½ means an addition of about 2s. 6d. per ton to the basis price of 54s. Given the 10½ tons per acre yield, he would have to increase the percentage of sugar in his beet by over 2½%, keeping the present rate of increase in price with increase in sugar content, to balance his expenditure if the costs of production remained the same, and to make a profit he should have to do considerably better. This does not seem possible with labour conditions as they are at present. Since every per cent. of content up to 15½% costs 3s. 6d., and

any per cent. over this costs only 2s. 6d., the factory under the present system gets cheaper sugar in the higher per cent. beet and to this extent it would benefit.

Even if the factory reduced both its dividend and its overhead by 50%, which would bring the price up to 38s. 4d. per ton, or £16 5s. 10d. per acre on the present yield of 8.5 tons, or £19 12s. 11d. on the average of 10½ tons, still it would not be a paying proposition to the farmer unless he either reduced costs or obtained a higher percentage of sugar than 17%. We have assumed here that with the extinction of the subsidy the Excise duty is also extinguished, but if this is not so, then for the example taken an additional £168,000 would have to be found or a reduction of the price of beet by 21s. per ton, leaving a price of only 17s. 4d. per ton.

At present a 100,000 factory costing £400,000 pays about 58s. per ton for beet of 17% sugar content. With a total extraction of 94%, a high extraction efficiency, 13½ tons of sugar and about 4½ tons of molasses are obtained from 100 tons of beet. A subsidy of about £286 10s., or 57s. 4d. per ton of beet, will be received on this production, making the actual payment by the factory for the beets about 1s. per ton. With the extinction of subsidy, how will it face the position? If during the subsidy period reserves have been built up and plant value annually depreciated, say, at 10%, then at the end of the subsidy period the capital value of the factory will have been practically wiped out, and an annual sum of, say, £40,000, or 8s. per ton, will in future be available for purchasing beet. Cutting a dividend charge of 10% and taxes and overheads to the same amount would supply another 16s., whilst another 3s. per ton of beet might be obtained if manufacturing costs were reduced by about £1 per ton of sugar (a very unlikely contingency). Altogether we have 27s. per ton of beet, so that nominally the factory can now afford to pay 28s. per ton of beet. This is just above the price of 25s. to 27s. paid for beet in unsubsidised and unprotected foreign industry, which can place raw or finished sugar on our market. At this price, however, it would seem that the farmer could not possibly produce beet, even with increases both in yield per acre and sugar content. For the first period of reduced subsidy, commencing next season, the National Farmers' Union, in agreement with the manufacturers, has recommended to its branches a price of 46s. per ton for beet of 15½%, with an addition of 3s. for the first per cent. over and 3s. 4d. for any additional per cent. This represents a price of 50s. 8d. for 17% beet, as against the old price of 57s. 9d., or 7s. reduction for 17% beet and 8s. for 15½% beet. The subsidy reduction of £6 10s. per ton sugar is equivalent at the yield we have taken (80.3%, 17% beet) to 17s. 9d. per ton beet, so that the proposed new scale on the average divides the reduction between the farmer and factory in the ratio 42.33% to 57.66%. If this rate of reduction is accepted, and can be applied to the two subsequent periods, then the farmer may expect ultimately 30s. for 15½% beet and 36s. 9d. for 17% beet. The factory, on the other hand, will have to reduce their overall cost of 1 ton of sugar by about £11 to £12.

The above analysis would seem to show that the cost

of manufacture is in this country about £1 to £2 per ton above foreign costs, and the natural question is can this be reduced? Reduction in manufacturing costs can only be effected by improving the efficiency of the operatives or of the plant. Increase in experience will certainly improve the efficiency of the operators, and may do something to reduce costs. Improvements in the process are unlikely, since the diffusion process has developed a high standard of efficiency from long experience, and keen competition both in the industry itself and against cane sugar producers. As the new plant erected in this country has this high efficiency, it does not seem likely that the gap which would appear inevitable at the end of the subsidy will be closed by the reduction of the cost of manufacture of the sugar by this process. We think, therefore, that the De Vecchis process provides an alternative way out of the impasse, and may well close this gap, as it appears possible for this process to contribute about 8s. per ton from both lower manufacturing cost and the increased dividends which it opens up. This contribution of 16s. per ton to the price of beet, with the other savings, should enable the industry to stand on its own feet.

Owing to the munificence of Sir Charles Cottier in presenting the patent rights of this process to the nation, there are no royalties to be paid for its use in this country. Permission to use it is vested in the Ministry of Agriculture by virtue of its connexion with the advancement of agriculture. If this should fulfil that aim, as we think it can, then this gift will have accomplished the purpose its donor had in mind.

In conclusion, we have to acknowledge our indebtedness to Dr. De Vecchis for some of the data we have given, and to Mr. J. H. Lane for some of the references.

CANADIAN MINING AND METALLURGY

The revised statistics give the following figures for lead, copper and silver production in Canada for 1926:—Lead, 283,801,265 lb., valued at \$19,240,661, being a new record for output. Copper production, 133,094,942 lb., valued at \$17,490,300, an increase of 18% in quantity over previous year. Silver, 22,371,924 fine oz., valued at \$13,894,531, a quantitative increase of 10% over 1925.

The Consolidated Mining and Smelting Company will erect, at Trail, B.C., a large contact sulphuric acid plant, utilising the sulphur fumes from the sulphide ores of the district. The first unit will cost over a quarter million dollars.

It is announced that arrangements have been completed whereby the entire blister copper output of the Noranda Mines, Ltd., Rouyn, will be purchased for a term of years at a sliding price scale by the British Metals Co. The production, at the outset, will be about 3,000,000 lbs. monthly, and probably refined at a point on the Atlantic coast.

The zinc-lead ore body of the Buchan Mine, of the Anglo-Newfoundland Development Company, has been found to extend beyond the limits of the company. The ore on the mine property is estimated at 5,000,000 tons, and valued at \$175,000,000.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

NEW MEMBER OF COUNCIL

Lieut.-Col. G. P. Pollitt, D.S.O., has been elected by the Council an Ordinary Member of Council of the Society in place of Dr. E. W. Smith, appointed Honorary Treasurer.

SUSPENSION OF ENTRANCE FEE

The Council has decided to continue the suspension of the Entrance Fee during the year 1928.

ABSTRACTS IN APPLIED CHEMISTRY

It has been arranged to supply members of the Society with reprints of the Abstracts of Applied Chemistry, printed on one side of the paper only, at the price of £1 for the year 1928.

Applications for these accompanied by the appropriate remittance should reach the General Secretary before the end of the present year.

COMMITTEES OF COUNCIL FOR 1927—28

House Committee.—The President, Hon. Treasurer, Dr. E. F. Armstrong, Mr. J. L. Baker, Mr. E. V. Evans, Dr. H. Levinstein, Sir Wm. J. Pope, Mr. Edwin Thompson, and Mr. W. J. U. Woolcock.

Annual General Meeting, New York, 1928, Committee.—The President, Hon. Treasurer, Dr. E. F. Armstrong, Prof. J. W. Hinchley, Mr. Edwin Thompson, and Mr. W. J. U. Woolcock.

Publications (Transactions) Committee.—Messrs J. L. Baker, W. H. Coleman, J. W. Hinchley, W. R. Hodgkinson, E. Grant Hooper, W. F. Reid, and W. G. Wagner.

REPRESENTATIVES ON OUTSIDE BODIES FOR 1927—28

Federal Council for Pure and Applied Chemistry.—Mr. F. H. Carr, Dr. S. Miall, and Mr. W. J. U. Woolcock.

National Physical Laboratory (General Board).—Prof. J. C. Philip and Prof. J. W. Hinchley.

British Engineering Standards Association.—Aircraft Sub-Committee on Chemicals: Prof. W. A. Bone. Sub-Committee on Textiles: Mr. C. F. Cross. Sub-Committee on Dopes: Dr. J. N. Goldsmith. Sectional Committee of Chemical Engineering: Mr. C. S. Garland, Mr. C. J. Goodwin, Dr. W. R. Ormandy, Mr. J. A. Reavell, and Mr. F. H. Rogers. Committee on Sieves and Screens: Mr. F. A. Greene. Committee on "Methods of Analysis of Coal": Mr. E. V. Evans, Mr. H. Hollings, and Mr. T. F. E. Rhead.

Mineral Resources Department of the Imperial Institute.—Lead, Silver, Zinc, and Cadmium Sub-Committee: Mr. H. M. Ridge. Aluminium, Magnesium, Potassium, and Sodium Sub-Committee: Dr. R. Seligman. Minor Metals Sub-Committee: Mr. W. G. Wagner. Publications and Libraries Sub-Committee: Mr. W. J. A. Butterfield. Abstracts Sub-Committee: Prof. H. Louis and Mr. T. F. Burton. Chemical Industries Sub-Committee: Mr. C. S. Garland.

Governing Board of Imperial College of Science and Technology.—Sir Wm. Pearce.

Chemical Society's Library.—Dr. J. P. Longstaff.

Joint Committee for the Standardisation of Scientific Glassware.—Mr. F. H. Carr, Dr. R. T. Colgate, and Dr. Bernard Dyer.

British International Committee on World Power.—Dr. H. Levinstein.

Beilby Memorial Fund Committee.—The President, Hon. Treasurer, and General Secretary.

DEATHS

Liversidge, Archibald, F.R.S. (Original Member), of Fieldhead, George Road, Kingston Hill, Surrey. Emeritus Professor of Chemistry in the University of Sydney, N.S.W. On September 26, 1927.

Sodeau, Dr. William H. (elected 1900), of The Chemical Department, Guy's Hospital Medical School, London, S.E.1. Chemist. On October 5, 1927.

Wilson, Anthony W. (elected 1884), of Felstead, Bentham, Lancaster. Retired Colour Works Manager. On October 22, 1927.

LIVERPOOL SECTION

The opening meeting of the session was held in the Muspratt Lecture Theatre, the University, on October 28. The incoming Chairman, Dr. Alfred Holt, was introduced by Prof. W. H. Roberts, who retired, and a cordial vote of thanks was passed to Prof. Roberts on the motion of the Chairman, seconded by Mr. T. W. Stuart.

The annual prizes were presented, the winners being: The Leverhulme Prize, H. N. Walls, B.Sc., of the Liverpool University; the Society of Chemical Industry Prizes, Senior Prize to Frederick Colin Dawson, and the Junior Prize to Norman Glass. It was announced by the Chairman that Harold Lewis, the winner of the Senior Society of Chemical Industry Prize in 1925, had graduated with first-class Honours in Chemistry, London.

Eighteen Associates of the Section were elected.

The Chairman then delivered his inaugural address, entitled "Chemical industries and Merseyside."

The lecturer said it was difficult to think of Merseyside without the association of chemical industries, and one was apt to forget their early history and the causes which led to their enormous development in this part of the country.

The geographical area of Merseyside, namely, the country within a radius of fifteen miles of Liverpool, together with Wigan and Warrington, was until rather more than a century ago an agricultural rather than an industrial area. The rapid expansion of chemical industries on Merseyside resulted from the fact that owing to the development of transport facilities fuel, salt, limestone, sulphur, and pyrites could readily and cheaply be brought together. Growth was hampered by the salt tax, which was not finally removed until 1823.

The development of water-borne and rail transport originated in this area in 1721, the Liverpool Corporation obtaining an Act of Parliament to make the River Weaver navigable from Frodsham Bridge to Winsford Bridge; thereafter, the salt trade from Cheshire to the Mersey grew rapidly.

Some fifty years later the Bridgewater Canal was opened, followed by others, which gave a great impetus

to the trade of Liverpool, as the vessels coming to that port for salt brought cargoes of china clay, pyrites, etc. The opening of these waterways also ensured a cheap and abundant supply of coal from the Wigan district.

The lecturer detailed the various branches of chemical industry which had flourished on Merseyside. Iron smelting did not develop until the middle of the nineteenth century, but copperas manufacture was of greater antiquity, having been established a hundred years earlier. Copper smelting was carried out on a large scale near Warrington, but later was transferred to St. Helens; in 1766, copper works were established in Liverpool, but owing to the nuisance created they were closed down after a few years.

The glass industry was set up in Liverpool about 200 years ago, and pottery was made here as early as 1643. In the latter connexion it was interesting to note that the partnership entered into between Wedgwood and Bently, as a result of which the Wedgwood ware was conveyed to Liverpool to receive its well-known blue colouring, was arranged at a house in Paradise Street. Sugar has been manufactured in Liverpool since 1667 on the present site of Messrs. Macfie's works.

Among other Merseyside industries dealt with were:—Rosin, turpentine, smalt, ultramarine, carbon dioxide, candles, tanning materials, starch, soap, alkali, acid, bleach, salt, coal-tar products, and matches. The lecturer gave interesting details of the development of alkali and soap manufactures, the earliest soap boiling known in the neighbourhood being at Ormskirk in 1709. In 1814—15 there were eleven soap-boilers in Liverpool, and in 1850 the Merseyside factories made one third of the total quantity produced in Great Britain, and the Mersey exported four fifths of the total export of the country.

On the motion of Prof. Roberts, seconded by Mr. Edwin Thompson, the retiring vice-chairman, a hearty vote of thanks was accorded to the chairman for his address.

CALENDAR OF FORTHCOMING EVENTS

Nov. 4.—*Institution of Mechanical Engineers, Thomas Hawksley Lecture.* Storey's Gate, St. James's Park, S.W.1, at 6 p.m. "Application of X-rays to the study of the crystalline structure of materials," by Sir W. H. Bragg.

Nov. 4.—*Society of Chemical Industry, Manchester Section.* Blackfriars House, Blackfriars Street, Manchester, at 7 p.m. Jointly with the Manchester Sections of the Institute of Chemistry, Society of Dyers and Colourists, and the Manchester Literary and Philosophical Society. "Some new principles in chemotherapy," by Prof. A. G. Green and M. Coplans.

Nov. 7.—*University of London, University College, Gower Street, W.C.1, at 5.15 p.m.* The Gow Lectures on "The colloid chemistry of the rubber industry," by Dr. E. A. Hauser. Prof. F. G. Donnan, C.B.E., will preside. (Also on November 9, 11, 14, 16, and 18.)

Nov. 7.—*Biochemical Society, Rooms of the National Institute for Medical Research, Hampstead, N.W.3, at 5 p.m.* (1) "On a cell-free dehydrogenase obtained from bacteria," by M. Stephenson. (2) "The cause of Andrewes' diazo test for uræmia," by G. A. Harrison. (3) "The equation of alcoholic fermentation," by A. Harden and F. R. Henley. (4) "Presence of histamine in tissue extracts," by W. V. Thorpe. (5) "Note on the fluorescence of ergosterol."

and its cause," by O. Rosenheim. (6) "A few observations concerning phosphagen," by M. G. and P. Eggleton. Demonstrations on "A simple shaker for light objects" will be given by J. T. Irving, and on "A new colorimeter based on Lovibond's colour system," by O. Rosenheim and E. Schuster.

Nov. 7.—Institution of the Rubber Industry, London and District Section. Engineers' Club, Coventry Street, W.1., at 8 p.m. "Permeability of rubber and methods of measuring it," by H. A. Daynes.

Nov. 7.—Society of Chemical Industry, London Section. Rooms of the Chemical Society, Burlington House, Piccadilly, W.1., at 8 p.m. "Recent advances in the hydrogenation of oils." General introduction by E. R. Bolton. Part I. (a) "Selective hydrogenation," (b) "Melting point of hydrogenated oils," by K. A. Williams. Part II. "Hydrogenation of fatty acids and neutral oils," by R. G. Pelly. Part III. "The activity of a nickel catalyst," by E. J. Lush.

Nov. 7.—Society of Dyers and Colourists, Manchester Section. Lecture Room of the Manchester Literary and Philosophical Society, 36, George Street, Manchester, at 7 p.m. "Wetting out agents and other auxiliary products used in dyeing and calico printing," by Dr. Rath.

Nov. 8.—Institution of the Rubber Industry, Liverpool Section. The Common Hall, Hackins Hey, Dale Street, Liverpool.

Nov. 8.—Institution of Petroleum Technologists, House of the Royal Society of Arts, John Street, W.C.2, at 5.30 p.m. "Composition of cracked distillates," by Prof. J. S. S. Braine and T. G. Hunter.

Nov. 8.—Armourers and Brasiers Company, at Royal School of Mines, Prince Consort Road, South Kensington, S.W., at 5.15 p.m. "X-rays and metals," by G. Shearer. (Also on Nov. 15 and 22.)

Nov. 9.—Society of Chemical Industry, Nottingham Section. Jointly with the Midlands Section of the Society of Dyers and Colourists, at University College, Nottingham, at 7.30 p.m. "Action of chlorine and hypochlorous acid on wool," by S. R. Trotman, Dr. E. R. Trotman, and J. Brown.

Nov. 9.—Society of Chemical Industry, Glasgow Section. Jointly with the Institute of Chemistry. "Research in the textile industry," by C. M. Keyworth.

Nov. 9.—Institution of Electrical Engineers, South Midland Centre, The University, Edmund Street, Birmingham, at 7 p.m. "Economic aspects of pulverised fuel," by F. Forrest. "Present and future possibilities of extracting oil from coal," by Prof. A. W. Nash. "Coal analysis in relation to heat value for steam raising," by Prof. K. N. Moss.

Nov. 9.—Institute of Metals, Swansea Local Section. Thomas' Cafe, High Street, Swansea, at 7 p.m. "Pyrometers in works practice," by P. Macmair.

Nov. 10.—Institute of Metals, London Local Section. Royal School of Mines, South Kensington, S.W.7, at 7.30 p.m. "Some metallurgical problems of the electrical industry," by C. C. Paterson.

Nov. 10.—Institute of Brewing, Scottish Section. Caledonian Station Hotel, Edinburgh. "Chemical study of polysaccharides," by Sir J. C. Irvine.

Nov. 10.—Institution of the Rubber Industry, Birmingham and District Section. The Grand Hotel, Birmingham. "Industrial application of latex," by P. Schidrowitz.

Nov. 11.—Oil and Colour Chemists' Association, Manchester Section. "Some problems of varnish films," by Dr. R. S. Morrell.

Nov. 12.—Society of Chemical Industry, Chemical Engineering Group, Rooms of the Chemical Society, Burlington House, Piccadilly, W.1., at 8 p.m. "Some modern methods of recovery of lubricating oils," by A. J. Broughall.

INSTITUTION OF CHEMICAL ENGINEERS

A public lecture was delivered before the Institution by Sir William Bragg, K.B.E., F.R.S., on October 28, the subject being "Crystallisation." The President, Sir Alexander Gibb, G.B.E., C.B., presided.

To the chemical engineer, said Sir William Bragg, crystallisation was a process of the highest industrial importance, and to everyone there was fascination in the regularity and beauty of jewels and crystals of all sorts. It was by no means clear how all natural crystals had grown; the diamond, for instance, was a standing mystery. In the industrial manufacture of crystals, evaporation and cooling were processes in general use, and often "seed" crystals were provided on which larger crystals were to grow. Crystal-growing was a delicate and sometimes uncertain operation, which might be profoundly affected by causes seemingly trivial and little understood. The workman was almost superstitious in his use of "tips and dodges." Mr. Hugh Griffiths in a previous discourse before the Society had told of a visit to a certain salt works where it was the practice, if a certain form of salt crystals was desired, to add a cake of soap to the brine, whereas if a different kind was desired, a cake of blue was added. No one knew why.

The new methods of X-ray analysis depended on the fact that the fine structure of the rays made it possible in a certain sense to "see" fine details of structure which were, and would ever be, hidden from the eye even though aided by the microscope. It was not possible to examine the perfect regularity of the crystal structure and to observe the manner in which the atoms and molecules were fitted together. Such new powers were naturally turned to the question of crystallisation in the hope that solution of odd puzzles might be found. Though the subject was still in its infancy, relative to the growth that seemed to lie before it, yet the X-ray analyst had already thrown some light upon the crystallisation process. As an instance, the new methods emphasised the extreme importance of the perfect regularity of a crystal face: a new molecule depositing itself on that face had to fit, so to speak, exactly into the hole provided for it, and, moreover, had to be presented in the right way. The fit was as exact and as appropriate as that of a key to a lock. Impurity might prevent the process entirely, it might be likened to dirt in the lock or the key. Sometimes a layer of an impurity only one molecule thick might run quickly over a surface, and render it quite inert, and sometimes the impurity might adhere to one type of face on a crystal preventing its further growth, while leaving another face free to grow. For instance, sylvine, a crystal of exactly the same form as ordinary salt, potassium being substituted for sodium, sometimes showed a curious lack of symmetry when treated with an etching fluid: the pits on faces that were expected to show the same results differed in a way that had led crystallographers to suppose an actual want of symmetry in the crystal. It now appeared that the anomaly lay in the presence of a minute quantity of impurity in the etching fluid, an impurity which consisted of molecules either all right-handed or all left-handed. Half of the faces in question had, so to speak, right-handed holes in them and half of them left. The

impurity blocked up one sort and not the other: and so the crystal want of symmetry arose. The minutest trace was sufficient since the poisoning layer need be no more than one molecule thick. Many operations, both in inorganic and organic nature were affected by the presence of minute impurities, and it was not at all unlikely that in many of them the phenomena were analogous. In this and other ways the X-ray analysis was giving a closer insight into crystallisation processes. It was certain that in this way a better understanding would finally be reached, and already there were indications of satisfactory progress.

• The annual reception of the Institution of Chemical Engineers was held by the President, Sir Alexander Gibb, and Lady Gibb at the New Prince's Galleries, Piccadilly, on November 2. Over 450 guests were present at the reception, which was extremely pleasant. Not only was the eye delighted by the forty-fourth exhibition of the Royal Institute of Oil Painters, which was on view, but the Kensington Singers charmed the ear with a number of part songs, old and new, grave and gay, and Mr. Bernard Shore contributed a number of viola solos which ranged from French dances by Marais and a delightful work (though with a lugubrious title) by Bach to modern music by composers such as Glazounov, Debussy, and Kreisler.

Amongst those attending the reception were: the Rt. Hon. the Earl of Lovelace and the Countess of Lovelace, the Lord Meston and Lady Meston, the Hon. Sir Charles Parsons, the Rt. Hon. Sir Alfred Mond Bart. M.P., the Hon. H. Fletcher Moulton, Sir William Leese, Bart., and Lady Leese, Col. Sir Edward Brotherton, Bart., Sir Rowland Blades, Bart. (Lord Mayor of London), and Lady Blades, Sir Frederick and Lady Black, Sir Eustace D'Eyncourt, Lieut.-Gen. Sir William Furse (Director, Imperial Institute) and Lady Furse, Sir Frank and Lady Heath, Sir Robert Elliott-Cooper, Sir Albert Gray, Sir Charles Walker, Vice-Admiral Sir Henry Bruce, Sir Vincent Baddeley, Vice-Admiral Sir Ernie Chatfield, Sir Trevredyn Wynne, Sir Robert B. Dixon and Lady Dixon, the Hon. Sir John Cockburn, Sir Murdoch MacDonald and Lady MacDonald, Sir John and Lady Biles, Sir Lynden Macassey and Lady Macassey, Sir Richard Threlfall, Sir Frederic Nathan (Past President of the Institution) and Lady Nathan, Sir William Pope, Sir Robert and Lady Waley Cohen, Sir John Flett (Director, Geological Survey of Great Britain), Col. Sir John Young, Sir John and Lady Snell, Sir Napier Shaw, Sir Alexander Roger, Sir Gregory and Lady Foster, Sir Richard Gregory, Sir Harry Courthope-Munroe, Sir Alexander Kennedy, Sir Cyril and Lady Kirkpatrick, Sir Ralph Wedgwood, Sir Benjamin and Lady Longbottom, the Mayor of the City of Westminster (Coun. S. P. B. Bucknill) and the Mayoress, the Mayors and Mayoresses of several of the Metropolitan Boroughs, Dr. E. F. Armstrong, Prof. H. E. Armstrong, Mr. and Mrs. Rustat Blake, Col. C. H. Bressey, Dr. J. M. Bulloch and Mrs. Bulloch, Mr. F. H. Carr (President, Society of Chemical Industry) and Mrs. Carr, Mr. and Mrs. R. W. Dana, Adml. H. P. Douglas (Hydrographer of the Navy) and Mrs. Douglas, Mr. C. O. G. Doune (Secretary, University College, London), Dr. W. H. Eccles and Mrs. Eccles, Mr. and Mrs. J. Ferguson, Mr. and

Mrs. C. S. Garland, Adml. J. de Courcy Hamilton and Mrs. Hamilton, Major E. O. Henrici, Mr. W. L. Hichens, Mr. C. W. Hurcomb, Adml. Mark Kerr, Mr. H. P. Macmillan, K.C., and Mrs. Macmillan, Mr. and Mrs. R. E. L. Maunsell, Mr. C. H. Merz, M. R. A. Möllersen (Consul-General for Esthonia) and Mme. Möllersen, Mr. Emile Mond, Mr. Henry Mond, Mr. Robert Mond, Mr. and Mrs. Basil Mott, Mr. and Mrs. Palmer, Mr. L. St. L. Pendred, Mr. H. St. John Raikes, K.C., and Mrs. Raikes, M. V. Rackauskas (Lithuanian Chargé d'Affaires) and Mme. Rackauskas, Mr. L. H. Savile, Dr. T. Franklin Sibly (Principal Officer, University of London), Mr. A. A. Campbell Swinton, Mr. and Mrs. J. Frater Taylor, Mr. H. T. Tizard (Secretary, Department of Scientific and Industrial Research), Dr. J. H. T. Tudsbury (Honorary Secretary, Institution of Civil Engineers), Mr. James Whitehead, K.C., Mr. W. Will, Prof. E. C. Williams, Dr. G. W. Monier Williams, and Prof. J. W. Hinchley (Honorary Secretary of the Institution).

CORRESPONDENCE

MORE REMINISCENCES

SIR, Your correspondent, P. H., writing of his reminiscences, will have reminded many others of their own early days although I myself can refer only to the late nineties. Yet the conditions then were so different from those obtaining now that my experiences may conceivably be of interest, and possibly this letter may induce other correspondents to contribute theirs. As assistant chemist at a factory on the Kentish marshes, I left home (even in winter) at 5.40 a.m. to walk 4 miles along country roads and start work at 6.30. Breakfast from 8.30 to 9.0 a.m. How well I remember frying a rasher over a Bunsen burner on a lead covered sink, surrounded by plant samples of nitric acid and COV.; sometimes dropping the bacon in the sink and having to rinse it under the tap. From 1.0 to 1.30 I ate my sandwiches: no opportunity for reading the newspaper, as a despotic manager forbade newspapers on the factory. At 5.30, nominally, work ceased. But I frequently worked "overtime," superintending the weighing out of acid mixings on the jetty in a nor' easter, in a haze of nitrous fumes and by the light of a cycle-lamp. At 7 again a four-mile walk home. The remuneration for this service was 30s. per week with deductions for Bank holidays and annual leave, but, as a consolation, a gift of 1s. 9d. on Beanfeast day! A yearly holiday was granted under protest: during my first year I was allowed 5 days, which was increased to one week the next year.

Truly, by comparison, the lot of the chemist nowadays is a bed of roses.

Yours faithfully,
W. J. W.

PERSONAL AND OTHER ITEMS

Prof. J. C. Philip has been appointed to succeed the late Sir James Dobbie as an elector to the professorship of physical chemistry at Cambridge.

The Nobel Prize for physiology and medicine for 1926 has been awarded to Prof. J. Fibiger, of Copenhagen, for his work on cancer, and the prize for 1927 to Prof. J. W. von Jauregg, of Vienna, for his work on the treat-

ment of general paralysis of the insane with the virus of malaria.

Mr. A. W. Allen has been appointed editor of the *Engineering and Mining Journal*, in succession to Mr. J. E. Spurr. Mr. Allen, who is an Englishman and a Cambridge man, has done important work in connexion with nitrates and the cyanide process.

Mr. F. W. Sperr, junr., director of research for the Koppers Company, Pittsburgh, has been awarded the 1926 Beal medal of the American Gas Association. Mr. Sperr has thus been awarded the medal twice, as he also received it in 1921.

Mr. W. Richter has been appointed general manager of the paint, lacquer and chemicals department of the E.I. du Pont de Nemours Co., in succession to Mr. W. P. Allen, who, at his own request, has been granted a leave of absence for a year.

The death, at the age of 76, is announced of Mr. E. Steer, J.P., D.L., formerly chairman of Guest, Keen & Nettlefolds.

We regret to announce the death, at the age of 82 years, of Mr. A. W. Wilson, of Felstead, Bentham, Yorks. Mr. Wilson was elected a member of the Society of Chemical Industry in 1884.

The following deaths are announced from Germany : A. Cobenzl, a well-known photochemist ; Prof. L. Darmstädter, the director of the State Library, Berlin.

The late Mr. J. S. Beauford, J.P., manager of the Rio Tinto Copper Co., left £41,700.

New School of Biochemistry at Oxford

The new School of Biochemistry at Oxford, which was opened by the Lord Chancellor on October 21, owes its existence to the Rockefeller Trustees, who offered £55,000 to meet the cost of building and equipping the school and £25,000 for its maintenance, on condition that the University contributed £25,000, or its equivalent in annual income, for maintenance.

The Lord Chancellor said that no university was worthy of the name which did not provide for those who went to it the opportunity of learning the best in all branches of knowledge, including the best scientific training within its reach. Oxford had now, for many years, given its attention to science. He supposed the early pioneers taught physiology, and out of physiology gradually emerged a special branch, which was sometimes called chemical physiology, and in later years biochemistry. He doubted whether any study bore within it greater promise of progress and of benefit to all living things. This branch of science owed very much, in Oxford, to Sir Charles Sherrington. Sir Archibald Garrod also had rendered much help to science in the University and in the preparations for the establishment of that school. By the generosity of Mr. Whitley, of Trinity College, the Whitley chair of biochemistry was founded, and it had been filled, first, too briefly, by Dr. Benjamin Moore, who nevertheless did admirable work, and since by Dr. R. A. Peters, whom they now congratulated on the greater sphere of work about to open before him.

The Rockefeller Trustees, who had already done much to forward the teaching of science, had made a princely

gift for the new school, and the University was contributing largely towards its maintenance. We did not know nearly enough about life and the processes of life. It was important that the science of biochemistry should advance. It might have a great effect upon the health and lives of many people. Speaking on behalf of the University, he said they were very grateful to the Rockefeller Trustees for their gift. With their usual self-effacement, the Rockefeller Trustees were unwilling to have their name put on the building or included as part of its name, but their generous help would never be forgotten. He believed the new structure would prove a powerful encouragement to the study in Oxford of the science of the processes of life, and would hereafter render signal services to the human race.

The new school has been built next to the Department of Physiology, with which it is connected, on two floors, by corridors. It has been designed by Mr. H. Redfern, F.R.I.B.A. The building is three storeys high, and is simple in style, with large windows. The ground floor contains the main lecture theatre for the two departments, and the first floor contains class rooms. The second floor includes research rooms, a professor's research suite, etc.

Among those present at the opening ceremony were : -- Lord Hugh Cecil, M.P., Sir George Buchanan, Sir Jeremiah Colman, Sir Walter Fletcher, Sir F. Gowland Hopkins, Professor of Biochemistry, Cambridge, Sir Bernard Spilsbury, Prof. Barcroft, Cambridge, Dr. H. H. Dale, Prof. H. Euler, Stockholm, Dr. J. S. Haldane, and Dr. R. A. Peters, Whitley Professor of Biochemistry.

British Cotton Research

At the annual meeting of the British Cotton Industry Research Association, on October 18, it was stated that the financial outlook of the Association gave cause for concern, and that a scheme for meeting the cost of the work would have to be evolved. The President, Mr. Kenneth Lea, said that during the present year the work of the Association had cost £49,000, an increase of £1000 over the previous year. In extending a cordial welcome to Dr. R. H. Pickard, F.R.S., the new director of research, the President said that the research staff of the Association, including those in the workshops, now numbered 87. The question of an artificial silk department, to be financed and housed separately, was being reconsidered. [Last year, despite bad trade, Lancashire consumed an amount of artificial silk yarn estimated at 4000 tons, and with the growing use of rayon in conjunction with cotton, many new technical problems have arisen in weaving and dyeing, as well as in finishing the mixed fabrics.]

Fuel Problems

The forthcoming publication of an important treatise on the fuel resources of Great Britain and their utilisation and treatment is announced. Sir Alfred Mond contributes an introduction to the book, which is entitled "Britain's Fuel Problems," and over 50 specialists have written contributions. The introductory articles will deal with fuel economy in America, Germany, France and Belgium, and nine sections will be devoted, respectively, to production, preparation, utilisation (including fuel in iron and steel practice), coal carbonisation, low-temperature distillation, the gasification of

coal, interior heating, the complete utilisation of fuel energy, and refractories. The special library edition of the work, which is now in the Press, will be published at practically net cost (42s.), by "The Fuel Economist."

Recent Advances in the Hydrogenation of Oils

On November 7 the London Section will hear a series of papers describing recent advances in the hydrogenation of oils. The general introduction, to be given by Mr. E. R. Bolton, will touch briefly on the origin of oil hydrogenation, and will compare the processes of hydrogenation by means of powder catalysts with a new continuous process in which a fixed catalyst is employed. The principle of this process will be demonstrated in laboratory apparatus, and lantern slides illustrating the construction and operation of commercial plant will be shown.

The advantages of the continuous process will be discussed, and it will be shown how the composition of the hydrogenated oil may be controlled by altering various factors in the methods of working. Certain of these factors will be dealt with in Part I by Mr. K. A. Williams, who will also deal with the relationship between melting point and selective action.

In Part II Mr. R. G. Pelly will discuss some aspects of the hydrogenation of fatty acids in comparison with neutral oils, and, finally, in Part III, Mr. E. J. Lush will give some observations on the hydrogenation of naphthalene and its bearing on the general question of the activity of a nickel catalyst.

British Association of Chemists

The Annual Dinner will be held at the Hotel Victoria, Northumberland Avenue, on Saturday, November 26, at 7 p.m. There will be several distinguished guests, including a member of the Ministry of Labour. A limited number of tickets (15s. each) is available to non-members; application should be made to the General Secretary as early as possible, but not later than November 19.

Preparation and Technical Applications of Beryllium

Dr. Illig has given an account (*Z. angew. Chem.*) of the preparation and uses of beryllium. The production in quantity is based on an electrolytic process, worked out by Stock and Goldschmidt in 1925, using a fused sodium barium beryllium fluoride as electrolyte. The Siemens and Halske A.-G. has now developed this method, and can put the process on a technical scale as soon as a demand exists. It is estimated that the present price of 6-11 shillings per g. would fall to approximately that of silver with increased production.

The properties of beryllium have proved surprising. The pure metal melts at 1285° is very hard and brittle, and resistant to the atmosphere. It has already found a limited application in the construction of X-ray tubes. Its chief use will, however, be in the form of alloys. The addition of 2% to iron increases the hardness from 100 to 300, and this may be further increased by heat treatment to 500-600. With copper or nickel a beryllium content of 2-3% yields alloys closely resembling bronze in their properties. They have the advantage that they can be worked prior to heat treatment. These alloys are more resistant to corrosion than carbon steel. In their production the use of cheaper poor quality metal

containing 10-20% of aluminium has proved entirely satisfactory. Hitherto little success has resulted from investigations on the alloys of beryllium with magnesium and aluminium; those with other heavy metals are being further studied.

New Swedish Rubber Company

H.M. Commercial Secretary at Stockholm reports that, according to the local press, the Hälsingborgs Gummi A/B, Ryska Gummifabriks A/B, Malmö, and the Skandinaviska Gummi A/B at Viskafors have agreed to amalgamate. The old companies will, for the time being, continue to operate independently. The new company, the Förenade Gummifabrikerna A/B, will have a capital of between 3 and 9 million kronor, and it appears that also Trälleborgs Gummifabrik will participate.

The I. G. Farbenindustrie

According to the *Financial Times*, the holding company of the interests of the I. G. Farbenindustrie A.-G. in the Bergius process has issued a balance-sheet for 1926 disclosing a net profit of 72,140 marks, which is carried forward.

The Trust has now taken over the sales of the products of the Rhenania-Kunheim Chemical Works. Shares of the Rhenania-Kunheim to the amount of 1,600,000 marks were sold by the Rutgerswerke a few months ago, but the new ownership has never been disclosed.

A company has been established with a preliminary capital of 500,000 marks under the title of "Kohlenchemie A.-G.," to co-ordinate the chemical interests of the Ruhr mines in the utilisation of coal.

COMPANY NEWS

ERINOID, LTD.

The trading profit for the year ended August 31, 1927, amounted to £27,000, compared with £40,278 for the previous year. After meeting charges and depreciation the net profit was £17,069, against £30,355. With £1971 dividend from the Compagnie Française de l'Onnilit and £6041 brought in, there was an available sum of £25,081. The dividend was 7%, against 10%, and after transferring £1547 to general reserve (£5000 for previous year), placing £2500 against £5000 to taxation reserve, and allocating £250 to the staff fund, £6992 remained to be carried forward.

CHEMICAL AND METALLURGICAL CORPORATION

An extraordinary meeting will be held on November 7 to pass resolutions authorising the directors to issue any of the 9,500,000 at present unissued new ordinary shares, and increasing the number of directors to 12. The directors propose to erect a modern electrolytic zinc refinery at some place in Europe where electric current is available at an economic price, which will enable the company to dispose of the whole of the constituents of the complex ores as metals, or their compounds, in a manufactured form. As indicated by the chairman at the last meeting, the company has evolved a very satisfactory process for the treatment of the South African platinum-copper-nickel concentrates, and a pilot plant has been in successful operation at the Stratford works. It is now proposed to erect, at Runcorn, a plant for the commercial treatment of these concentrates. The additional capital is required in order to carry out the above policy.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5 - £5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5 -£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market. 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London. 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s. - 6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 10s.—£10 per ton. Good demand.
 Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£8—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals, - 7½d.—8d. per lb. Crude 60's, 2s. 3d.—2s. 5d. per gal.
 Acid Cresylic, 99/100.—2s. 11d.—3s. per gal. 97/99.—2s. 4½d.—2s. 5½d. per gal. Pale, 95%, 2s. 3d.—2s. 4d. per gal. Dark, 95%, 2s. 1d.—2s. 2d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—10d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 7d. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 6d.—2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7¾d. per gal. ex works. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.—10½d. per gal. Solvent 95/160, 1s. 3d.—1s. 4d. per gal. Solvent 90/190, 8½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—84s.—87s. 6d. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 6d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—8d. per lb., naked at works.
 Aniline Salts.—8d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb., 100%.
 Benzaldehyde.—2s. 3d. per lb.

Benaidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—5½d. per lb.

m-Cresol 98/100%.—2s. 7½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—1s. 10d. per lb.

Dimethylaniline.—1s. 11d. per lb.

Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton

Dinitrochlorbenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

α-Naphthol.—2s. per lb. d/d.

β-Naphthol.—10d. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb.

β-Naphthylamine.—3s. per lb.

p-Nitraniline.—1s. 7d. —1s. 8d. per lb.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb.

R. Salt.—2s. 2d. per lb.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—7½d.—8½d. per lb.

p-Toluidine.—2s. per lb., ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—(Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 4d. per lb. Technical 11½d.—1s. per lb. Good demand.

Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Amidol.—9s. per lb. d/d.

Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—9s. 6d. per oz.

Barbitone.—5s. 9d.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—9s. 9d.—9s. 10d. per lb. Bismuth Citrate.—9s. 6d.—9s. 9d. per lb. Bismuth Salicylate.—8s. 9d.—9s. per lb. Bismuth Subnitrate.—7s. 9d.—8s. per lb. Bismuth Nitrate.—5s. 9d.—6s. per lb. Bismuth Oxide.—13s. 9d.—14s. per lb. Bismuth Subchloride.—11s. 9d.—12s. per lb. Bismuth Subgallate.—7s. 9d.—8s. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d.—2s. 4d. per lb. Potassium. 1s. 9½d.—1s. 10½d. per lb. Sodium.—2s.—2s. 1d. per lb.

Granulated ½d. per lb. less. All spot. Large quantities at lower rates.

Calcium Lactate.—1s. 2d.—1s. 3½d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ethers: S.G. 730, 10½d.—1s. 1½d. drums. Other gravities at proportionate prices.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—4s. 9d.—5s. per lb.

Hexamine.—2s. 3d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal. in carboys; Winchesters, 2s. 11d. per gal.; 20 vols., 4s. 3d. per gal. in carboys; Winchesters, 5s. per gal.

Hydroquinone.—2s. 11d.—3s. 2d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate.—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—18s.—20s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 8s. 6d.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonat.—8s. 9d.—9s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—2s. 6d.—2s. 9d. per lb.

Phenazone.—4s.—4s. 3d. per lb.

Phenolphthalein.—6s. 6d.—6s. 9d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2½%.

Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.

Resorcin.—3s. 9d.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.

Sod. Citrate, B.P.C., 1911.—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 11d.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net.
 Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 7½d.—1s. 9d. per lb. Crystal,
 1s. 8½d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—27 10s.—£28 10s. per ton
 according to quantity, delivered U.K.
 Sulphonal.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s.—2s. 1d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to
 quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.
 Aubepine (*ex Anethole*).—11s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s.
 per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl
 Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d.
 per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—
 4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—
 (*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb.
 Linalyl Acetate.—(*ex Bois de Rose*) 18s. 6d. per lb.—
 (*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.
 —1s. 8d. per lb. Vanillin.—16s. 6d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb.
 Bergamot.—26s. per lb. Bourbon Geranium.—13s. 6d.
 per lb.
 Camphor.—75s. per cwt. Cananga, Java, 15s. 9d. per lb.
 Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d.
 per oz. Citronella.—Java, 1s. 10d. per lb., c.i.f. U.K.
 port, for shipment over 1928. Ceylon, Pure, 1s. 8d.
 per lb. Clove, pure 5s. 3d. per lb.
 Eucalyptus, Australian.—2s. 2d. per lb. Lavender.—Mont
 Blanc, 28/40%, 17s. per lb. Lemon.—7s. 3d. per lb.
 Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d.
 per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian,
 75s. per oz. Palma Rosa.—10s. per lb. Peppermint
 —Wayne County, 15s. 9d. per lb. Japanese, 8s. per
 lb. Petitgrain.—8s. 6d. per lb. Sandalwood—Mysore,
 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Dec. 26th. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Nov. 10th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Aaronson, and Chemical Waterproofing Corp. Treating porous or fibrous materials. 27,926. Oct. 20.
 Braham. Drying-apparatus. 27,678. Oct. 18.

Carpmael (I.-G. Farbenind.). Manufacture of products by gaseous reaction etc. 27,938. Oct. 20.

Glover. Furnaces. 27,542. Oct. 17.
 Haas, and Zellstofffabr. Waldhof. Indicating and regulating concentration of liquids. 28,038. Oct. 21. (Ger., 20.11.26).

Marks (Carbide & Carbon Chem. Corp.). Recovery of absorbable substances. 28,158. Oct. 22.

Read. Identifying crystals. 27,785. Oct. 19.

Redlich. Preparation of emulsions. 27,970. Oct. 20.

II.—Complete Specifications

9934 (1926). Hammond and Shackleton. Heat-treatment of liquid and solid materials. (278,768.)

14,397 (1926). Tocco and Landi. Rotary chemical furnaces. (278,774.)

18,033 (1926). Berten & Co. See XVII.

18,070 (1926). Karplus. Compositions for preventing boiler scale. (255,865.)

24,193 (1926). Pfandler Co. Heat-exchangers. (265,133.)

26,358 (1926). Savage. See XII.

31,173 (1926). Albersheim and Konheim. Apparatus for determining the viscosity of fluids. (263,781.)

722 (1927). Chicago Pneumatic Tool Co. Processes of transforming heat. (265,562.)

4108 (1927). Capra. Filter-presses (278,940.)

4641 (1927). Gewerkschaft Sachtleben, and Kuppers. Rotary furnaces. (268,308.)

8460 (1927). Cerini. See VII.

13,831 (1927). Hammond and Shackleton. Heat-treatment. (278,985.)

16,619 (1927). Vernay. Thickening filtering apparatus. (275,573.)

18,454 (1927). Kramer, and Hartstoffmetall A.-G. Pulverising-mills. (278,997.)

19,853 (1927). Mulot. Purifying or filtering apparatus for gaseous fluids. (279,000.)

*23,184 (1927). Studenges, fur Gasind. Apparatus for preparing compressed gases. (279,041.)

*27,441 (1927). Feige. Apparatus for carrying out chemical reactions. (279,120.)

II.—Applications

Arnold (Standard Development Co.). Fractionation of hydrocarbon mixtures etc. 28,140. Oct. 22.

Bomke. Preparing hydrogen. 27,551. Oct. 17. (Ger., 16.10.26.)

Bysow. Producing diolefines from naphtha etc. 27,962. Oct. 20.

Chilowsky. Manufacture of gas from heavy oils. 27,914. Oct. 20. (Fr., 27.10.26.)

Craig. Low-temperature distillation of coal etc. 27,842. Oct. 20.

Ellis (Amer. Sheet & Tin Plate Co.). Purifying and drying oil. 21,957. Oct. 20. Separating oil from aqueous emulsions. 27,958. Oct. 20.

Engelhard. Gas analysis apparatus. 27,846. Oct. 17. (U.S., 27.8.27.)

Florentin, Kling, and Matignon. Obtaining light hydrocarbides from complex organic compounds. 27,952. Oct. 20. (Fr., 23.10.26.)

Gordon, Hughes, and Imperial Chem. Industries. Treatment of coal distillation gases. 27,513. Oct. 17.

Hoyois. Treatment of coal, ores, etc. 27,621. Oct. 18. (Belg., 19.10.26.)

Imbert. Producing gas from wood etc. 27,901. Oct. 20. (Ger., 25.10.26.)

Johnson (I.-G. Farbenind.). Recovery of hydrocarbons etc. 27,497. Oct. 17. Manufacture of hydrocarbons of low-boiling point. 27,909. Oct. 20. Eliminating sulphur compounds from gases.

Laing and Nielsen. Distillation of carbonaceous materials etc. 27,831—2. Oct. 19.

Lookwood. Removal of sulphur from mineral oil. 27,971. Oct. 20.

Lucas, and V.L. Oil Processes, Ltd. Cracking liquid hydrocarbons. 27,461. Oct. 17.

Ott. Alcohol fuel. 27,791. Oct. 19.

Ringrose. Apparatus for detecting etc. inflammable gases. 27,853-4. Oct. 20.

Siemens & Halske A.-G. Determination of amount of carbonic acid in flue gases. 27,912. Oct. 20. (Ger., 25.10.26.)

Soc. de Recherches et de Perfect. Industriels. Furnaces for distilling carbonaceous material. 27,570. Oct. 17. (Ger., 15.10.26.)

II.—Complete Specifications

21,749 (1926). Standard Development Co. Purification of hydrocarbon oils containing sulphur. (270,626.)

4916 (1927). Suida. Recovery of acetic acid and other products in the carbonisation of wood. (275,158.)

6375 (1927). Alexander. See IX.

*6609 (1927). Koks- und Halbkoks-Brikettierungs-Ges. Production of semi-coke briquettes from bituminous coal. (279,020.)

*24,915 (1927). Spilker, Zerbe, and Ges. für Teerverwertung. Hydrogenating and splitting hydrocarbons etc. (279,055.)

*25,513-4 (1927). Humphreys & Glasgow, Ltd. Manufacture of mixed gas. (279,059-60.)

*26,443 (1927). I.-G. Farbenind. Hydrogenation of coals, tars, mineral oils, etc. (279,072.)

*27,198 (1927). Corson. Manufacturing hydrocarbons from calcium carbide. (279,095.)

*27,318 (1927). Algernon. Norit Maatsch. Producing and regenerating activated carbon etc. (279,104.)

*27,551 (1927). Bomke. Preparing hydrogen. (279,128.)

*25,570 (1927). Soc. de Recherches et de Perfect. Industriels. Furnace for distilling at low temperature carboniferous material. (279,130.)

III.—Complete Specification

*26,443 (1927). I.-G. Farbenind. See II.

IV.—Applications

Beavis and Schindelmeyer. Production of nitro and amino derivatives of cymene. 27,694. Oct. 18.

Carpmael (I.-G. Farbenind.). Manufacture of benzantraquinone derivatives etc. 27,668. Oct. 18.

I.-G. Farbenind. Manufacture of dinitrohalogen-aryls. 27,684. Oct. 18. (Ger., 18.10.26.) Manufacture of vat dyestuffs. 28,037. Oct. 21. (Ger., 23.10.26.)

Imray (I.-G. Farbenind.). Manufacture of derivatives of pyrazolanthrone. 28,036. Oct. 21.

Scottish Dyes, Ltd., Smith, and Thomas. Manufacture of dyestuffs etc. 27,525. Oct. 17.

Silesia, Verein Chem. Fabr. Separation of mono- and di-alkyl derivatives of aromatic amines. 28,002. Oct. 21. (Ger., 19.11.26.)

Soc. Chem. Ind. in Basle. Manufacture of vat dyestuffs. 27,915. Oct. 20. (Switz., 20.10.26.)

IV.—Complete Specifications

12,283 (1926). Carpmael (I.-G. Farbenind.). Manufacture of vat dyestuffs of the anthraquinone series. (278,771.)

17,684 (1926). Dicker (Verein f. Chem. Ind.). See XX.

19,311 (1926). Thomson, Thomas, and Scottish Dyes, Ltd. Dyes and dyeing. (278,834.)

26,332 (1926). I.-G. Farbenind., Maennchen, and Hummerich. Producing stable preparations of vat-dyestuffs. (278,890.)

30,158 (1926). I. G. Farbenind. Manufacture of thiazole derivatives of 1:4-naphthoquinone. (262,141.)

20,415 (1927). Carpmael (I.-G. Farbenind.). Manufacture of vat dyestuffs of the anthraquinone series. (279,003.)

*27,684 (1927). I.-G. Farbenind. Manufacture of dinitrohalogenaryls. (279,134.)

V.—Applications

British Celanese, Ltd. Treatment of organic derivatives of cellulose. 28,151. Oct. 22. (U.S., 23.10.26.)

British Celanese, Ltd., and Kinsella. Apparatus for manufacture of artificial silk etc. 28,163. Oct. 22.

Buggenhoudt and Homeyer. Transformation of textile etc. materials. 27,701. Oct. 18. (Belg., 18.10.26.)

Carpmael (I.-G. Farbenind.). Manufacture of cellulose ethers. 28,079. Oct. 21.

Fraser. Preparation of vegetable fibres. 27,763. Oct. 19.

Spinnstoffwerk Glauchau A.-G., and Voss. Washing artificial etc. threads. 28,018. Oct. 21. (Ger., 12.11.26.)

V.—Complete Specifications

9773 (1926). White (Brown Co.). Production of high alpha-cellulose. (278,767.)

18,030 (1926). Courtaulds, Ltd., and Lewis. Manufacture of artificial threads etc. (278,814.)

25,285 (1926). Courtaulds, Ltd., and Topham. Manufacture of artificial threads etc. (278,881.)

8543 (1927). Bemberg A.-G. Manufacture of twisted artificial silk. (268,393.)

*22,461 (1927). I.-G. Farbenind. Opening-up materials containing cellulose. (279,036.)

*27,701 (1927). Buggenhoudt and Homeyer. Transformation of materials having a base of cellulose. (279,137.)

VI.—Applications

Aaronson, and Chemical Waterproofing Corp. 27,926. See I.

I.-G. Farbenind. Dyeing cellulose esters etc. 27,685. Oct. 18. (Ger., 18.10.26.)

VI.—Complete Specifications

19,311 (1926). Thomson, Thomas, and Scottish Dyes, Ltd. See IV.

26,332 (1926). I.-G. Farbenind., Maennchen, and Hummerich. See IV.

*27,685 (1927). I.-G. Farbenind. Dyeing cellulose esters and cellulose ethers. (279,137.)

VII.—Applications

Bomke. 27,551. See II.

Coley. 27,495. See X.

Marks (Louisville Cement Co.). 28,057. See IX.

Pritchard, and United Alkali Co. Production of caustic soda. 28,066. Oct. 21.

Smith. Nickel compounds. 27,784. Oct. 19.

VII.—Complete Specifications

21,561 (1926). Rhodesia Broken Hill Development Co., Ltd. (Stevens, Norris, and Watson). Purification of zinc solutions. (278,851.)

31,275 (1926). Nederlandsche Mijnbouw en Handelsmaatsch. Manufacture of cyanides. (262,802.)

4916 (1927). Suida. See II.

8460 (1927). Cerini. Apparatus for purifying impure solutions of caustic soda etc. (268,385.)

8007 (1927). Lichtenberger and Kaiser. Manufacturing pure sulphate of barium and sulphate of calcium. (268,779.)

*22,466 (1927). App. et Evaporateurs Kestner. Production of nitrate of lime. (279,037.)

*27,551 (1927). Bomke. See II.

VIII.—Complete Specification

18,448 (1926). South Metropolitan Gas Co., and Lamprey. Manufacture of refractories. (278,821.)

IX.—Applications

Ambly. Furnace for producing cement. 27,825. Oct. 19.

Hart, Rodwell, and Roper. Cements, paints, etc. 27,773. Oct. 19.

Marks (Louisville Cement Co.). Burning lime and cement. 28,057. Oct. 21.

Raschig and Raschig. Paving-materials. 27,925. Oct. 20.

IX.—Complete Specifications

17,062 (1926). Garrow. Preparation of organic materials or aggregates for use with cements. (278,788.)

475 (1927). Davies. Magnesium oxychloride coverings. (278,926.)

6375 (1927). Alexander. Manufacturing bituminous products etc. (270,649.)

12,895 (1927). Bates. Artificial marble. (278,983.)

*27,193 (1927). Carl and Riedel. Material for road-beds etc. (279,093.)

X.—Applications

Beatty. Nickel and nickel alloys. 27,954. Oct. 20.

British Thomson-Houston Co. Alloys. 28,041. Oct. 21. (U.S., 22.10.26.)

Coley. Distillation process for zinc oxides. 27,495. Oct. 17.

Hoyois. 27,621. See II.

Krupp A.-G. Raising yield point of steel alloys. 28,021. Oct. 21. (Ger., 7.12.26.)

Marks (Amer. Machine & Foundry Co.). Fusible alloy. 27,964. Oct. 20.

Norddeutsche Affinerie. Dearsenifying ores etc. 27,532. Oct. 17. (Ger., 3.3.27.)

O'Brien & Partners, Ltd., and Gower. Coating aluminium etc. 27,880. Oct. 20.

Ruben (Kahr). Distillation of zinc. 27,959. Oct. 20.

Smith. Treatment of ores etc. containing platinum. 28,035. Oct. 21.

Standard Telephones & Cables, Ltd. (Western Electric Co.). Electrodeposition of alloys. 27,760. Oct. 19.

X.—Complete Specifications

17,261 (1926). Jacobsen, Goffin, Goffin, and Renson. Recovering tin from tin-plate. (255,092.)

17,770 (1926). Ramen. Chlorinating ores. (255,475.)

1508 (1927). Buddeus. Reducing ores etc. (264,834.)

7536 (1927). Krupp A.-G. Sintered hard metal alloys and articles manufactured thereof. (278,955.)

XI.—Applications

Almeida Accumulators, Ltd., and Levy. Electric cells. 28,155—6. Oct. 22.

British Thomson-Houston Co., Ltd., Ward, and Warren. Insulating enamels, varnishes, etc. 28,139. Oct. 22.

Standard Telephones & Cables, Ltd. (Western Electric Co.). 27,760. See X.

XI.—Complete Specifications

24,129 (1926). Burger. Galvanic cell. (259,220.)

28,608 (1926). Hodgkiss and Smith. Batteries, accumulators, etc. (278,903.)

XII.—Applications

André. Treatment of oil seeds etc. 27,496. Oct. 17. (Fr., 15.10.26.)

Chesavon Fabrik. Cleansing-substances. 27,700. Oct. 18. (Ger., 19.10.26.)

Ellis (Amer. Sheet & Tin Plate Co.). 21,957—8. See II.

XII.—Complete Specifications

18,047 (1926). Simon, and Simon Bros. (Engineers), Ltd. Apparatus for distilling solvents in connexion with extraction of oils, fats, etc. (278,815.)

26,358 (1926). Savage. Extracting oleaginous and other materials with volatile solvents. (278,891.)

*27,496 (1927). André. Treatment of oil seeds etc. (279,122.)

XIII.—Applications

Allen & Sons, Ltd., and Butler. Luminous inks etc. 28,121. Oct. 22.

British Thomson-Houston Co., Ltd., Ward, and Warren. 28,139. See XI.

Du Pont de Nemours & Co. Coating-compositions. 27,965. Oct. 20. (U.S., 22.7.27.)

Gallie. Manufacturing and applying lacquer. 27,455. Oct. 17.

Hailwood, Naunton, Shepherdson, and Imperial Chemical Industries, Ltd. 28,089. See XIV.

Hart, Rodwell, and Roper. 27,773. See IX.

Menzen. Surface coatings. 27,494. Oct. 17.

XIII.—Complete Specifications

9623 (1926). Wilson, Thomas, and Scottish Dyes, Ltd. Production of colour bases for varnishes etc. (278,765.)

17,123 (1926). Klein and Brown. Manufacture of titanium pigments. (278,791.)

67 (1927). Craven, and Yorkshire Dyeware & Chem. Co. See XIV.

20,707 (1927). I.-G. Farbenind. Varnishes etc. (275,652.)

XIV.—Applications

Cogedex Comp. Gén. d'Exploitation. Utilising latex in making regenerated rubber. 27,633. Oct. 18. (Fr., 31.8.27.)

Hailwood, Naunton, Shepherdson, and Imperial Chemical Industries. Manufacture etc. of pigments for colouring rubber. 28,089. Oct. 21.

XIV.—Complete Specifications

67 (1927). Craven, and Yorkshire Dyeware & Chem. Co. Manufacture of solid resin from crude guttapercha and/or balata. (278,922.)

4643 (1927). Silesia, Verein Chem. Fabr. Accelerating vulcanisation. (270,644.)

XV.—Complete Specification

25,605 (1926). Ehrenreich. Tanning shark skins. (278,885.)

XVI.—Complete Specification

10,820 (1927). Selbi (Soc. d'Exploitation de Licences de Brevets Industriels). Manufacture of fertiliser from vinasses. (279,022.)

XVII.—Complete Specification

18,033 (1926). Berten & Co. Apparatus for evaporating or concentrating sugar solution etc. (265,127.)

XIX.—Applications

Hobbs and Lane. Preservation of meat. 27,479. Oct. 17. Johnson (I.-G. Farbenind.). Preservation of perishable goods. 27,500. Oct. 17.

Perino. Manufacture of vegetable alimentary product. 27,934. Oct. 20. (Ger., 22.10.26.)

XIX.—Complete Specifications

17,504 (1926). Heyman. Freezing-apparatus for use in the concentration of fruit juices. (278,799.)

23,436 (1926). Meyer. Preparation of water-soluble albumin. (260,224.)

XX.—Applications

Beavis and Schindelmeyer. 27,694. See IV.

Carpmael (I.-G. Farbenind.). Manufacture of disubstituted guanidines. 27,822. Oct. 19.

Florentin, Kling, and Matignon. 27,952. See II.

Hirst, Rowell, and Imperial Chemical Industries. Oxidation of volatile organic compounds. 27,641. Oct. 18.

Holzverkohlungs-Ind. A.-G., and Roka. Production of ketones. 27,655. Oct. 18.

I.-G. Farbenind. Manufacture of gland preparations. 27,510. Oct. 17. (Ger., 15.10.26.)

Manufacture of physiologically-active extracts. 27,511. Oct. 17. (Ger., 20.10.26.)

Manufacture of water-soluble dinitroarylamino-diarylamines. 27,683. Oct. 18. (Ger., 18.10.26.)

Manufacture of aromatic mercaptans. 27,686. Oct. 18. (Ger., 18.10.26.)

Imperial Chemical Industries, Ltd., and Riley. Compounds of aromatic diamines. 27,543. Oct. 17.

Nobel Industries, Ltd. (Du Pont de Nemours & Co.). Production of condensation products. 28,054. Oct. 21.

XX.—Complete Specifications

14,657 (1926). Johnson (I.-G. Farbenind.). Manufacture of organic compounds. (278,777.)

17,070 (1926). Carpmael (I.-G. Farbenind.). Manufacture of 4-hydroxy-3-acetaminoaryl-1-arsonic acids. (278,789.)

17,684 (1926). Dicker (Verein f. Chem. Ind.). Production of derivatives of organic amido- or imido-compounds. (255,468.)

10,743 (1927). Raschig. Production of chlorthymol (1-methyl-3-oxy-4-isopropyl-6-chlorbenzene). (270,283.)

10,852 (1927). Chem. Fabr. vorm. Sandoz. Preparation of gall acids. (269,925.)

12,811 (1927). Dicker (Verein f. Chem. Ind.). Production of santalol derivatives. (278,982.)

14,935 (1927). Hoffmann-La Roche & Co. Manufacture of 1-3-dioxy-4-carboxy-6-phenylalkyl-benzene. (272,232.)

*26,323 (1927). Consort. f. Elektrochem. Ind. Manufacture of acetic anhydride. (279,070.)

*27,330 (1927). Daudt. Producing tetra-ethyl lead. (279,106.)

*27,510 (1927). I.-G. Farbenind. Manufacture of solutions of the active principle of the ovary or like glands. (279,123.)

*27,683 (1927). I.-G. Farbenind. Manufacture of water-soluble dinitroarylamino-diarylamines. (279,133.)

*27,686 (1927). I.-G. Farbenind. Manufacture of aromatic mercaptans. (279,136.)

XXI.—Application

I.-G. Farbenind. Photographic developer. 27,509. Oct. 17. (Ger., 19,11,26.)

XXI.—Complete Specifications

15,968 (1927). Devienne. Toning and fixing of photographic prints. (272,925.)

*21,598 (1927). I.-G. Farbenind. Production of photographic films. (279,033.)

XXII.—Applications

Hercules Powder Co. Treating nitrocellulose. 27,940. Oct. 20. (U.S., 1,7,27.) Nitrate carbohydrate solutions. 27,941—2. Oct. 20. U.S., 8,7,27.)

I.-G. Farbenind., and Jenkins. Nitrocellulose compositions. 27,691. Oct. 18.

XXIII.—Applications

Franke. Separating tarry substances from water. 27,817. Oct. 19. (Ger., 21,10,26.)

I.-G. Farbenind. Manufacture of disinfecting etc. preparations. 27,546. Oct. 17.

Selden Co. Base-exchange bodies. 27,828. Oct. 19. (U.S., 19,10,26.)

XXIII.—Complete Specifications

*17,960 (1927). Rosenheim. Production of base-exchanging substances. (279,028.)

*27,050 (1927). Krause. Sterilising water etc. (279,085.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Australia*: Air compressors (343). *Belgium*: Cold storage refrigerating and sterilisation plant, hydraulic plant (349). *Brazil*: Sugar machinery (362). Black and galvanised sheets, non-ferrous metals, caustic soda, soda ash, industrial chemicals, linseed oil, paint and varnish (363). *British India*: Pharmaceutical products, patent medicines (344); Glass bottles, metallic capsules, collapsible lead tubes, sprinkler corks (345); Paper, glycerin for manufacture of nitro-glycerin, unsensitised, glazed photo paper for ferro-prussiate photography (Director-General, India Store Department, Branch

No. 10, Belvedere Road, Lambeth, S.E.1). *Syria*: Rubber goloshes (360).

The I.C.I. at the Public Works, Roads and Transport Exhibition

Imperial Chemical Industries, Ltd., is showing at this Exhibition on Stand No. 20, Main Hall, various products of its constituent companies, including:—Silicate of soda P. 84 specially prepared for hardening and water-proofing concrete; a block showing the remarkable hardening effect of silicate of soda on concrete; silicate of soda for silicate macadam roads; blocks prepared from silicate of soda and limestone only, showing resemblance to concrete; and special grade silicate of soda for prevention of plumbo solvency and iron corrosion of drinking water mains.

Other exhibits include soda ash and hydrated lime for water softening and the treatment of industrial waters, and samples of limestone of various sizes suitable for all purposes, such as concrete making, paths, etc. Chlorox, a disinfectant, steriliser and cleanser, is shown together with liquid chlorine; a demonstration showing the application of chlorine to water supplies will be given. There are Melanoid bituminous paints in various grades to suit the requirements of every industry; commercial explosives and accessories to meet all public works requirements; complete plants and accessories for electric welding, and electrodes suitable for all types of metals; Thermit welding for tramways, etc.; and pure metals and alloys, carbon free.

Crawshaw's chemical colander, the new apparatus designed for the removal of grease from all metals and mechanical parts will be demonstrated on application; this apparatus is also being shown at the International Commercial Motor Transport Exhibition at the Olympia. Artificial leather cloth, all types of gas mantles, and storm lanterns are also amongst the many products shown by Imperial Chemical Industries, whose stand will well repay a visit.

News from Advertisements

Chief chemist, also assistant chemists with knowledge of artificial silk viscose process required (p. vi).

An engineer assistant is required by the Director of the Chemical Research Laboratory, Teddington, Middlesex (p. vi).

The University of London announces particulars of the forthcoming Gow Lectures on the Colloid Chemistry of the Rubber Industry, which will be given by Dr. E. A. Hauser, of Frankfurt-on-Main (p. vi).

The Appointments Board of the Imperial College of Science and Technology announces particulars of the facilities it offers (p. vi).

Chemist, B.Sc., requires post (p. vi).

There are now 126 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

COAL IN GREAT BRITAIN. By W. Gibson, D.Sc., F.R.S. Revised and enlarged edition. Pp. viii + 334. London: Edward Arnold & Co., 1927. 21s.

DISPERSOIDOLOGICAL INVESTIGATIONS, XVII. By Prof. P. P. von Weimarn and Collaborators. Vol. VIII, No. 6. Reports of the Imperial Industrial Research Institute, Department of Commerce and Industry. Pp. 55. Osaka, Japan: Imperial Industrial Research Institute, June, 1927.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

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EDITORIAL

Formaldehyde and So On

WE spent a very pleasant evening over the first publication on Chemistry Research issued by the new branch of the Department of Scientific and Industrial Research. It was a leisure evening, and we have few of these, and so we did not hurry and did not feel ashamed to wander a little off the beaten track. The Chemistry Research Board put us in a good humour at once by writing "the Board thinks"; we confess that we are tired of hearing from so many Government Departments that the Board think, or publish, or issue, or some other equally ungrammatical statement. Our pleasure took the form of considering what duty we owe the Board, and we find we are requested to state that this first report, on the Production of Formaldehyde by Oxidation of Hydrocarbons, can be obtained from H.M. Stationery Office in many cities and towns in the Empire, and in Helsingfors, Berlin and Tokyo, at the price of one shilling and nine pence. An editor of a chemical journal ought to know something about so common a substance as formaldehyde; we therefore spent half an hour looking up the few books we possess at home which give any account of it. We were referred to its discovery by Hofmann, in 1868, and to its connexion with photosynthesis and to the experiments of Ingenhousz, of Baly, Heilbron, and others. Having come to the conclusion that we could now write a few notes about this substance without committing such an error as to describe it as a colourless liquid, or a weak acid, we turned again to the Report. Formaldehyde we judge to be one of those simple organic compounds destined to play an important part in chemical manufacture: it is not particularly stable, and its activity makes it useful in an immense number of actions. Methanol, or methyl alcohol, may be synthetically prepared at low cost: we understand that sodium formate may be prepared, also very cheaply, by treating caustic soda with carbon monoxide. The Chemical Research Board has attempted to make cheap formaldehyde, or else a cheap aqueous solution of it, by the oxidation of the simpler hydrocarbons present in many commercial gases. The price of formaldehyde was £130 a ton during the war, and this was subsequently reduced to about £40 a ton, but even this is excessive. Some day, we suppose, a method will be invented for making it at a cost of five or ten pounds a ton. It will then be available as a cheap germicide or disinfectant: the statement in the Report that "the disinfecting action of formaldehyde is irreversible, germs being rendered permanently innocuous," is, we think, true. But is not the statement equally true of the action of the gallows and many other germicides besides formaldehyde? The Report shows that the particular methods attempted were not successful;

nevertheless there are many other methods which will, perhaps, be more amenable to reason. While we were groping about for a phrase to put in lieu of the too well-known one about the fish in the sea, we remembered, rather vaguely, a passage in a favourite poem describing how the Cyclops fell in love with the nymph Galatea, and how she disappointed him. Well, for once we had a little leisure, so we fetched down our Theocritus and read the whole idyll through and found it very good indeed. We should like to quote many lines of it here, but it really has not much to do with formaldehyde. Then we remembered that at the Cannizzaro centenary last year we and a few others visited the very spot where the Cyclops saw the fair Galatea swimming about in the Mediterranean, and we turned up the Alembic Club reprint of Cannizzaro's paper of 1858, and then we remembered how delightful it was to see Syracuse and the fountain of Arethusa and we read how Divine Alpheus, "by secret sluice, stole underseas to meet his Arethuse." The same poet alludes again to the fountain Arethuse, and "thou honour'd flood, smooth-sliding Mincius, crown'd with vocal reeds." The result was that, having for once in a long while a little leisure, we spent a very pleasant evening reading about Syracuse and Hiero and Theron and Pindar, and we read an Olympian Ode or two, with some difficulty and the assistance of a translation, and had a real good time. And here we offer our thanks to Sir Richard Threlfall and Dr. F. E. Smith and Sir Robert Robertson and Prof. J. E. Thorpe and the Directors of Artillery and Research and all others. May they produce many other reports, and when these appear, may we have a vacant evening, a clear fire, and a clean hearth! We will forget the smoke, the wealth, the roar of London, and the bustling street, for still by the Sicilian shore, the murmur of the Muse is sweet! We have had a very delightful holiday; to-morrow we must think about X-rays and Canada, and indulge in no more erring from the path.

A Pound and a Half of Coal

We were once privileged to examine some rather valuable early nineteenth century cartoons and we still remember vividly the ludicrous expression depicted upon the faces of a group of London citizens apparently in the penultimate stage of suffocation, engendered by the noisome products of combustion of coal gas, applied for the first time for street lighting. If the cartoon presents but a slightly exaggerated historical fact we imagine that a Prof. Cobb would have had great difficulty in persuading the citizens of London, Manchester or Leeds that an increase in the amount of coal-carbonised was a forward step. In some ways we are more enlightened to-day, and Prof. Cobb finds that we readily turn with him and

gaze into the smokeless atmospheres of the future. But as we write in comfort before a fire of smokeless coal glowing with evident satisfaction in its radiating efficiency we realise that it will be a long time before the burning of raw coal in one place or another will be a thing of the distressing past, and it is therefore satisfactory to note that raw coal is daily being made to give more and more of its potential energy with the production of less smoke.

A large proportion of the raw coal used to-day is burned under steam boilers in factories or electrical power-generating stations. The lessons which are being learnt in the latter installations may well be applied in the former, where frequently the efficiency of coal utilisation is woefully low. The progress which is being made in steam raising in power-generating stations may be exemplified by the single fact that, in two decades, the amount of coal used for the generation of one kilowatt-hour unit of electricity has fallen from ten pounds to two pounds. In some of the larger central stations it is confidently expected that it will soon be possible to generate a unit of electricity for every pound and a half of coal consumed in the boiler installation. Thus it is that we are supplied with electrical power to-day at almost pre-war costs—and occasionally even lower than pre-war costs—in spite of the fact that labour, plant and fuel charges have risen considerably in the interim.

The high efficiencies which are attained in central station steam-raising installations follow an intensive study of the problems of coal burning, heat conservation and plant design. Steam boilers of high rating are fired with pulverised coal burning in a combustion chamber constructed with water-cooled walls. Radiation from the setting is cut down to a minimum and large amounts of heat formerly passing away with the combustion gases to the stack are used for pre-heating the air on its way to the combustion zone. The tendency to produce steam at very high pressures is growing, and with it comes a better utilisation of the steam in the turbine, whilst frequently it is possible to make use of the spent low-pressure steam for heating purposes. Stoker-fired furnaces are being brought up to efficiencies which compare favourably with those shown in plant fired with pulverised coal, but, unless we are making a fundamental mistake, the latter type of installation appears to possess an economic advantage in that very low grades of coal—and therefore very cheap coal—may be used without sensible diminution in efficiency.

The value of cheaper electrical power demands no elaborate discussion, but there is another matter which the progress in power generation is able to teach the chemical industry. It is possible to burn coal under steam boilers and obtain amounts of steam half as much again as compared with the average return in chemical works. To reproduce the favourable conditions of power stations within chemical works and to raise the efficiency of steam-raising from 60% to 90% is probably impracticable, all things considered, but a great improvement is indeed possible. Complete, rapid combustion, effective control by means of registering instruments and thorough heat conservation are all possible as a result of the activities of the fuel engineer who is eager to keep within his ken the smaller installation as well as the large central power generating station.

"IN CANADA WITH THE EMPIRE MINING AND METALLURGICAL CONGRESS"

By A DELEGATE FROM GREAT BRITAIN

(Continued)

From Hamilton the Congress passed on to Niagara Falls for an evening visit to this great wonder of nature, afterwards going underneath the Falls through the Scenic Tunnel. The aluminium works on the American side, though of metallurgical interest, are decidedly not an addition to the scenic attractions of the district. From Niagara Falls we proceeded by night to Port Colborne, on Lake Erie, where the Welland Canal débouches on its way across country to Lake Ontario. Here parties visited the great grain elevator, the flour mill of the Maple Leaf Milling Company (the largest in the British Empire), the blast-furnace of the Canadian Furnace Company, and the refinery of the International Nickel Company. The capacity of the Furnace plant is about 125,000 tons of pig-iron per annum.

The nickel plant refines Bessemerised copper-nickel matte produced at Copper Cliff, in the Sudbury district of Northern Ontario. The Port Colborne refinery is equipped with four blast-furnaces, with a capacity of 100,000 tons per annum for treating mattes, five converter stands with a capacity of 15,000 tons of copper per annum, eleven roasting furnaces, one Dwight-Lloyd sintering machine, and one anode furnace. Stack gases are treated in a Cottrell electric separator for the recovery of valuable fumes. The electrolytic copper refinery has a capacity of 6000 tons annually. The nickel refinery formerly used the Orford process, being equipped with four refining furnaces, and having an annual capacity of 24,000 tons. A new electrolytic nickel refinery, capacity 6000 tons, has recently been installed which provides also for the recovery of the precious metals present in the mattes. In addition to refined copper and nickel, there is a small production of nickel oxide and sulphate.

From Port Colborne we returned to Toronto, spending Saturday afternoon and evening at the Canadian National Exhibition, an annual fair held in grounds very much larger than those of Wembley, with a frontage on Lake Ontario, where a remarkable accumulation of automobiles from all over North America may be seen during the ten days the Exhibition is open. We saw quite a creditable exhibit from Great Britain, but the importance of this Exhibition in Canadian business is such that a very much larger representation of British manufacturers is to be desired in the interests of British trade with Canada.

After a quiet Sunday at Toronto, morning found the party at Sudbury, where we entrained for Copper Cliff to inspect the Creighton mine of the International Nickel Company, afterwards proceeding to the Inco smelter, from which the matte is despatched for refining to Port Colborne. During the afternoon of the same day we visited the smelter and acid plant of the Mond Nickel Company, the latter plant having been installed to collect and utilise the sulphur fumes. Since our visit, I understand, the Mond Company has lost its Worthington mine, the buildings and a large section of the railway track having subsided many hundreds of feet into the earth. This Company and the International together can take solace in the fact that the Frood mine, in which both have

interests, is reckoned to contain at a depth of 2300 ft. some 100,000,000 tons of ore, or sufficient to supply the world demand at the present rate for 75 years.

The treatment of the ore at the Inco smelter includes roasting, smelting in blast or reverberatory furnaces, and the enrichment of the furnace matte by blowing in basic converters. A portion of the ore is roasted in wedge roasting furnaces and charged to reverberatory furnaces, but most of it is roasted in the open-air in large heaps of 5000 tons of ore each, others loaded by steam shovels into railway cars *en route* to the smelting plant. Here, mixed with a certain proportion of unroasted ore, coke and flux, it is charged into blast furnaces, from which it issues in the form of slag, and a matte carrying 25 to 27% combined copper and nickel. The reverberatory charge also consists of both roasted and green ore and, in addition, flue dust. It yields a matte of about 16% in copper and nickel. Matte from both blast and reverberatory furnaces is charged molten, with quartz and mine rock as flux, into large, magnesite-lined Pierce-Smith converters. In these it is blown until the matte contains 79 or 80% copper-nickel and only 0.3 to 0.5% iron, the balance being sulphur.

At Coniston, the Mond Nickel Company, instead of heap-roasting the ore from its mines, sinters it on Dwight-Lloyd straight-line sintering machines, from which it is taken to blast furnaces, the resulting furnace matte being blown to high-grade converter matte in large Pierce-Smith basic converters. The blast furnaces handle raw ore, sintered ore, metal-bearing scrap, limestone and coke, each having a capacity of 400 to 500 tons of ore a day. The matte from the furnace runs into a settler to separate it from the slag, whence it is tapped into ladles of about 10 tons capacity, poured into the converters, each holding about 40 tons. Fine raw ore is also charged to the converters. Air blown through the molten mass oxidises the sulphur, which passes off as SO_2 into the acid plant. The iron, combining with the silica of silicious copper ores added as flux, goes off as a slag. The resulting converter matte, containing some 41% nickel and an equal amount of copper, 17% sulphur, and less than 1% of iron, is ladled into moulds to solidify, and thence shipped to Wales for refining.

The sulphuric acid plant, established in 1925, is capable of producing 25,000 tons of acid a year, and saves the Company many thousands of dollars in litigation with "fume farmers." Power for both mines, concentrators and smelters in the Sudbury district comes from hydro electric developments in the neighbourhood.

The next day was devoted to an examination of the silver mines and concentrating plants in the Cobalt-South Lorrain district, where the ores are of a complex character, containing not only silver, but also cobalt, arsenic, nickel, and some copper and bismuth. Ninety-seven per cent. of the silver occurs native. At the mills in the vicinity of Cobalt we saw the extraction of the metal by cyanidation, which has largely replaced the gravity washing process. Oil flotation is employed to treat very low-grade material, usually the tailings from other processes carrying from 3 to 5 ounces of silver to the ton. Residues are sent to the Deloro Smelting & Refining Company's plant at Deloro, Ont.

At the Kirkland Lake goldfield, visited the next day, we viewed underground workings at 2475 ft., and the

milling, oil flotation and cyanidation processes at the surface, proceeding after lunch to Timmins, the hub of the Porcupine district, to see on the following day the great Hollinger mine, which is straining every nerve to secure distinction as the world's greatest gold mine.

In the Kirkland Lake mills the practice is "all-sliming" cyanidation, followed by precipitation with zinc dust. The presence of tellurides in the ores has occasioned the introduction in one mill of a flotation machine into the ordinary cyanide circuit after the tube mills and classifiers. By means of this the tellurides are cut out of the pulp as a flotation concentrate, which is then treated with bromine and turned back into the circuit at the agitators. At one mine sodium peroxide is added to the pulp at the agitators for the same purpose. In the Porcupine mills the ores yield readily to cyanide treatment, and this, with supplementary amalgamation on two mines, is the general practice. The "all-sliming" method is adopted here also.

On the afternoon of the visit to the Porcupine gold field we who were booked for Tour "A," westward from Cochrane, bid farewell to the "Green" train conveying delegates taking Tour "B" eastward to the Rouyn coppermining district, to the Saguenay power and aluminium developments, and to the Sydney, Cape Breton, coal and steel industries, and thence to Newfoundland to visit the Bell Island iron ore mines. The "Blue" and "Red" trains proceeded westward at night to Hudson and Minaki, where some of our number embarked on flying boats for a trip to the gold mines and hydro-electric power station in Central Manitoba, joining us the next day at Winnipeg none the worse for their experience. The Central Manitoba Mines, Ltd., whose properties were visited by this party, are, it is understood, installing a mill for the cyanide treatment of the ore of the Kitchener mine, with a crushing capacity of 300 tons per day; the cyaniding plant will be able to deal with 150 tons daily. Power will be transmitted a distance of 43 miles from the Great Falls plant of the Manitoba Power Company, on the Winnipeg River, which has a total installation of 168,000 h.p., in six units of 28,000 h.p. each, four of which are now in operation, and supplying for the most part the City of Winnipeg and its immediate vicinity.

We spent, in the City of Winnipeg, two very interesting days, and on Monday, September 5, found ourselves breakfasting at Estevan, Saskatchewan, in the southern part of the province, 12 miles from the United States frontier. Here visits were paid to several of the lignite mines, in which operations are being carried on at comparatively shallow depth. The district is underlain by no less than 9,000,000,000 tons of coal, the principal defect of which is its extreme friability, making summer transport difficult. The Governments of Canada, with Manitoba and Saskatchewan, have together spent about \$1,000,000 in efforts to find a commercially practicable method of carbonising and briquetting this coal, but the plant which we visited in the course of the day has been abandoned for some time past. While we were there it was announced briefly that the plant had been disposed of to English capitalists, together with the Western Dominion colliery, and that a new process was to be tried out there.

(To be continued)

PLANT FOR THE DRYING OF COSSETTES IN THE DE VECCHIS PROCESS OF BEET SUGAR MANUFACTURE*

By G. W. RILEY, M.I.Chem.E.

It is proposed to deal with the pre-drying of the beet cossettes in some detail, as this forms such an important feature of the De Vecchis process.

George Scott & Son (London) Ltd.—becoming acquainted with the White Paper and learning of some of the difficulties experienced, approached Dr. De Vecchis early

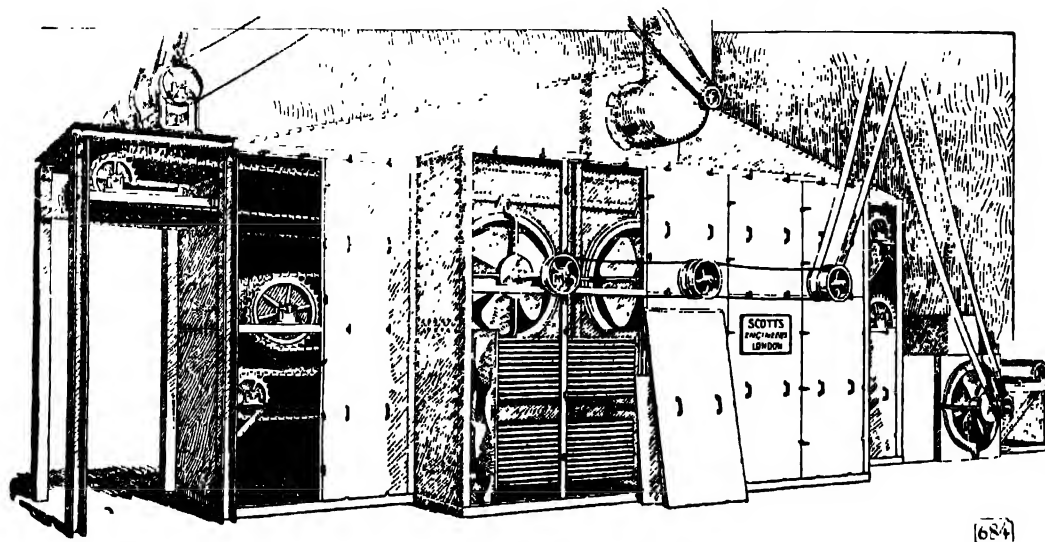


FIG. 1

A description of one of the earlier designs of dryer used at Loreo will be found in the White Paper, Cmd. 2343 (1925), and it is generally known that considerable

difficulty arose in the working of this and the other types of dryers used in Italian factories. In 1926 with a view to putting forward a design based on their standard hand dryer. This design is shown in the perspective line illustration (Fig. 1 and photo-

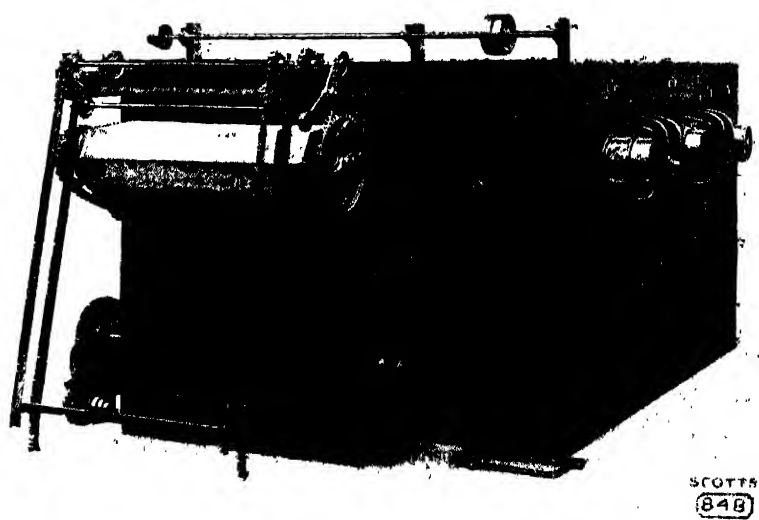


FIG. 2

difficulty arose in the working of this and the other types of dryers used in Italian factories.

The firm with which one of the authors is concerned—

graphic reproduction (Fig. 2). These dryers are usually made steam-heated, but the general mechanical details and the method of re-circulation were considered to be specially applicable to the present problem.

Designs were accordingly prepared for a fire-heated

* Paper read at a joint meeting of the Chemical Engineering Group of the Glasgow Section at Glasgow on October 19, 1927.

dryer to deal with 70 tons of washed and sliced beet per 24 hrs., working with the limiting temperatures specified by Dr. De Vecchis and providing the coagulating conditions desired. This was erected and put to work at Sanguinetto for the 1926 campaign. Before describing the machine it is proposed to deal briefly with certain principles underlying the design of this type of dryer.

The removal of the moisture from the wet material is achieved by passing air through some form of heater and then through the dryer chamber, where the air parts

should also be approximately the same for all efficient types of dryers working under similar conditions as regards capacities, internal temperatures, etc., and making use of reasonably efficient methods of minimising radiation losses. The heat required to evaporate a given amount of water does not vary greatly with the temperature, while the heat in the dried material as discharged from the dryer is a constant factor when care is taken to ensure that the temperature of the dried product is brought to a constant figure. This last condition is a necessary corollary of the coagulating con-

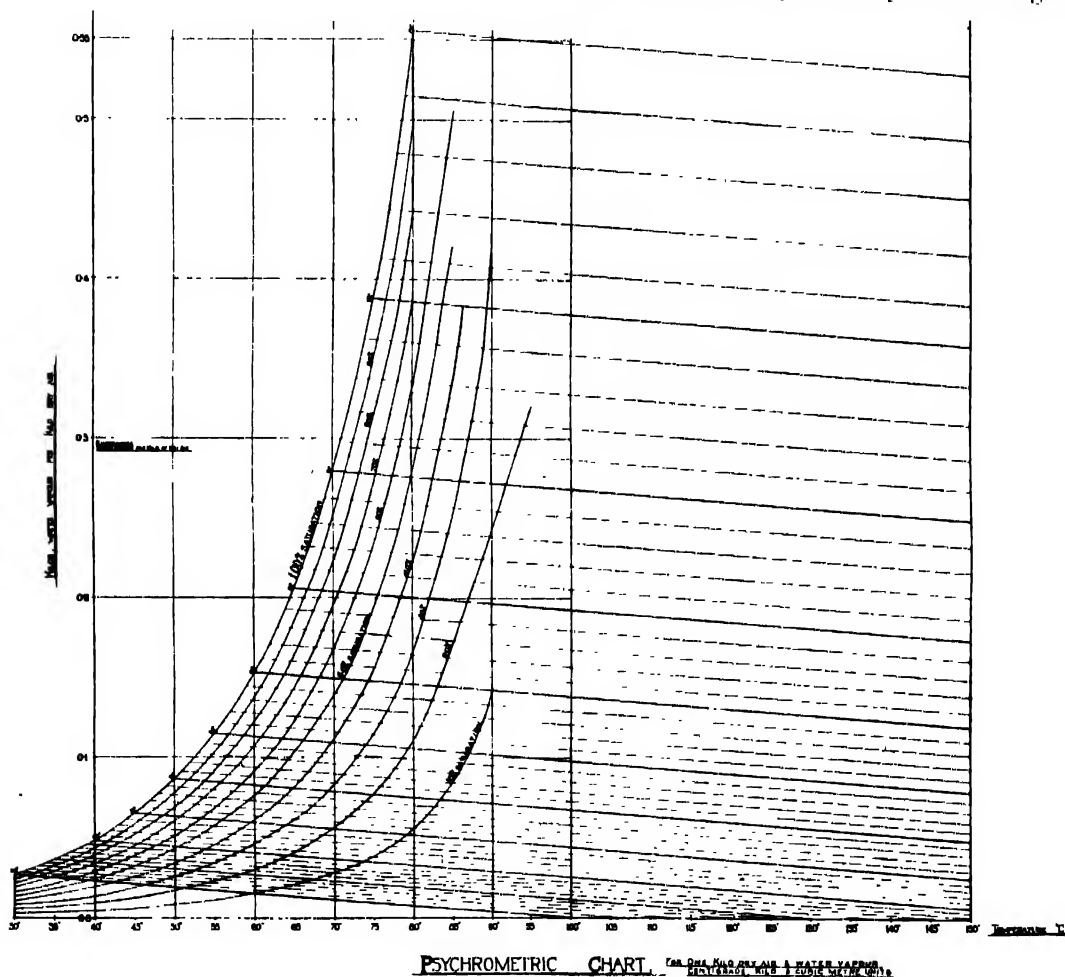


FIG. 3

with some of its heat to the wet material, heating it and evaporating the moisture. Where it is permissible to pass the products of combustion through the dryer it is obviously more economical in fuel consumption compared with steam-heated plant, as all the boiler losses are eliminated. There is also a distinct advantage over indirect heating, as for practical reasons it is impossible completely to transfer all the heat in the furnace gases to the air or gas used in drying. Under good average conditions there should be little loss of heat by incomplete combustion in the furnaces, and the loss should be approximately the same for most types of furnaces in common use. The loss of heat by radiation

conditions specified by Dr. De Vecchis. The only other direction in which some of the original heat supplied is carried from the machine is in the air accompanying the water vapour discharged from the dryer. It is, therefore, convenient to consider the proportions of heat carried away in the water vapour and the discharged air when examining the thermal efficiency of any particular type of dryer using air or gas as a heat-carrying medium.

In this case it was considered desirable to limit the maximum temperature of the air or gas coming into contact with the wet beet to 100°–105° C., in order to obviate caramelisation or inversion of the sugar

content of the beet, and it is interesting to consider how best to obtain the highest heat efficiency under this limiting condition. Two alternatives are possible with fire-heated dryers in which the products of combustion pass through the drying chamber; the first, to dilute the furnace gases with atmospheric air—to give the limiting temperature—passing the mixture through the dryer chamber, and the second, to re-circulate the air through the chamber, expelling part as nearly saturated as possible at each circuit and re-heating the remainder to the limiting temperature by admixture of hot furnace gases before returning same to the drying chamber.

in connexion with this problem, as most psychrometric charts are concerned with lower temperatures than were contemplated in this case. The chart deals with unit weight of dry air and the weights of water vapour required to saturate or partly saturate it at the various temperatures. The abscissæ represent temperatures and the ordinates represent weights of water vapour. The 100% saturation line represents the weight of water vapour required to saturate unit weight of dry air, and the 90%, 80%, etc. curves represent percentage saturations at varying temperatures, the percentage saturation for the purpose of the chart being defined as the ratio

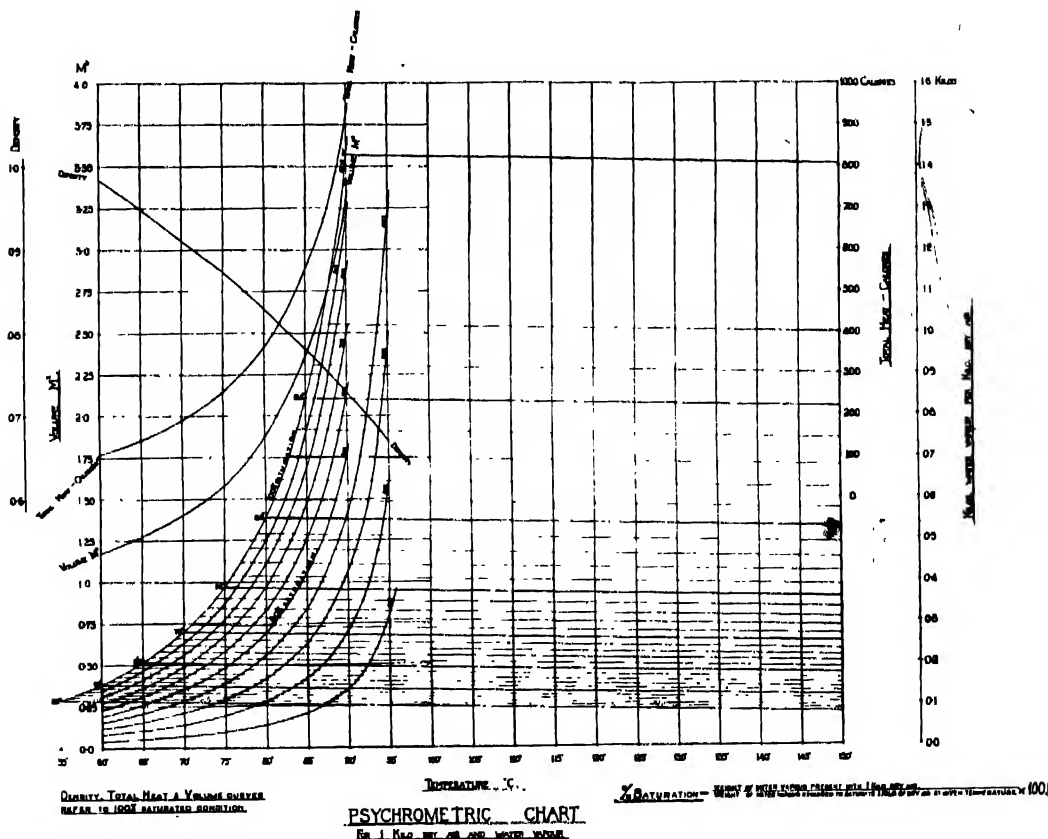


FIG. 4

ADVANTAGES OF RE-CIRCULATION

With the first alternative it is desirable to transfer as much heat as possible from the hot dry air to the water, but it is not possible to reduce the temperature of the resulting air-water vapour mixture below the saturation temperature. Actually it is not practical to reach this temperature, as intimate and prolonged contact would be necessary to arrive at this state of equilibrium. The psychrometric chart (Fig. 3) gives the weights of water vapour required to saturate unit weight of dry air at different temperatures and the weights of water vapour required to give various percentage saturations.

The psychrometric chart is extremely useful in studying these air dryer problems. Fig. 3 was especially prepared

of the weight of water vapour present per unit weight of dry air to the weight of water vapour required to saturate unit weight of dry air at the given temperature. Relative humidities are, of course, usually calculated on a unit volume basis, but this is not so convenient for the study of drying problems as percentage saturation. The nearly horizontal lines sloping down to the right are lines of constant heat or adiabatic lines. Fig. 4 shows another psychrometric chart drawn to a smaller scale, and which indicates the density, volume and total heat values in centigrade, kilogram, cubic metre units for saturated mixtures containing 1 kilogram of dry air. It will be observed from Fig. 3 that unit weight (kilo or pound) of *dry air* at an initial temperature of approximately 100° C., when brought into intimate contact

with water (at 15° C.) for a sufficient period of time, would become fully saturated at 30° C., the weight of water vapour being 0.027 units. It could also be 50% saturated at 39.5° C., the weight of water vapour being 0.0235 units.

From the psychrometric chart it will be noted that the weight of water vapour increases more rapidly than the heat content of the air portion of the mixture. The combined effect of these two factors is that the higher the temperature of the exhaust gases the greater the thermal efficiency of the drying. This is also true for other percentage saturations.

representing temperatures of air-water vapour mixture discharged from a dryer and give the results obtainable under our conditions with re-circulation of air through the dryer. In addition to the heat per unit weight evaporated and thermal efficiency, they show the heat required to evaporate water at given vapour discharge temperatures from water at 15° C. when no air or gas is present. It will be noted that this curve is almost a horizontal straight line. A study of these curves demonstrates clearly the advantage of a high temperature in the air-water vapour mixture, together with a high percentage of saturation.

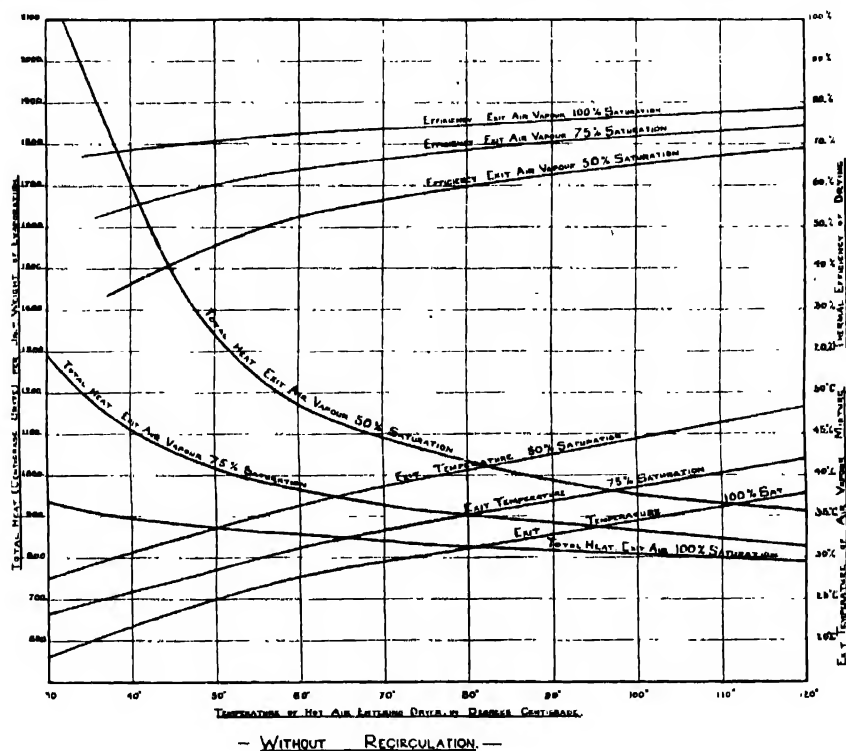


FIG. 5

Drying by hot air

Figs. 5 and 5A.—Assumptions: Air enters heater saturated at 15° C.

Wet material enters dryer at 15° C.

Quantities of heat plotted per unit. Weight evaporation from wet material.

Percentage saturation of air-water vapour mixture — $\frac{\text{Weight water vapour mixed with unit weight dry air}}{\text{Weight water vapour required to saturate at same temperature}}$

If A = Heat in water vapour evaporated per unit weight evaporated above water at 15° C.

If B = Heat added to atmospheric air (saturated 15° C.) to evaporated unit weight of water.

Thermal efficiency = $\frac{A}{B} \times 100$; radiation and other losses neglected.

This is more clearly shown by a study of the curves in Figs. 5 and 5A. These all apply to the evaporation of unit weight of moisture starting with atmospheric air fully saturated at 15° C. and water also initially at 15° C. The curves in Fig. 5 are plotted with the abscissæ representing the temperature of the hot air entering the drying chamber, and correspond with the first alternative. They give the heat required per unit weight evaporated for 100%, 75%, and 50% saturated exhausts, the corresponding temperatures of the exhaust mixture and the thermal efficiency of drying as defined on the diagram. The curves in Fig. 5A on p. 1040 are all plotted with the abscissæ

Applying this data to the Sanguinetto dryer with a maximum air temperature of 100° C.

Without re-circulation

100% saturated exhaust gives exit temperature 34.5° C., heat required per unit weight evaporation	802 centigrade units.
75% saturated exhaust, exit temperature 39.5° C., heat required	800 centigrade units.
50% saturated exhaust, exit temperature 44.5° C., heat required	855 centigrade units.

With re-circulation, and with exit temperature 75° C.

100% saturated exhaust, heat required per unit weight evaporated	667 centigrade units.
75% saturated exhaust, heat required per unit weight evaporated	680 centigrade units.
50% saturated exhaust, heat required per unit weight evaporated	705 centigrade units.

To obtain a corresponding heat efficiency with a non-re-circulating dryer it would be necessary to have an initial temperature of 1100° C. in the air admitted to the dryer chamber with a 100% saturated exhaust at 75° C. or 800° C. and 530° C. with 75% and 50% saturated exhausts respectively.

TWO-COMPARTMENT DRYERS

The considerations set out above deal with a single compartment dryer, but will be correct for a two-compartment dryer so long as there is only one exit for the air-water vapour mixture. When re-circulating it is neces-

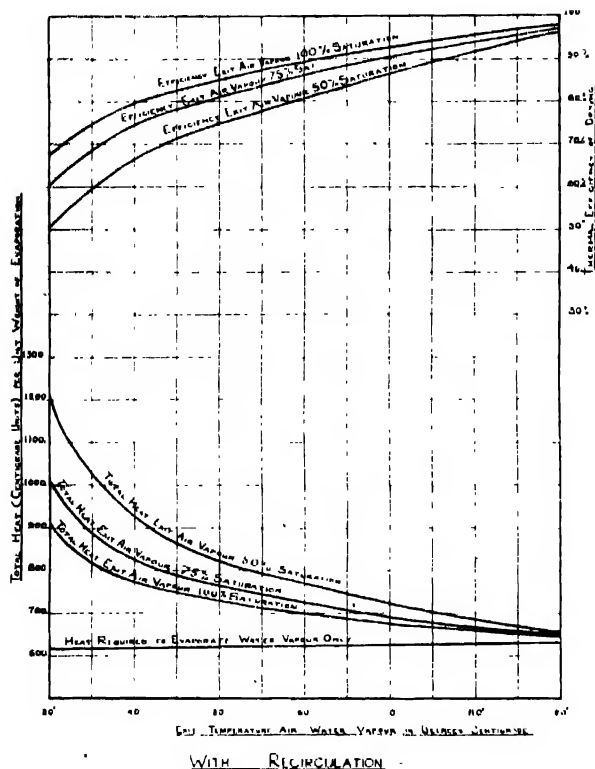


FIG. 5A
Drying by hot air

sary for a considerable amount of water vapour to be re-circulated with the atmospheric air, and this water vapour acts as a heat carrier equally with the air. By making suitable arrangements, it is possible to divide the drying chamber into two compartments with re-circulating and air-withdrawal arrangements in each, designed to maintain in circulation through one of the compartments an exceedingly dry atmosphere, exhausting this into the second dryer compartment circuit, the exhaust from the complete machine being from the second compartment. Differing maximum temperature conditions can also be maintained in each compartment if necessary. This is particularly convenient in the present case, as it is necessary to obtain a very dry product and to maintain the dry material for a specific period at a somewhat lower temperature than the maximum permissible in the other compartments where the greater part of the drying takes place. It is also an advantage

in other cases, since for a large number of materials it is necessary to control and maintain a lower temperature more carefully in the circulating air in contact with the nearly-dried material than is permissible with the moist material. Further, the last stages of drying are very frequently the most difficult, and a very dry atmosphere is of particular advantage.

How these differing conditions were provided for will be clear from a study of one of the flow diagrams shown in Fig. 6. These flow diagrams were prepared when first considering details of the design, in order to arrive at the most favourable working conditions and the volumes, etc. of air which would have to be circulated under certain conditions to give the desired results, and will be dealt with later, but, in the meantime, the small proportionate weight of water vapour in the mixture circulating in the lower drying chamber as compared with the mixture circulating in the upper chamber will be noted.

FUEL REQUIREMENTS

When estimating the fuel consumption per 100 tons of washed beet, an original moisture content of 77% and a final moisture content of 2% were assumed. This gives an evaporation of 76.53 tons and 23.47 tons as the weight of the dried cossettes. Assuming also a 50% air-water vapour mixture discharged from the dryer, a saturated external atmosphere of 15° C., a temperature of 15° C. in the wet beet, and the specific heat of dry beet 0.5, the heat required per 100 tons of wet beet is arrived at as follows:

Weight of water vapour required to saturate unit weight of dry air at 75° C.	0.3877 units
Weight of water per unit weight of air to give 60% saturation	0.3877 $\times \frac{40}{100}$ or 0.2322 units.
Weight of water to saturate unit weight of air at 15° C.	0.01047
Increase in moisture content unit weight air entering dryer saturated at 15° C. and leaving 60% saturated at 75° C.	0.2322 - 0.01047 units 0.2215 units.
Weight of dry air required to evaporate 76.53 tons water	$\frac{76.53}{0.2215}$ or 344.5 tons
Weight of water vapour entering dryer with air	$344.5 \times 0.01047 = 3.607$ tons.

For 100 tons wet beet

Heat required to evaporate water only	76.53×620.4 , or 48168 C. ton units.
Heat required to heat the dry air to exhaust temperature	$344.5 \times (75 - 15)$ > 0.2375 , or 4900
Heat required to heat up water vapour in the air	$3.607 \times (75 - 15)$ > 0.48 , or 104
Heat added to dry matter in beet	$23 \times (90 - 15) \times 0.5$ 862.5
Heat added to water in dried beet	$0.47 \times (90 - 15) = 135.3$

Total	51078.8
Allowing 10% heat loss on total used for radiation losses, incomplete combustion, unconsumed ash, etc.	0008.7
	00087.5

Or, say, 8 tons of fuel having a calorific value of 7500 centigrade pound units, or 13,500 B.Th.U. and a total heat consumption per ton of washed beet of 600 centigrade ton units, or 1,344,000 centigrade pound units, or 2,419,200 B.Th.U. This corresponds with 9.56 pounds of evaporation per pound of coal.

It will be of interest to compare this estimate of fuel consumption with results recently obtained at Sangi-netto. This season it was decided to use oil fuel, and with this it is particularly easy to measure fuel consumptions. The early results of complete day runs gave

fuel consumptions varying from 4.9 tons of fuel oil to 6 tons per 100 tons of washed beet, the oil having a heating value of 10,500 calories (18,900 B.Th.U.). This corresponds with 6.86 to 8.4 tons of 7500 calories (13,500 B.Th.U.) fuel per 100 tons. With more experience the operators will undoubtedly reduce the fuel consumption regularly to the lower figure, or do

give completely satisfactory results. Last season at Sanguinetto coke and "Rubbli Kuhl" breeze were used, giving quite good results as regards fuel economy and good quality cosettes. The Italian furnaces used were not well suited for this small fuel, but even so, fuel consumptions of 8 tons and less per 100 tons of washed beet were obtained over complete day runs.

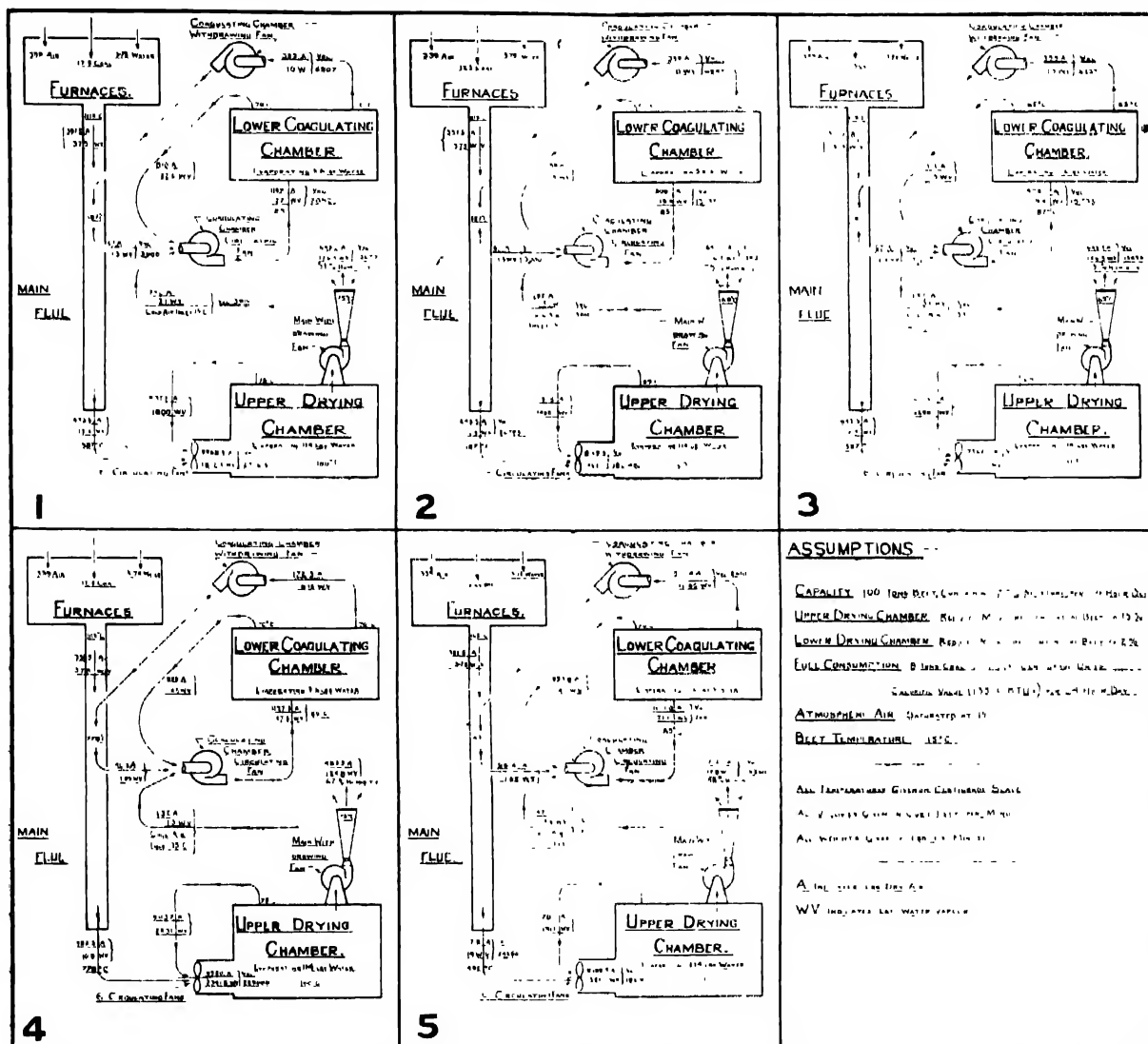


Fig. 6

Air circulation diagrams

even better. There is no reason why equivalent results should not be obtainable with solid fuel. Italy, of course, has to import all its fuel, and oil therefore is in rather a favoured position, but in this country solid fuel would give cheaper running costs.

Bearing in mind that a high CO_2 content in the furnace gases is not necessary with these dryers, it should be possible to make certain of complete combustion, and it is considered possible that cheap bituminous coal, with or without coke smalls or small anthracite fuel, would

HEAT AND AIR FLOW

To arrive at the most desirable conditions as to volumes of air circulated etc. a number of flow diagrams (some of which are shown in Fig. 6) were prepared. These diagrams also illustrate the flow of furnace gases through the machine. The wet beet first enters the upper drying chamber, passing through this on travelling bands before being discharged into the lower drying and coagulating chamber, but for convenience the upper drying chamber is shown below the coagulating chamber, whereas in

actual practice it comes above. The hot furnace gases travel through the main flue extending the full length of the dryer. The drying air is circulated through the lower drying chambers and its flues by the centrifugal fan indicated. A supply of hot furnace gases and atmospheric air continuously mix with the circulating air, and a portion of the circulating air (after passing through the partially dried cossettes entering this chamber) is withdrawn through the coagulating chamber by the fan and delivered back into the main flue, thus reducing the temperature of the flue gases.

The circulation through the upper drying chamber is maintained by a series of large propeller fans coupled together and arranged along the full length of the drying chamber. The furnace gases enter the circuit through regulated openings in the main flue and restore the temperature of the drying gases to the predetermined maximum just before these gases come into contact with the beet. A portion of the more saturated air is withdrawn by the main withdrawing fan from the circuit after

of all the conditions led the engineers to expect an average temperature drop of approximately 30° C. Again, it is not possible to obtain a fully saturated air discharge without unduly increasing the time of contact of air mixture and cossettes, thus making the equipment excessively large. A temperature of approximately 70° C. and a percentage saturation of approximately 60% were accordingly legislated for, and means provided to vary slightly the position over the top band through which the exhaust gases were discharged from the plant. In this connexion it will be of interest to record that tests recently made of the temperature in the beet leaving the top chamber gave a reading of 76° C.

1926 DRYER

Seventy tons per 24 hrs was decided upon as the maximum safe duty for a single unit dryer in the first place, the principal deciding factors being the weight and strength of the drying band chains and the length of machine necessary to provide circulating area for the



FIG. 6A

passing through a selected area of the top travelling band, on which rests the wettest beet, and is discharged from the machine.

Temperatures are indicated at different points of the circuit and weights of dry air and moisture in circulation, together with volumes at certain critical points. The very large volumes of air-water vapour mixture that have to be circulated will be noted, and it is interesting to compare the volumes with those provided for in the Loreo dryer described in the White Paper. In that case, for 5 tons of wet beet per hour a circulation of 18,000 cb. ft. per min. was provided, against from 163,000 to 240,000 cb. ft. per min. called for in the hypothetical cases set out in the diagram for 4-16 ton of beet per hour. Actually in the 100-ton "Scott" machine provision was made for the circulation of larger volumes than are indicated in the diagrams.

It will be clear that the actual amounts circulated depend upon the average temperature drop of the air mixture in each circuit, and that this temperature drop would vary along the machine. A careful consideration

air etc. This equipment was designed and the parts shipped last year despite the interference of the General Strike. As a result of that strike, however, it was not found possible to experiment with the drying of beet with air of the temperatures and humidities contemplated, although a small stationary dryer was made for the purpose. It was not, therefore, possible to confirm or check some of the assumptions made.

This machine was provided with three endless drying bands in the top chamber and two endless bands in the bottom or coagulating chamber, and was heated by means of five hand-fired furnaces working under balanced draught burning small coke and "Rubbli Kulm." This mixed fuel had a high dust content. The hand-fired furnaces were provided by the Italian factory, and the type was decided upon by the customers as likely to provide the most satisfactory commercial results in view of the comparatively low cost of Italian labour.

Provision was made for 15 different periods of drying, the total times for drying and coagulating varying from 2 to 3½ hrs.

(To be continued)

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, is now ready.

The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

SUSPENSION OF ENTRANCE FEE

The Council has decided to continue the suspension of the Entrance Fee during the year 1928.

ABSTRACTS IN APPLIED CHEMISTRY

It has been arranged to supply members of the Society with reprints of the Abstracts of Applied Chemistry, printed on one side of the paper only, at the price of £1 for the year 1928.

Applications for these, accompanied by the appropriate remittance, should reach the General Secretary before the end of the present year.

LONDON SECTION

The meeting on November 7 was devoted to a consideration of "Recent advances in the hydrogenation of oils."

In a "General introduction" Mr. E. R. Bolton reviewed briefly the early history of hydrogenation, and compared the older methods employing powder catalysts with a new continuous process using a fixed catalyst, which is regenerated repeatedly without loss, and which may therefore be described as constituting "part of the plant." Oil was hydrogenated in laboratory apparatus to demonstrate the principle of continuous hydrogenation by a fixed catalyst, and the construction and operation of commercial plant was illustrated by lantern slides. The advantages of the continuous hydrogenation process—such as the avoidance of the necessity for filtration of hydrogenated oil—were emphasised, and data given showing the ease of control of the degree of hydrogenation. The composition of oils hydrogenated by different processes was discussed, and it was shown how composition could be altered at will by varying the methods of operating the continuous process.

In the next paper "Selective hydrogenation" was discussed by Mr. K. A. Williams, B.Sc., who described a method by which the extent of the selective effect in the hydrogenation of oils may be measured. The method is applied to the hydrogenation of a number of oils under varying conditions. It was shown that the degree to which the reaction is selective is inversely proportional to the iodine value of the oil treated, and, for a particular oil, directly proportional to the temperature of reaction. With fatty acids the selective effect is directly proportional to the iodine value of the original material.

In a further paper, on the "Melting point of hydrogenated oils," Mr. Williams gave the results of measure-

ments of the melting points of cottonseed oil hydrogenated, under varying conditions, to different extents. A relation was deduced between the melting point of the hardened product, the temperature of hydrogenation, and the corresponding extent of selection in the reaction.

The "Hydrogenation of fatty acids and neutral oils" was dealt with by Mr. R. G. Pelly, F.I.C. On hydrogenating whale oil containing 12% of free fatty acids, it was found that the fatty acids were hydrogenated more fully than the natural oil. Further investigation of this point by the hydrogenation of neutral oils and fatty acids and of known mixtures by means of (a) activated nickel turnings, (b) nickel carbonate-kieselguhr catalyst, has shown that (1) the rate of hydrogenation of fatty acids alone is less than that of neutral oil alone; (2) when a mixture of fatty acids and neutral oil is hydrogenated, the rate of hydrogenation of neutral oil is greatly retarded and that of the fatty acids is increased, in some cases beyond the rate for neutral oil alone; (3) the rate of hydrogenation of neutral glycerides is retarded even by saturated fatty acids. The COOH group in the free fatty acid molecule appears to be the important factor in this problem, but further investigation is needed.

The last paper, on "The activity of a nickel catalyst," was by Mr. E. J. Lush, M.A. It was shown that, in the hydrogenation of naphthalene, tetralin is formed exclusively when the naphthalene is passed over the catalyst in the vapour phase. In the liquid phase decalin is formed, and curves were given showing the influence of temperature and pressure of the hydrogen on the amount of decalin formed. The total hydrogen absorbed under standard conditions of temperature and pressure is independent of the relative proportions of tetralin and decalin produced. This observation is similar to that made in the hydrogenation of mixtures of linolein and olein, and evidence is produced from the hydrogenation of acetone, naphthalene, and vegetable oils to show that the weight of hydrogen added for a given weight of catalyst under standard conditions is independent of the substance being hydrogenated.

MANCHESTER SECTION

A joint meeting of the Manchester Sections of the Society of Dyers and Colourists, the Society of Chemical Industry, the Institute of Chemistry, and the Manchester Literary and Philosophical Society was held on November 4. Dr. H. Levinstein, President of the Society of Dyers and Colourists, presided, and was received with most hearty expressions of good wishes for his complete recovery from his recent illness.

An address entitled "Some new principles in chemotherapy," by Prof. A. G. Green, F.R.S., and Myer Coplans, M.D., was read by Prof. Green. The authors stated that the chemotherapy of dyestuffs and allied synthetic organic substances, based largely upon the views of Ehrlich, had on the whole been disappointing, owing to the chemical alteration of the drug under the influence of living matter. Such progress as had been made in therapeutic research had been mainly empirical, since we were at present unable to predict what specific chemical groupings would give to a drug a preferential affinity for invading organisms rather than for the protective cells of the body.

The authors had examined the question whether it might not be possible to exert a controlled and selective action upon foreign organisms and their toxins by the administration of compounds (derivatives of dyestuffs in particular) which were themselves inactive and innocuous, but which could be converted in the body or particular parts of it into active agents.

Two classes of compounds which might fulfil these conditions had been examined. A.- Leuco compounds which could give rise to physiologically active dyestuffs upon oxidation. B.- Special dyestuffs (or leuco-dyes) containing "labile acidic" groups, such as the "sulphate" group— $\text{NH}\cdot\text{C}_6\text{H}_4\cdot\text{OSO}_3\text{H}$ —or the omega-sulphonic group— $\text{NH}\cdot\text{CH}_2\cdot\text{SO}_3\text{H}$. From the authors' investigations the following conclusions were derived.

1. Leuco-dyes of the triphenylmethane class had a much smaller toxicity and bactericidal activity than the corresponding dyestuffs. When administered to animals they were excreted both by the liver and kidney if acidic or by the liver alone if basic.

2. Leuco-dyes of the triphenylmethane class exhibited a very remarkable neutralising or detoxicating action upon toxins such as those of diphtheria, tetanus, and cobra venom. In the case of the first two a very definite quantitative relationship could be proved to exist which varied with the toxin and the leuco-dye. It was believed that further investigation of this action might afford a basis for the local treatment of diphtheria and tetanus.

3. Sulphate dyes and sulphate leuco-dyes had in the unaltered condition but little toxic action and little or no bactericidal power. When, however, those substances were administered to animals they were excreted both by the kidneys and liver, and rendered the urine and bile strongly antiseptic.

4. Rabbits which had been artificially infected with an active strain of *B. typhosus*, and had thus become "typhoid carriers," were completely sterilised by continued administration of sulphate compounds.

5. Experiments made with mice infected with *Trypanosoma equiperdum* indicated the possibility of employing omega-sulphonic acids of active substances for blood sterilisation.

The results obtained would seem to indicate the possibility of new methods of attack in the treatment of disease, in which substances having little or no toxicity or physiological activity in themselves might be administered with the object of gradually liberating in the system definite drugs having a destructive effect upon invading organisms.

The paper was followed by a prolonged discussion.

MONTREAL SECTION

The first meeting of the session was held at the Windsor Hotel on October 19, preceded by the usual dinner. The chairman, Dr. J. F. Snell, presided, and about 70 members and guests were present.

Prof. Clark S. Robinson, of the Massachusetts Institute of Technology, delivered a very interesting address on "The theory and practice of industrial distillation and filtration." Prof. Robinson showed how the art of distillation was perfected long before the theory was seriously studied, and how, even to-day, empiricism still holds sway. He then discussed the function of the

fractionating column, and showed the importance of the reflux ratio and its relation to the amount of heat required, and hence to the cost of operation. After touching on the methods in use for calculating the diameter of the column and the number of plates, Prof. Robinson described a new graphical method, developed within the last two years, of computing the number of plates required. He stressed the importance, in those cases which are complicated because of the number of substances to be separated, of reasoning by analogy from the effects obtained with binary mixtures, and showed how difficult problems may be simplified by this method. In conclusion, he made a number of generalisations applicable to all problems of distillation and fractionation.

A very keen discussion followed the lecture, in which Dr. H. Hubbert, Dr. G. S. Whitby, Dr. F. W. Skirrow, and Messrs. J. A. Wales, J. N. Stephenson, H. Wyatt Johnston, and others took part.

OTTAWA SECTION

The opening meeting of the session was held at the University Club. Dr. F. T. Shutt presided, and was supported by a large gathering.

Mr. R. D. Whitmore, the secretary, read a paper, "The Society of Chemical Industry in Ottawa: An historical note." The Canadian Section of the S.C.I. was established in 1902 through the efforts of members of the Society in Toronto, Montreal and Ottawa. Most of the meetings in the earlier days were held in Toronto and Montreal, though the first Ottawa meeting was in 1904, at which papers were read and the aims of the Canadian Section were explained. However, at that time there was not a large number of chemists in Ottawa, and the formation of a branch in the capital was deferred until 1917. It acted through the Canadian Section until re-organised less than three years later as an independent Section. It is now one of the strongest and most vigorous of the Sections in Canada, and from the first has continued to be successful in promoting the welfare of both the full and the associate members, in providing a common meeting ground for chemists of the capital, and it also claims credit for further activities of a wider and more national character.

The chairman, Dr. Shutt, delivered his inaugural address, "A chemical study of a new system of grass land management for increased protein production." Some 27 years previously, with Dr. Fletcher, he had shown that young grasses had a higher nitrogen (protein) content than the more mature plants. Grasses, particularly as hay, are regarded as "low protein concentrates" so that if consumed when young they are much more valuable as food. In Germany, during the war, this knowledge was used in experimental work at Hohenheim by close grazing some 70 acres a small plot at a time. It was found that in three successive years they had reduced the pasture area per cow to one third of what had previously been necessary. Later, and more elaborate experiments were successfully made in Britain. In the experiments conducted at the Experimental Farm, Ottawa, a pasture which was growing meadow fox-tail was divided into four equal plots and A was cut weekly, B every 2 weeks, C at 3-week intervals, and D as hay

(before it seeded out) and subsequently the aftermath was cut. The cuts were weighed and analysed and the results tabulated in four charts. The charts showed that (1) the total weight of dry matter rose from A to D; (2) A had consistently the highest protein content (about 22%); (3) that the average protein content was from high to low in the order A, B, C, D, and that the reverse was true for the fibre content, and (4) that C showed the highest total weight of digestible matter, and that A, B, and C were all higher than D in digestible protein as calculated from the digestion coefficients established at Cambridge in some similar work. The great difference between the work recounted and that of the German and English trials was that whereas the two latter had heavily fertilised the land, no manuring was done in this work. The work is proceeding and other factors will be introduced.

SOUTH WALES SECTION

A meeting was held jointly with the local Section of the Institute of Chemistry at Thomas's Café, Swansea, on October 24, when a paper on "Hormones" was read by Mr. D. H. Hey, B.Sc. The chair was occupied by Mr. C. M. W. Grieb.

The lecturer described the better-known ductless glands, and their uses in the body, special attention being paid to the suprarenal, thyroid and pituitary. The hormones secreted by these bodies were dealt with, and their functions described. It was pointed out that they not only act as activating agents, but that some have important inhibiting effects, and the feminising of male organisms was explained in this connexion. The far-reaching effects of abnormalities in the functioning of the ductless glands were cited, and slides were shown dealing with cretinism, goitre, myxædema, acromegaly, gigantism, etc. Slides were also shown to illustrate sections of the thyroid gland in man and other animals, both in the normal and abnormal conditions. Cases were cited of experimental work on the removal of glands and on subsequent grafting: also on the injection and oral administration of gland extracts. The chemical nature of the few hormones of known constitution was dealt with, and the synthesis of thyroxine by Dr. Harrington was described. An account was given of recent work on insulin, and it was stated that as yet we could not claim to have isolated as a pure chemical entity the active constituent associated with the physiological activities of insulin. The rôle of sulphur and of nickel and cobalt in insulin preparations was discussed. A brief summary of the immense possibilities of further work in this field was given, and the paper concluded with a general reference to the ideal attitude of scientific research to life. It was pointed out that there was just a possibility that one day in our thirst for knowledge we might find ourselves possessing powers which we have no wish to possess, but that if we can direct our progress along such lines as will lead to a better understanding of life, to the alleviation of human suffering, and perhaps to a control over those unhealthy conditions of mind which lead to crime and immorality, humanity would be the richer.

An interesting discussion followed, in which Prof. Coates, Dr. A. G. Ramsay, Dr. MacNair, Mr. Ayling, and the Chairman took part.

CALENDAR OF FORTHCOMING EVENTS

Nov. 14.—**University of London, University College, Gower Street, W.C.1, at 5.15 p.m.** The Gow Lectures on "The colloid chemistry of the rubber industry," by Dr. E. A. Hauser. Prof. F. G. Donnan, C.B.E., will preside. (Also on November 16 and 18.)

Nov. 14.—**Institute of Metals, Scottish Local Section, Rooms of the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, at 7.30 p.m.** "Brass foundry practice," by A. Logan.

Nov. 14.—**Institute of Brewing, London Section, Charing Cross Hotel, Strand, W.C.2, at 7.45 p.m.** "Modern malt kilns," by Dr. A. Fernbach.

Nov. 14.—**Royal Society of Arts, John Street, Adelphi, W.C.2, at 8 p.m.** *Cantor Lecture 1.* "Alloy steels: their manufacture, properties and uses," by Prof. H. C. H. Carpenter. (Also on November 21 and 28.)

Nov. 14.—**Ceramic Society, North Staffordshire Technical College, Stoke-on-Trent, at 7.30 p.m.** "Electrical pottery firing—some notes on the Moore and Campbell electric enamel tunnel kiln," by B. J. Moore and A. J. Campbell. "Utilisation of waste heat for steam raising," by Dr. G. Martin.

Nov. 15.—**Armourers and Brasiers Company, Royal School of Mines, South Kensington, S.W., at 5.15 p.m.** "X-rays and metals," by G. Shearer. (Also on November 22.)

Nov. 15.—**Hull Chemical and Engineering Society, Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m.** "The ramifications of the oil industry," Part II. "Plant," by T. Andrews.

Nov. 16.—**Institute of Chemistry, London and South-Eastern Counties Section. Annual General Meeting, 30, Russell Square, W.C.1, at 8 p.m.**

Nov. 17.—**Institute of Metals, Birmingham Local Section, Engineers' Club, Waterloo Street, Birmingham, at 7 p.m.** Open discussion on "Annealing." (Arranged by the Co-ordinating Committee.)

Nov. 17.—**Society of Chemical Industry and Institute of Chemistry, Edinburgh and East of Scotland Sections, The Pharmaceutical Hall, 36, York Place, Edinburgh, at 7.15 p.m.** "Chemical formulae of long ago," by Prof. R. M. Caven.

Nov. 17 and 18.—**Society of Chemical Industry, Liverpool Section. Committee of Associated Learned Societies of Liverpool and District has arranged for exhibitions of scientific and educational films in the large hall of the David Lewis Club, Great George Street, Liverpool, at 7.30 p.m.**

Nov. 17.—**Institution of Mining and Metallurgy, General Meeting.**

Nov. 17.—**Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m.** *Ordinary Scientific Meeting.* (1) "Differential potentiometric titration. Part I. Simple method. Part II. Refined method," by B. Cavanagh. (2) "A general method for the preparation of carbocyanine dyes," by Miss F. M. Hamer.

Nov. 18.—**Society of Chemical Industry, Chemical Engineering Group, Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m.** "Some modern methods of recovery of lubricating oils," by A. J. Broughall.

Nov. 24.—**Society of Chemical Industry, Birmingham and Midland Section, The Chamber of Commerce Buildings, Birmingham.** "Notes on the chemistry and physics of stone decay," by A. R. Warnes.

INSTITUTION OF CHEMICAL

Below is a list of those present at the Annual Reception held at the New Prince's Galleries on November 2, supplementary to the list published in the issue for November 4:—The Lord Shaw of Dunfermline and the Hon. Mrs. Vaughan Thompson, the Lady Lockyer, the Lady Phyllis Allan, Mr. Alistair and Lady Diana Gibb, Mr. J. Arthur Reavell (Vice-President of the Institution), Mr. W. A. S. Calder (Vice-President of the Institution) and Mrs. Calder, Mr. E. H. Rogers (Honorary Treasurer) and Mrs. Rogers, Mr. and Mrs. H. J. Pooley, Mr. and Mrs. R. T. Campbell Finlayson, Mr. and Mrs. S. G. M. Ure, Mr. and Mrs. James MacGregor, Mr. and Mrs. William Macnab, Mr. and Mrs. P. Parrish, Dr. and Mrs. E. W. Smith, Mr. and Mrs. H. Talbot, Mr. R. G. Browning, Mr. and Mrs. J. H. Aiken, Mr. and Mrs. A. Allen, Mr. T. H. Bailey, Mr. Arthur Baker, Dr. J. H. Bankes, Mr. and Mrs. C. Barber, Mr. H. E. C. Bennett, Mr. and Mrs. W. H. Bennett, Mrs. Church Bliss, Mr. and Mrs. R. R. Byrne, Mr. and Mrs. E. P. Carter, Mr. and Mrs. A. Chaston Chapman, Mr. W. H. Coleman, Dr. H. G. Colman, Mr. F. C. Cooke, Lieut.-Col. F. A. Cortez-Leigh and Mrs. Cortez-Leigh, Mr. H. W. Cremer, Col. R. E. Crompton, Mr. P. B. Crossley, Prof. C. R. Darling, Dr. and Mrs. F. B. Dehn, Prof. and Mrs. S. M. Dixon, Mr. and Mrs. A. A. Drummond, Dr. A. E. Dunstan, Mr. R. Edgeworth-Johnstone, Mr. Edgar C. Evans, Mr. and Mrs. E. V. Evans, Dr. Margaret Fishenden, Mr. G. H. Ford, Prof. and Mrs. A. Fowler, Mr. and Mrs. P. C. Gardiner, Mr. and Mrs. W. J. Gee, Mr. and Mrs. W. D. Graddon, Mr. George Gray, Mr. and Mrs. H. E. J. Green, Mr. W. C. Hancock, Mr. F. W. Harbord, Mr. T. Shirley Hawkins, Mr. and Mrs. W. Hawkyard, Mr. Noel Heaton, Dr. H. S. Hele-Shaw, Dr. T. A. Henry, Mr. A. F. Hogg (Principal, Woolwich Polytechnic), Prof. B. W. Holman, Mr. and Mrs. A. V. Hussey, Mr. and Mrs. D. N. Jackman, Dr. and Mrs. L. A. Jordan, Mr. and Mrs. J. Kewley, Mr. Clifford A. King, Dr. J. G. King, Mr. and Mrs. C. A. Klein, Prof. H. Klugh, Dr. L. H. Lampitt, Dr. and Mrs. C. H. Lander, Mr. and Mrs. L. A. Legros, Dr. and Mrs. R. Lessing, Mr. J. Macleod, Mr. and Mrs. R. M. Macnaught, Dr. E. W. Maddison, Mr. and Mrs. R. J. Marx, Dr. P. May, Prof. and Mrs. W. H. Merrett, Dr. and Mrs. S. Miall, Mr. and Mrs. T. Miller-Jones, Mr. and Mrs. J. E. Montgomery, Dr. and Mrs. G. T. Moody, Dr. Burrows Moore, Mr. W. M. Mordey, Mr. E. W. Moss, Mr. and Mrs. A. E. Munby, Mr. F. H. Newman, Dr. D. M. Newitt, Prof. and Mrs. W. L. Odell, Lieut.-Col. W. A. J. O'Meara, Dr. and Mrs. W. R. Ormandy, Prof. and Mrs. S. G. Paine, Mr. and Mrs. R. G. Parker, Mr. George Patchin (Principal, Sir John Cass Technical Institute), Rear-Adml. and Mrs. A. D. Pound, Mr. and Mrs. L. Guy Radcliffe, Mr. and Mrs. William Reavell, Mr. and Mrs. G. A. Renton, Mr. H. T. F. Rhodes, Prof. K. Rice-Oxley, Mr. D. E. Roberts, Mr. J. F. Ronca, Dr. and Mrs. W. Rosenhain, Mr. and Mrs. C. E. Sage, Prof. and Mrs. S. B. Schryver, Prof. F. M. Simpson, Mr. and Mrs. F. S. Sinnatt, Dr. S. Skinner, Mr. and Mrs. J. F. Smellie, Mr. and Mrs. C. C. Smith, Mr. H. C. Smith, Mr. C. P.

Sparks, Mr. H. M. Spiers, Mr. L. Summer, Mr. and Mrs. F. Colin Sutton, Mr. W. A. Tait, Mr. J. Terrace, Dr. F. B. Thole, Prof. and Mrs. J. F. Thorpe, Mr. H. B. Toy, Dr. and Mrs. F. R. Tunks, Prof. T. Turner, Mr. W. G. Turner, Mr. A. J. V. Underwood, Mr. S. E. Watts, Mr. and Mrs. J. C. White, Mr. J. A. Wickham, Mr. Basil Wilson, Mr. M. F. G. Wilson, Dr. C. R. Young.

Recent Elections

Members

Carr, Francis H., C.B.E., F.I.C., Chief Technical Director, British Drug Houses, Ltd.
 Hatfield, W. H., D.Met., F.Inst.P., M.I.Mech.E., Director of the Brown-Firth Research Laboratories.
 Hazeldon, J. N., B.Sc., A.I.C., Chief Technologist, Coal Oil Extraction, Ltd.
 Heastie, B., A.M.Inst.C.E., Chief Technical Engineer, Kestner Evaporator & Engineering Co., Ltd.
 Holman, B. W., A.R.S.M., Assistant Professor of Mining, Royal School of Mines.
 Meredith, D. O., General Superintendent, Electrolytic Zinc Co. of Australasia, Ltd.
 Murphy, R. K., Chem.E., Dr. Ing., Lecturer-in-Charge of Chemistry and Head of Science Department, Sydney Technical College.
 Myers, E. M., General Manager, By-Products, Coke Oven Works & Washeries, Bolckow Vaughan & Co., Ltd.
 Roy, H. L., A.B., D.Eng., Professor of Chemical Engineering, Bengal Technical Institute.

Associate-Members

Graddon, W. D., B.Sc., Technical Managing Director, Vitalite Co., Ltd.
 Hussey, A. V., O.B.E., A.C.G.I., A.I.C., Works Manager, Lafarge Aluminous Cement Co., Ltd.
 Reid, A. T., B.Eng., Research Engineer, Hardie Rubber Works and Asbestos Slab & Sheet Manufacturing Co., Sydney.
 Stokes, A. H. J., A.M.I.Mech.E., Managing Director, Trade Grinding, Ltd.
 Taylor, C. B., B.Sc., A.R.C.Sc., A.I.C.
 Thyne, C. A. MacIntosh, Technical Assistant, Provan Gas Works, Glasgow.

Graduates

Deanesly, R. M., B.Sc., Shell Co., California.
 Rowden, E., B.Sc. (Hons.), A.R.C.Sc., D.I.C., Assistant with John Brown & Co., Ltd., Sheffield.
 Venkajee, T., B.A., Chemist and Works Supervisor, Carnatic Paper Mills, Rajahmundry.

Student

Klein, E., Student at the University of the Witwatersrand.

CHEMICAL SOCIETY

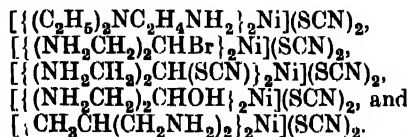
At a meeting held on November 3, Sir J. J. Thomson, O.M., F.R.S., was unanimously elected an Honorary Fellow. The President, Prof. H. B. Baker, C.B.E., F.R.S., announced that Professors C. S. Gibson, J. T. Hewitt, G. T. Morgan, and J. F. Thorpe had been reappointed to represent the Society on the Bureau of Chemical Abstracts, and that Professors A. J. Allmand and F. G. Donnan and Dr. T. Slater Price would represent the Society on the Editorial Board of the Journal of Physical Chemistry, together with Dr. E. K. Rideal, appointed by the Faraday Society. It was also announced that Prof. W. A. Bone's lecture on "Gaseous combustion at high pressures" would be delivered at the Society's

rooms on November 24, at 8 p.m., and that applications for grants from the Research Fund must be made on or before December 1.

Dr. F. G. Mann described :—

The complex salts of nickel with various aliphatic diamines.

ATTEMPTS have been made to obtain more decisive evidence for the configuration of the tetrammino-nickelous complex by co-ordinating nickel with diamines, producing the compounds



If the nickel complex has the uniplanar configuration, all these salts should exhibit *cis-trans* isomerism; if the complex has the tetrahedral configuration, they should be resolvable into optically active forms. Actually, no trace of *cis-trans* isomerism could be detected, whilst all attempts to resolve the first, fourth, and fifth salts failed.

Although bivalent nickel can show a co-ordination number of 6 as well as 4, the metal could not be co-ordinated with three molecules of any of the diamines used, a result in favour of the uniplanar configuration for the 4-co-ordination complex.

It is probable that most bivalent metals, including platinum and palladium, can, on co-ordination, assume the uniplanar or the tetrahedral configuration, according to the nature of the co-ordinating groups.

Prof. G. T. Morgan agreed that the assumption by the molecule of a uniplanar or tetrahedral configuration might well depend on circumstances. It was possible that in the series, nitrogen \rightarrow antimony, the differing atomic volumes might constrain the associating units to arrange themselves differently. Prof. Morgan gave examples of the differences already observed, and remarked that some of the work on the platinum compounds was carried out more than 50 years ago; it was desirable that these early results should be re-examined.

Dr. F. Challenger discussed :—

The mechanism of the formation of citric and oxalic acids from sugars by Aspergillus Niger. [With T. K. Walker and V. Subramaniam.]

WHEN the mould is grown on potassium hydrogen saccharate solution, potassium citrate is formed. The importance of saccharic acid in the mycological production of citric acid is evidenced by its isolation in the form of its potassium hydrogen salt from cultures of *A. niger* on glucose. Calcium saccharate is produced when the mould is grown on solutions of calcium gluconate. This was to be expected since gluconic acid is known to be formed when *A. niger* is grown on glucose.

The formation of acetone in cultures of *A. niger* on citric acid (J. 1927, 200) was ascribed to the decarboxylation of acetonedicarboxylic acid, although proof of the presence of this acid was lacking; it has now been detected in ammonium citrate cultures.

Oxalic acid is produced by growth of the mould on ammonium acetonedicarboxylate. Acetic acid may readily be obtained from *A. niger* cultures on citric acid. Under similar conditions, glyoxylic and oxalic acids are

formed in *A. niger* cultures on solutions of calcium glycolate and ammonium glycolate respectively, thus affording further evidence that the change acetic \rightarrow oxalic acid proceeds as already suggested.

Dr. R. H. Pickard referred to the industrial importance of such studies, and expressed the hope that the kinetics of the various stages would eventually be worked out. The cotton industry was interested in retarding, and the leather industry in accelerating the reactions.

In reply to Prof. H. Bassett, Dr. T. K. Walker said that the mould grows vigorously over a wide p_H range; the acidity may appreciably influence the formation of intermediates, but no systematic study in this direction had yet been undertaken.

Dr. W. Wardlaw discussed :—

The complex cyanides of molybdenum. [With W. R. Bucknall.]

ABNORMALLY, molybdenum and tungsten in the complex cyanides $K_4Mo(CN)_8$ and $K_4W(CN)_8$ are converted by acid permanganate to the quinquevalent state only. The oxidation from the quadrivalent to the quinquevalent condition is now clearly shown by the isolation of the complex salts $R_2Mo(CN)_8$ from the fully oxidised solution of $K_4Mo(CN)_8$. The complex acid $H_3Mo(CN)_8 \cdot 3H_2O$ has also been prepared. From a consideration of the electronic theory of valency an explanation of this abnormal oxidation with acid permanganate is put forward. New salts $[Cu(NH_3)_3]Mo(CN)_8$, $[Cu(en)_2]_2Mo(CN)_8$ in which the copper exhibits co-ordination numbers of 3 and 4 have been prepared and a study of the so-called red and blue cyanides of quadrivalent molybdenum has been made. The action of concentrated nitric acid on $K_4Mo(CN)_8$ can be made to yield a complex acid $H[MoO_3(CN)_2 \cdot 2H_2O]$ in which molybdenum is quinquevalent. Further oxidation with acid destroys the complex salt.

Dr. S. Sugden read the following paper :—

The parachor and chemical constitution. Part VI. Some cases of supposed ring-chain tautomerism. [With F. B. Garner.]

THE parachor, because of its strictly additive character, is unable to distinguish between tautomers which differ only by the position of a double linking in the molecule. If, however, isomeric change causes the production of a ring instead of a double linking, the isomerides should possess different values for this constant.

The values of the parachors of quinone, toluquinone, succinyl chloride, the two forms of phthalyl chloride, benzil, and 2:2'-dimethoxybenzil indicate that these substances, with the exception of the higher melting isomeride of phthalyl chloride, all possess the normal structure and, in the liquid state, cannot contain more than a small amount of the isomeride in which a new ring is produced by isomeric change.

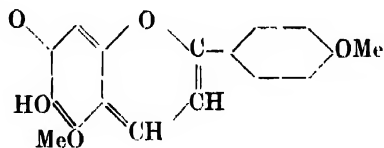
The parachors of the phthalyl chlorides indicate that the form m.p. 15° has the symmetrical structure, whilst the isomeride m.p. 88.5° has the unsymmetrical formula.

Prof. R. Robinson described :

The colouring matters of carajura. [With E. Chapman and A. G. Perkin.]

CARAJURA, a rare red pigment prepared from *Bignonia*

chica, contains peaty matter, wax, a coloured resin, silica, calcium oxalate and other salts of calcium, magnesium and potassium, and colouring matters, of which two have been isolated. The more important of these, *carajurin*, $C_{17}H_{14}O_5$, is the anhydro-base corresponding with a dihydroxydimethoxyflavylium salt. On boiling with hydriodic acid, it yields *carajuretin hydriodide*, $C_{15}H_{10}O_5 \cdot HI$ and from this *carajutin*, $C_{15}H_{10}O_5$, may be obtained in scarlet needles. *Carajuretin hydrochloride* is identified with the synthetically prepared *scutellareinidin chloride*, and is therefore 5:6:7:4'-tetrahydroxyflavylium chloride. The following formula is ascribed to *carajurin* :—



Carajurone, a second colouring matter of *carajura*, appears to be a *carajuretin monomethyl ether*. *Dibromocarajurin dibromide*, $C_{17}H_{12}O_5Br_4$, *dibromocarajurin*, and acetyl derivatives of the hydrated forms of *carajurin* and *carajuretin* have been prepared; *O-penta-acetyldihydrocarajuretinol* is of particular interest.

In an exploration of the ground for the syntheses of quercetaletin and gossypetin, ictol monomethyl ether is shown to be 2:5-dimethoxyresorcinol; the isomeric 4:5-dimethoxyresorcinol has been synthesised from veratrole. The method for the preparation of antiarol has been improved and *antiarolaldehyde* $(MeO)_3C_6H(OH) \cdot CHO$, obtained from it by the Gattermann synthesis. Condensation of *antiarolaldehyde* and *p*-acetylanisole in presence of hydrogen chloride gave 5:6:7:4'-tetramethoxyflavylium chloride, and from this *scutellareinidin chloride* was obtained by demethylation. A number of other flavylium salts, related to this series, have been prepared.

BIOCHEMICAL SOCIETY

A meeting was held in the National Institute for Medical Research on November 7, when the following papers were read :

"A cell-free dehydrogenase obtained from bacteria," by M. Stephenson. By autolysis in the presence of phosphate buffer pH 7.6, a preparation can be obtained from washed suspensions of *B. coli* which dehydrogenates lactic acid in the presence of methylene blue, forming pyruvic acid. This preparation is inactive towards other hydrogen donors hitherto tried, with the possible exception of α -hydroxybutyric acid. In the presence of lactate all Clark's reduction potential indicators are reduced. The enzyme does not transfer hydrogen to oxygen direct, no oxygen uptake and no production of pyruvate occurring in the system enzyme, lactate, air; in the presence of a small amount of methylene blue (1 in 30,000), however, an oxygen uptake occurs approximately equal to the change of the lactate to pyruvate. This oxygen uptake is unaffected by cyanide (M/1000). The intact cell differs from the enzyme preparation in its behaviour towards lactic acid in that it is able to reduce molecular oxygen directly, independently of an

extraneous hydrogen carrier, but this mechanism is inhibited by M/1000 cyanide.

In a paper on "The cause of Andrewes' diazo test for uræmia," G. A. Harrison showed that the substance in uræmic sera responsible for Andrewes' diazo reaction is an indoxyl compound, presumably potassium indoxyl sulphate (indican).

A. Harden and F. R. Henley contributed a paper entitled "The equation of alcoholic fermentation."

"Presence of histamine in tissue extracts," by W. V. Thorpe. Histamine (β -iminazolyethylamine) has been isolated in a state of chemical purity from an extract of fresh ox muscle under conditions which preclude its formation by autolysis or bacterial action. It was suggested that the depressor activity of muscle extracts prepared and tested under the given conditions was due entirely to histamine. No choline was detected. The distribution of depressor activity in extracts of various organs was discussed.

"Note on the induced fluorescence of ergosterol," by O. Rosenheim. A brilliant blue fluorescence is observed when ergosterol is exposed to a source of ultra-violet rays (mercury vapour lamp) from which the visible rays are screened off by "Wood's Glass" and a screen of bromine vapour. Eight specimens of different origin were examined, four of which had been prepared from ergot and the others from yeast. Under the same conditions pure cholesterol, freed from ergosterol by bromine, showed no fluorescence. The phenomenon stood in no relationship, however, to the formation of vitamin D from ergosterol by ultra-violet irradiation. It was found that under certain conditions non-fluorescent preparations of ergosterol could be obtained, which were rendered as highly anti-rachitic by irradiation as the fluorescent ones. Moreover, a specimen of cholesterol which could not be activated and was free from ergosterol, as shown by the spectroscopic test, possessed a strong blue fluorescence. This was traced to a previous treatment with charcoal (Norite), during recrystallisation from alcohol, and a similar treatment induced fluorescence in non-fluorescent ergosterol. Since the same result was also produced by repeatedly recrystallising non-fluorescent ergosterol from ordinary ether, kept in light and containing peroxides, the conclusion seemed justified that the fluorescence of sterols under the above conditions was due to the formation of traces of oxidation products.

"A few observations concerning phosphagen," by M. G. Eggleton and P. Eggleton. Only vertebrates appear to contain phosphagen in their muscles, and of these, muscles which are capable of rapid energy output are, generally speaking, in their resting condition richer in phosphagen than muscles intended for lower rates of energy expenditure. The rate of disappearance of phosphagen in a muscle resting under anaerobic conditions cannot be correlated directly to the rate of production of lactic acid. The phosphagen has diminished to an inappreciable concentration before the lactic acid production has reached a quarter of its final value. Breakdown of phosphagen in a muscle, whether the result of fatigue or heat rigour or the incubation of the minced muscle in $NaHCO_3$ buffer (with or without the addition of NaF), always results in the liberation of free creatine

in an amount roughly corresponding to the phosphagen which has disappeared. When phosphagen is initially present in a minced muscle which is being incubated in the presence of NaF, some conversion of inorganic into organic phosphate can sometimes be observed. But in muscles which contain initially no phosphagen (e.g., plain muscle) no such synthesis has so far been observed.

SOCIETY OF PUBLIC ANALYSTS

A meeting was held on Nov. 2 in the Institute of Pathology and Research, St. Mary's Hospital, at the invitation of that Institute, Mr. E. Richards Bolton, President, being in the chair. The following papers were read and discussed:

"The biological tests for blood," by Sir William Willcox, K.C.I.E., M.D. An outline was given of the evolution of blood tests, from the days when the only differential method available was based on differences in the form and size of the blood corpuscles, down to the refined serum tests of the present time. The author described his technique for examining blood stains, and illustrated his method of filtering the stain extract before applying the serum tests.

"The technique of the precipitin test and its forensic value," by G. Roche Lynch, O.B.E., M.B. After a summary of the theory of the formation of antigens in the blood of a living animal, and an account of the properties of anti-bodies, the author described the various methods of preparing anti-sera, the extraction of blood stains, the filtration and sterilisation of the extract by means of special apparatus, the methods of determining the concentration of the extract, and the various ways in which the precipitin test could be applied. The precautions required and the limitations of the test were discussed, and possible applications of the serum test in the examination of foods were given.

"The use of the blood grouping reactions in forensic investigations," by F. C. Martley, M.A., M.D. The theory and technique of blood agglutination tests were discussed and demonstrated, and the author showed how, by means of the four blood groups in which the blood of different individuals could be classed, it was often possible to distinguish between the blood of different persons. Various applications of the method in forensic work were pointed out.

SOCIETY OF GLASS TECHNOLOGY

The opening meeting for the session was held in Sheffield on October 19, the President, Mr. Walter Butterworth, senr., M.A., in the chair. Following an introductory address by the President, two papers were presented.

"Opal glass, crystal growth and impact brittleness," by J. F. Hyslop. The fluoride particles in an opal glass were globular if the viscosity of the glass was high. With low viscosity the particles assumed characteristic crystalline form. In an opal glass heated under the critical point found by Gehlhoff and Thomas, the logarithm of the particle size was directly proportional to the reciprocal of the absolute temperature. That is, the particle size, for equal times of heating under the critical point, was inversely proportional to the viscosity of the glass. Impact brittleness in opal glass was

associated with several factors. The chief cause of brittleness was the tendency of the glass to produce sharp angular crystals and these might be formed by: (a) the tendency of the matrix to precipitate silica. If the opal was susceptible to this secondary devitrification, a careful choice of working temperature was necessary if the absence of brittleness was desired. (b) the tendency of the glass to grow angular instead of globular fluoride particles. This happened in a glass of low viscosity and such a glass was brittle at low and high working temperatures.

"The detection of selenium in decolourised bottle glass," by E. J. C. Bowmaker, B.Sc., and J. D. Cauwood, M.Sc. The procedure consisted in treating 2 to 3 g. of glass in platinum with 15 to 20 c.c. of hydrofluoric acid and 2 c.c. of strong nitric acid, and evaporating to dryness at about 90° C. To the residue, 4 to 5 c.c. of strong nitric acid was added and the solution again evaporated to dryness. The residue was then dissolved with 5 c.c. of 1:1 nitric acid and a little water added to the solution; 10 c.c. of strong sulphuric acid was added and the whole evaporated until fuming for a few minutes. The solution was allowed to become quite cold, when a piece of codeine sulphate, about the size of a pin's head, was added and stirred until dissolved. The solution was then heated to the fuming point when a green coloration denoted the presence of selenium. Manganese and copper must be absent.

CORRESPONDENCE

"THERMS"

SIR,—Mr. Butterfield's comparison between gas and electricity (Transactions, p. 407) might be carried one step further by calculating the price of electricity per therm and also giving the costs of coal and oil on a therm basis, thus:—

Coal at 20s. per ton	is equivalent to	$\frac{3}{4}$ d. per therm.
Fuel oil at 4½d. per gallon	..	2¾d. per therm.
Town gas	..	7d. to 10d. per therm.
Electricity at 1d. per unit	..	29d. per therm.

The above costs are very suggestive, especially from the point of view of the "transport of therms." A transport system (land and water) is already in existence for the stuff which costs ¾d. per therm. Is it really worth while to build a costly system of overhead transmission lines for the stuff which costs 29d. per therm?

At the same time it is not quite fair to electricity to make the comparison on a therm basis, and it would be interesting to read an authoritative article on the cost of generating electricity in a medium-sized works where low-pressure steam from the generating plant could be utilised to the full for heating purposes. At the Edinburgh meeting one heard mention of costs of generation which made a penny a unit sound very expensive.

I remain, Sir, etc.,

R. H. ATKINSON

REGISTRATION AND THE TITLE "CHEMIST"

SIR,—The report of the Registration Committee of the British Association of Chemists has now been published in the "Chemical Practitioner," and it may be of interest shortly to discuss the reasons which have caused the

Committee to employ the term the "Register of Chemical Practitioners."

Besides not wishing to encroach upon any legal right possessed by the Pharmacists, the Council and Committee are, at least, doubtful, if it is in the best interests of the profession of Chemistry officially to employ the title "Chemist." Even in the minds of the best-instructed section of the public it has become associated with pharmacy, and to eradicate that impression, having regard to its traditional and legal associations, even if justified, will be exceedingly difficult. This does not necessarily mean, however, that the name, as a matter of courtesy, cannot be employed as heretofore. Strictly, no physician without a doctor's degree has any right to describe himself as a doctor, but custom freely permits the use of the title. If it were employed officially, however, a great deal of confusion would result. Without being exact, the analogy is sufficiently close for practical illustration, and the new *official* title suggested by the committee seems admirably suited to overcome a difficulty which has appeared to some a real obstacle to recognised legal status.

I am instructed to state that copies of the "Chemical Practitioner" containing the report can be obtained from the Registered Office of the Association, "Empire House," 175, Piccadilly, London, W.1. price 6d. post free.

We have noted with interest the correspondence appearing in your columns regarding the salary and conditions of chemists. If those who are interested in the economic situation of chemists will call by appointment at the offices of the Association, we shall be happy to supply them with evidence of the numerous cases in which the Association has been able successfully to deal with the question of salary and conditions. The Association cannot, however, except in special cases, act for those not included within its membership.

I am, Sir, etc.,

HY. T. F. RHODES.

General Secretary,
British Association of Chemists

PERSONAL AND OTHER ITEMS

The King has approved the following awards this year by the President and Council of the Royal Society:—A Royal Medal to Sir Thomas Lewis, F.R.S., for his researches upon the vascular system. A Royal Medal to Prof. J. C. McLennan, F.R.S., for his researches in spectroscopy and atomic physics.

The following awards have also been made by the President and Council: The Copley Medal to Sir Charles Sherrington, O.M., F.R.S., for his distinguished work on neurology. The Davy Medal to Prof. A. A. Noyes for his work in physical chemistry, especially on the subject of electrolytic solutions. The Buchanan Medal to Dr. Major Greenwood for his statistical researches and other work in relation to public health. The Hughes Medal to Mr. William D. Coolidge for his work on the X-rays and the development of highly efficient apparatus for their production.

The Harrison Medal was presented to Mr. Francis H. Carr, C.B.E., President of the Society of Chemical Industry, on the occasion of the Harrison Memorial Lecture at the Pharmaceutical Society on November 8.

Prof. W. A. Bone, D.Sc., F.R.S., will deliver a lecture entitled "Gaseous Combustion at High Pressures" at the Chemical Society, Burlington House, on Thursday, November 24, at 8 p.m.

Sir Josiah Stamp, G.B.E., has been appointed chairman of the London, Midland & Scottish Railway in succession to Sir Guy Granet. Sir Josiah Stamp is also a director of Imperial Chemical Industries, Ltd.

The Council of the British Association has decided to recommend the General Committee to apply for a Royal Charter, and to accept the offer by Mr. A. A. Campbell Swinton to bear the cost.

One man was killed and three injured owing to the fall of a dye vat, weighing about a ton, which was being hoisted into place at the Huddersfield works of the British Dyestuffs Corporation, Ltd., on November 5.

Representatives of the U.S. Tariff Commission are coming to Europe to investigate the cost of the British crushing process for the extraction of linseed oil, costs in the Belgian glass industry, etc., in relation to an inquiry into an increase of duties under the U.S. Tariff Law.

The death is announced of Sir William Galloway, whose pioneer investigations showed that coal dust in the air of mines was the cause of explosions, and that an explosion could raise further dust from the floors and walls of galleries and so spread the explosions to other parts of the mine. He advocated the use of stone dust as a means of preventing explosions as long ago as 1898.

The death is announced of M. Maurice Prudhomme, who discovered Alizarin Blue in 1877 and took out several patents for the application of aniline black.

The Empire as an Economic Unit

Sir Alfred Mond delivered an address on "An Empire Economic Unit," before the Empire Industries Association, on November 2. Sir Alfred Mond said that on the discovery of a solution of the problem of organising the British Empire as an economic unit, depended the prosperity of the masses in this country and the future existence of the Empire itself. A glance at the economic groupings to-day showed the United States a continent protected from the rest of the world by a tariff ring, yet having a free exchange of goods between New York and San Francisco, and, on the other hand, a Europe in which the idea of an economic union was making obvious headway. Was Great Britain prepared to enter the tariff fence of Europe and to become one of the factors of the European economic unit with all that it implied? Were we to remain suspended in isolation between two vast groups? He saw only one way out of this dilemma, and that was by creating an Imperial economic unit which would, in fact, be more powerful than either of the other two units. If that were done, the problems now pressing upon us would take on wholly different aspects. When we ceased to look on this country as a unit and brought in all the agricultural territories of the Empire, it would be realised that so far from there being industrial over-development, there was still room for vast industrial expansion within the Empire. He was sometimes told that Great Britain had nothing to bargain with in negotiating trade agreements, but as a plenipotentiary of the British

Empire, with all its raw materials and resources at his back, he would undertake not only to negotiate, but to dictate terms. In fact, inter-Imperial trade had become in recent years a more and more dominating factor in the trade position of this country, and it was for us to increase that trade to its utmost limits and to secure a more systematic development in conference with the Dominions as to what each different part of the Empire was to do. Industries created under existing tariffs could not be wiped out, but future consumption and growth could be allocated partly to one and partly to the other, and it was quite possible to form an Empire pool for the compensation of industries and workpeople suffering from the reduction of tariffs. Economic theories were tools, not masters, and should be applied in ways which would procure the best results.

A New Antiseptic

An account of a new antiseptic, marketed by the Mond Staffordshire Refining Co. under the name of "Monsol," was given at a luncheon at the Carlton Hotel on November 3. Sir Alfred Mond said the new antiseptic had been derived from the products obtained from coal tar. Sir Arthur Slogett, who was Director-General of the Army Medical Services in the war, described the medical tests of the antiseptic, and said that "Monsol" was non-poisonous and had extraordinary germicidal power; it could be applied to the skin, to the throat, it could be swallowed, and it could be injected; it was something new and quite unlike anything else, and it had strong medical testimony behind it. Mr. Henry Mond explained that only after extensive use in hospitals and in private medical practice had they felt justified in introducing "Monsol" to the public. He thought the antiseptic would be exceptionally useful in veterinary work.

New Biological Buildings at Birmingham University

The new buildings for the departments of biochemistry, botany and zoology of the University of Birmingham, formally opened on October 20 by the Prime Minister, Mr. Stanley Baldwin, form part of the original design of Sir Aston Webb, the University architect. Situated close to the chemical department, they have cost, with equipment, £120,000, and of this £40,000 has been given by Sir William Waters Butler, Bart., brewer, who is also a chemist. The biochemistry department occupies the greater part of the first floor. Each of the three departments has its own lecture rooms, and there is, in addition, a very large lecture theatre.

The British School of Malting and Brewing and Department of Biochemistry of Fermentation was opened in 1900 as a department of Mason College (the predecessor of the University), with the late Prof. Adrian Brown in charge. The high reputation of the Department for training and research built up by Prof. Brown has been maintained during the eight years which have elapsed since his death, under Prof. A. R. Ling. Many papers dealing principally with the carbohydrates and the chemistry of starch have been published. Reliable methods have been described for the estimation of starch in barley, wheat, and potatoes. Several papers have been published describing studies on the products of the hydrolysis of starch by enzymes, as a result of

which much light has been thrown on the nature and constitution of starch and of the products formed during the mashing process. In addition, researches have been conducted on glycogen, pectins, hemicelluloses, and on various other subjects. In addition to the fermentation industries, the Department also deals with agriculture and cognate industries; chemistry and bacteriology as applied to food and drugs; and water supply.

Desiccation of Sugar Beet and the Extraction of Sugar

The Ministry of Agriculture and Fisheries has issued a "Report on an Investigation into the Desiccation of Sugar Beet and the Extraction of Sugar-beet Effluents," by Dr. B. J. Owen (H.M. Stationery Office, 1927. Pp. 84. Price 2s. 6d.).

The report deals with the work on this important problem which has been in progress for some time at Oxford. It is shown that sugar-beet cossettes can be successfully dried if certain factors are taken into account. Caramelisation can be avoided if the drying temperature does not exceed 220° F., whilst drying must be rapid to prevent the formation of invert sugar; a suitable and economic time is 45 min. Two processes are described, one in which the beet is not moved during drying, and one in which the beet is treated in continuous or intermittent motion on a belt or movable trays, and hot air is passed through it at intervals to produce progressive desiccation.

Trials with both small and large-scale diffusion plant showed that juice up to 50° Brix could be obtained from dried cossettes, the juices being purer and more highly concentrated than those obtained from fresh beets. It is concluded: that no rupture of the cell-membrane occurs, either in single or two-stage drying, so that extraction can only take place by diffusion (and not by lixiviation, as De Vecchis states); and that the albuminoid bodies are equally coagulated by both methods of drying, though the second stage tends to be uneconomic and productive of inversion.

The purification of raw juices of 50° Brix was found to be attended with difficulties unless due regard be taken for the viscosity of the juice and the relative concentration of the impurities and their effect upon filtration. When suspended impurities were removed by mechanical clarification, before or after liming, the purification became simple, the juice then being brought to the required alkalinity and filtered.

A new sequence of operations in the system of boiling and crystallisation is described, which, it is thought, offers economies worthy of the attention of the sugar industry.

In an appendix on the treatment of effluents, it is pointed out that, though the amount of effluent in the desiccation process is much reduced, the effluent is still a potential source of trouble. Trials carried out with a Brackett screen and a Pennell-Wyllie filter showed that the use of a system of screening and filtration, means being provided so that either recirculating or direct discharge could be used, offers distinct advantages for the treatment of the effluent. The method works well with the conveying and wash waters, and it is considered that the process waters could probably be purified by the same method, excess lime being used in the filter.

Low Temperature Carbonisation

It is announced that an agreement has now been signed in the United States between the Public Service Electric & Gas Co., New Jersey, and International Combustion Engineering Corporation, New York, to put down in the township of Raritan, State of New Jersey, a "K.S.G." low-temperature carbonisation plant, which will be the largest in the world. The plant, which will occupy a site of 38 acres, and will be completed on March 1, 1929, will consist of eight standard "K.S.G." process retorts, each with a daily throughput of 80 tons of coal. This will give 2,000,000 to 3,000,000 cb. ft. daily of rich gas of 800 B.Th.U. per cb. ft., which is to be mixed with blue water-gas to bring up the total to 4,000,000 cb. ft. of town gas, of 530 B.Th.U. per cb. ft., continuity of supply being guaranteed, with a production of 450 tons of smokeless fuel (10-12% volatile matter), and 14,000 gallons of low-temperature tar. Included in the equipment is a very large carburetted water-gas plant, in two separate sections, capable of producing 3,000,000 cb. ft. of gas of 530 B.Th.U. per day, giving the desired output in the case of any stoppage of the low-temperature plant.

The "K.S.G." retort is a horizontal rotary steel cylinder, 76 ft. long and 10 ft. in diameter, having an inner cylinder 5 ft. 8 in. diameter, with external heating, giving about 2½ hrs. carbonisation with maximum temperature zone of 950 to 1000° F., and 10-12% volatile matter in the residual smokeless fuel. Particularly important is the claim that in this way bituminous coal dust and smalls can be converted direct under continuous operation into comparatively large pieces of smokeless fuel, equal or superior in value to lump coal.

The "K.S.G." (Kohlenscheidungs-Gesellschaft) process of low-temperature carbonisation has been in operation at the Matthias Stinnes 1/11 Colliery, Karnap, near Essen, since 1924, utilising gas-coal smalls and dust.

The International Combustion Engineering Corporation controls the "K.S.G." process (formerly a project of Hugo Stinnes) and the "McEwen-Runge" process for the low-temperature carbonisation of pulverised coal, now in operation at the Lakeside Station, Milwaukee, and has a working arrangement with Imperial Chemical Industries, Ltd.

The I. G. Farbenindustrie

The Norsk Hydro company has formally approved of the agreement with the I. G. Farbenindustrie for mutual co-operation in the technical and sales department (cf. CHEM. & IND., Oct. 21, p. 968). The capital of the Norsk-Hydro will be raised from 19 million to 77 million kronen (about £1,050,000 to £4,300,000) by exchange of shares with the I. G., and the enlargement of the Norwegian synthetic ammonia factory is to be put in hand with the object of increasing the output of fixed nitrogen threefold.

The decision of the German Railway Company to allow the I. G. a lower rate for the transport of "synthetic petrol," has led to an application by the petrol associations for similar concessions. In making the application the I. G. claimed that the ordinary (higher) rate would make it impossible to market synthetic petrol economically in Germany, and that the concession would not give the I. G. any competitive advantages.

Nitrate for Soviet Russia

According to *The Times*, it appears that arrangements have been made for the transport of high-grade refined Chilean nitrate to Soviet Russia. Nitrate of this quality is, states *The Times*, used exclusively for the production of explosives.

COMPANY NEWS

ANGLO-PERSIAN OIL CO., LTD.

The eighteenth ordinary general meeting, held on November 2, was presided over by the chairman, Sir John Cadman, K.C.M.G., who, after reviewing the accounts (cf. CHEM. AND IND., October 21, 1927, p. 968), said that production amounted to over 4,800,000 tons, which compared closely with the estimate of 4½ millions for last year. The current year's production would probably exceed 5 million tons. The first units for the recovery of petrol from field gas had been running efficiently for some time. Additional plant was now being erected which would enable an extraction of 2½ million gallons of spirit monthly from 900 million cb. ft. of gas. The business in Persian oil carried on by Scottish Oils, Ltd., had continued on an expanding scale, but the position of the shale industry was still unsatisfactory. For some months past the petroleum industry had been in an extremely unsettled condition. The decreased exports from Mexico had been more than offset by large over production in the United States, and by a significant advance in production from South America and elsewhere. As regards the prospects for the current year, unless there was some radical change in prices there was likely to be a reduction in the profits of the company, which might affect the ordinary dividend. At the end of the meeting a resolution was passed ratifying the action of the board in creating for Lord Greenway the special office of president of the company and appointing him thereto in recognition of his valuable services.

CHEMICAL AND METALLURGICAL CORPORATION, LTD.

An extraordinary general meeting was held on November 7, at which resolutions were passed authorising the directors to issue any of the 9,500,000 at present unissued new ordinary shares, and increasing the number of directors to 12 (cf. CHEM. AND IND., Nov. 4, 1927, p. 1026).

ERINOID, LTD.

The twelfth annual general meeting was held on November 3, Mr. Andrew Binnie (chairman) presiding. The result of the past year's working was disappointing, due partly to an increase in the cost of raw material, but mainly to the severe cutting of prices by competitors. For the first eight months business was very quiet, but there had been a rush of business in the last four months which taxed the company's manufacturing capacity to the utmost limit. If the sales continued on their present scale, the results of the coming year should show a substantial improvement. The French company had done well and paid a good dividend. There was no revenue from the American company, but the Board expected to receive a contribution during the current year. (For details of the accounts, cf. CHEM. & IND., November 4, 1927, p. 1026.)

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial.—Cryst., £34 per ton; Powder, £36 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5 5s. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate.—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
Arsenic Sulphide, Yellow.—1s. 9d. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 1d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithopone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.t.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
Sulphur Chloride.—4d.—7d. per lb., carboys extra.
Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
Thiocarbamilide.—2s. 1d. 2s. 3d. per lb., according to quantity.
Vermilion, pale or deep.—6s.—6s. 3d. per lb.
Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 10s.—£10 per ton. Good demand.
Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.
Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
Red Liquor.—9d.—10d.
Wood Creosote.—1s. 9d. per gal., unrefined.
Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
Wood Tar.—£4—£5 per ton.
Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals, 7½d.—8d. per lb. Crude 60's, 2s. 3d.—2s. 5d. per gal.
Acid Cresylic, 99/100.—2s. 11d.—3s. per gal. 97/99.—2s. 4½d.—2s. 8d. per gal. Pale, 95%, 2s. 3d.—2s. 6d. per gal. Dark, 95%, 2s. 1d.—2s. 3d. per gal.
Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil. Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
Benzole.—Crude 65's, 9½d.—9½d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 6d. per gal., ex works in tank wagons.
Toluole.—90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 6d.—2s. per gal.
Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.
Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7½d. per gal. ex works. Salty, 7d. per gal., loss 1½%.
Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.—10d. per gal. Solvent 95/160, 1s. 3d.—1s. 4d. per gal. Solvent 90/190, 9½d.—1s. 3d. per gal.
Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
Pitch, medium soft.—85s.—87s. 6d. per ton, f.o.b. according to district. Market firm.
Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/150—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 6d. per lb.
Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
Acid H.—3s. per lb.
Acid Naphthionic.—1s. 6d. per lb.
Acid Neville and Winther.—4s. 9d. per lb.
Acid Sulphanilic.—8½d. per lb.
Aniline Oil.—8d. per lb., naked at works.
Aniline Salts.—8d. per lb., naked at works.
Anthranilic Acid.—6s. per lb., 100%.
Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—5½d. per lb.

m-Cresol 98/100%.—2s. 7½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—1s. 10d. per lb.

Dimethylaniline.—1s. 11d. per lb.

Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton.

Dinitrochlorbenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

a-Naphthol.—2s. per lb. d/d.

β-Naphthol.—10d. per lb. d/d.

a-Naphthylamine.—1s. 3d. per lb.

β-Naphthylamine.—3s. per lb.

p-Nitraniline.—1s. 7d.—1s. 8d. per lb.

m-Nitraniline.—3s. per lb. d/d.

o-Nitraniline.—5s. 9d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb.

R. Salt.—2s. 2d. per lb.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—7½d.—8½d. per lb.

p-Toluidine.—2s. per lb., ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—Cryst. 40s.—43s. per cwt. Powder 44s.—47s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 6½d.—1s. 7½d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 4d. per lb. Technical 11½d.—1s. per lb. Good demand.

Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Amidol.—9s. per lb. d/d.

Acetanilide.—1s. 6d.—1s. 8d. per lb. for quantity.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—9s. 6d. per oz.

Barbitone.—5s. 9d.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—10s. 4d.—10s. 7d. per lb. Bismuth Citrate.—9s. 10d.—10s. 1d. per lb. Bismuth Salicylate.—9s. 10d.—10s. 1d. per lb. Bismuth Subnitrate.—8s. 4d.—8s. 7d. per lb. Bismuth Nitrate.—6s. 1d.—6s. 4d. per lb. Bismuth Oxide.—13s. 10d.—14s. 1d. per lb. Bismuth Subchloride.—13s. 10d.—14s. 1d. per lb. Bismuth Subgallate.—8s. 1d.—8s. 4d. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal 24s.—27s. per cwt. Powder 26s.—29s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 2d.—2s. 4d. per lb. Potassium. 1s. 9½d.—1s. 11d. per lb. Sodium.—2s.—2s. 2d. per lb.

Granulated ½d. per lb. less. All spot. Large quantities at lower rates.

Calcium Lactate.—1s. 2d.—1s. 3½d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ethers: S.G. 730, 10½d.—1s. 1½d. drums. Other gravities at proportionate prices.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—4s. 9d.—5s. per lb.

Hexamine.—2s. 3d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal. in carboys; Winchesters, 2s. 11d. per gal.; 20 vols., 4s. 3d. per gal. in carboys; Winchesters, 5s. per gal.

Hydroquinone.—2s. 11d.—3s. 2d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate.—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—18s.—20s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £32 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.K. recryst., B.P., 17s. 9d. per lb. net.

Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 6s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonat.—8s. 9d.—9s. per lb.

Metol.—11s. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb.

Phenacetin.—2s. 6d.—2s. 9d. per lb.

Phenazone.—4s.—4s. 3d. per lb.

Phenolphthalein.—6s. 6d.—6s. 9d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2½%.

Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—6d. per lb. spot.

Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.

Resorcin.—3s. 9d.—4s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 11d.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net.
 Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 7½d.—1s. 9d. per lb. Crystal,
 1s. 8½d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton
 according to quantity, delivered U.K.
 Sulphonal.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to
 quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.
 Aubepine (*ex Anethole*).—11s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s.
 per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl
 Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d.
 per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—
 4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—
 (*ex Bois de Rose*) 15s. per lb.—(*ex Shui Oil*) 10s. 6d. per lb.
 Linalyl Acetate.—(*ex Bois de Rose*) 18s. 6d. per lb.—
 (*ex Shui Oil*) 14s. 6d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.
 —1s. 8d. per lb. Vanillin.—16s. 6d.—17s. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb.
 Bergamot.—26s. per lb. Bourbon Geranium.—13s. 6d.
 per lb.
 Camphor.—75s. per cwt. Cananga, Java, 15s. 9d. per lb.
 Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d.
 per oz. Citronella.—Java, 1s. 10d. per lb. c.i.f. U.K.
 port, for shipment over 1928. Ceylon, Pure, 1s. 8d.
 per lb. Clove, pure 5s. 3d. per lb.
 Eucalyptus, Australian.—2s. 2d. per lb. Lavender.—Mont
 Blanc, 28/40%, 17s. per lb. Lemon.—7s. 3d. per lb.
 Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d.
 per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian,
 75s. per oz. Palma Rosa.—10s. per lb. Peppermint
 —Wayne County, 15s. 9d. per lb. Japanese, 8s. per
 lb. Petitgrain.—8s. 6d. per lb. Sandalwood—Mysore,
 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST.

They
 Chancery Lane, London, W.C. 2, on Nov. 17th. 1927. Complete Specifications
 marked * are those which are open to public inspection before acceptance.
 The remainder are those accepted.

I.—Applications

Anme-Luther Werke Braunschweig. Impact or beater
 mills. 28,608. Oct. 28. (Ger., 31.1.27.)

Bramwell, and Synthetic Ammonia & Nitrates, Ltd.
 Heat-exchangers. 28,595. Oct. 27.

Campbell. Apparatus for treating solids with liquids.
 28,351. Oct. 25.

Denham. Grinding etc. machines. 28,753. Oct. 28.

Fischer. Purifying gases. 28,358. Oct. 25. (Ger.,
 24.12.26.)

Garland. Edge filtration. 28,736. Oct. 28.

Laing and Nielsen. Coating or impregnating granular
 materials etc. 28,454. Oct. 26.

Laughlin Filter Corp. Centrifugal separators. 28,860.
 Oct. 29. (U.S., 30.10.26.)

Lazarus. Prevention of boiler incrustation. 28,890—1.
 Oct. 29. (Ger., 12.1.27 and 21.7.27.)

Olsen. Heat-exchangers. 28,507. Oct. 26.

I.—Complete Specifications

18,071 (1926). Puening. Heating method and apparatus.
 (255,866.)

7940 (1927). British Furnaces, Ltd., and Smith (Surface
 Combustion Co.). Furnaces or kilns. (279,317.)

9017 (1927). Smet-Solvay Co. Distillation. (269,517.)

14,182 (1927). Trocknungs-, Verschwelungs- und Vergas-
 ungs-Ges., and Bartling. Rotary annular sole plate ovens.
 (279,343.)

14,225 (1927). Trocknungs-, Verschwelungs- und Vergas-
 ungs-Ges., and Bartling. Annular rotary hearth ovens.
 (279,344.)

*28,224 (1927). Schmidt. Regenerative ovens or furnaces.
 (279,505.)

II.—Applications

Anglo-Persian Oil Co., Ltd., Dunstan, and Thorpe. Liquid
 fuels for internal-combustion engines. 28,897. Oct. 29.

Bueb, and Dessauer Vertikal-Ofen Ges. Production of
 mixture of coal gas and water gas. 28,234. Oct. 24.

Cornelius and Flodin. Continuously producing and drying
 briquettes. 28,354. Oct. 25.

Fischer. 28,358. See I.

Griffin and Laing. Pulverising etc. coal etc. 28,270.
 Oct. 24.

I.-G. Farbenind. Extraction of carbon dioxide from gases.
 28,209. Oct. 24. Recovering acetylene from gases. 28,748.
 Oct. 28. (Ger., 16.11.26.)

Jacques, and Shotts Iron Co. Complete gasification of
 solid fuel. 28,303. Oct. 25.

Soc. Anon. d'Ougrée-Maribayce. Manufacture of coke, and
 electrodes therefrom. 28,734. Oct. 28. (Fr., 9.8.27.)

II.—Complete Specifications

10,642 (1926). Hart. Manufacture of fuel briquettes.
 (279,140.)

18,782 (1926). Crisp. Apparatus for purifying coal gas.
 (279,184.)

20,670 (1926). South Metropolitan Gas Co., and Lamprey.
 See VIII.

27,580 (1926). Simmance. Gas calorimeters. (279,253.)

7920 (1927). Johnson (I.-G. Farbenind.). Production of
 fuel gases. (279,316.)

8196 (1927). Barker (Cunningham). Mechanically-ope-
 rated gas analysers. (279,319.)

14,503 (1927). Johnson (I.-G. Farbenind.). Catalytic
 production of hydrocarbons. (279,347.)

*24,916 (1927). Spilker, Zerbo, and Ges. f. Teerverwertung.
 Hydrogenating and splitting hydrocarbons etc. (279,410.)

*27,621 (1927). Hoyois. Treatment of coals, ores, etc.
 (279,447.)

*27,912 (1927). Siemens & Halske A.-G. Determination
 of carbonic acid in flue gases. (279,478.)

*27,952 (1927). Florentin, Kling, and Matignon. Obtain-
 ing light hydrocarbons from complex organic compounds.
 (279,488.)

IV.—Applications

British Dyestuffs Corp., Ltd., Baddiley, Brightman, and Chorley. Disazo dyes. 28,495. Oct. 26.

Carpmael (I.-G. Farbenind.). Manufacture of 1-8-naphthoxypenthiophen compounds. 28,386. Oct. 25. Manufacture of new derivatives of anthanthrone. 28,387. Oct. 25. Manufacture of anthraquinone dyestuffs. 28,516. Oct. 26.

I.-G. Farbenind. Manufacture of diacydyl-derivatives of the naphthalene etc. series. 28,225. Oct. 24. (Ger., 23.10.26.) Manufacture of vat dyestuffs. 28,749. Oct. 28. (Ger., 18.11.26.)

Imray (I.-G. Farbenind.). Manufacture of dyestuffs. 28,757-9. Oct. 28. Manufacture of nitrosamine printing-colours. 28,760. Oct. 28.

Johnson (I.-G. Farbenind.). Condensation of phthalic anhydride etc. 28,211. Oct. 24. Manufacture of condensation products of phthalic anhydride etc. 28,212. Oct. 24. Manufacture of azo dyestuffs. 28,214. Oct. 24.

IV.—Complete Specifications

10,633 (1926). Thomson, Thomas, and Scottish Dyes, Ltd. Manufacture of dyestuffs and intermediates. (278,496.)

12,906 (1926). Imray (I.-G. Farbenind.). Manufacture of azo-dyestuffs. (279,146.)

21,074 (1926). British Dyestuffs Corp., Shepherdson, and Thornley. Manufacture and use of vat dyes of the benzanthrone series. (279,205.)

1082 (1927). Carpmael (I.-G. Farbenind.). Reduction of aromatic nitro compounds. (279,283.)

2047 (1927). I.-G. Farbenind. Manufacture of mono-diazo-compounds of 1:4-diaminoanthraquinone mono- or disulphonic acids. (264,879.)

11,845 (1927). I.-G. Farbenind. Manufacture of a yellow azo-dyestuff. (270,352.)

*22,462 (1927). I.-G. Farbenind. Manufacture of dyestuffs of the anthracene series. (279,401.)

*26,565 (1927). I.-G. Farbenind. Manufacture of azo dyestuffs and their chromium compounds. (279,429.)

*27,293 (1927). I.-G. Farbenind. Manufacture of dye intermediate. (279,436.)

*27,915 (1927). Soc. Chem. Ind. in Basle. Manufacture of vat-dyestuffs. (279,479.)

*28,225 (1927). I.-G. Farbenind. Manufacture of diacydyl-derivatives of the naphthalene and acenaphthene series. (279,506.)

V.—Applications

British Celanese, Ltd., Bower, Dreyfus, Kinsella, and Taylor. Production of artificial filaments etc. 28,193-4. Oct. 24.

British Celanese, Ltd. Cellulose products. 28,580. Oct. 27. (U.S., 4.11.26.)

Chamberlain and Periam. Production of films from cellulose etc. 28,501. Oct. 26.

Du Pont de Nemours & Co. 28,360. See XXII.

Grenaudier. Recovery of wood pulp from printed matter. 28,328. Oct. 25. (Fr., 25.10.26.)

I.-G. Farbenind. Production of cellulose acetate solutions etc. 28,444. Oct. 26. Spinning artificial silk. 28,761. Oct. 28. (Ger., 30.10.26.)

Johnson (I.-G. Farbenind.). Manufacture of coloured compositions from cellulose esters etc. 28,475. Oct. 26.

Ward. Treatment of paper pulp etc. 28,418. Oct. 26.

V.—Complete Specifications

10,485 (1926). Hands, and Spicers, Ltd. Compositions containing cellulose esters, ethers, etc. (279,139.)

12,253 (1926). I.-G. Farbenind. Manufacture of preparations of alkyl cellulose. (252,176.)

14,362, 20,659 (1926). Classen. Production of cellulose. (279,147.)

29,042 (1926). Clavel. Treatment of artificial silks. (277,602.)

4285 (1927). Gillis. Degumming flax straw. (279,302.)

4880 (1927). Handelsmaatsch. Fibra. Producing wood pulp. (267,107.)

8495 (1927). Verein f. Chem. Ind. See XX.

*27,294 (1927). I.-G. Farbenind. Desulphurising viscose silk. (279,437.)

*28,151 (1927). British Celanese, Ltd. Treatment of organic derivatives of cellulose. (279,502.)

*28,328 (1927). Grenaudier. Recovery of pulp from printed paper. (279,516.)

*28,360 (1927). Du Pont de Nemours & Co. See XXII.

VI.—Applications

Burrell, Hallworth, Holden, and Livsey. Treatment of textile materials etc. 28,539. October 27.

Carpmael (I.-G. Farbenind.). Manufacture of piece-dyed tissues. 28,385. Oct. 25.

Elhs (Chem. Works, formerly Sandoz). Dyeing effect threads. 28,636. Oct. 27.

I.-G. Farbenind. Printing with vat dyestuffs. 28,481. Oct. 26. (Ger., 26.10.26.)

Imray (I.-G. Farbenind.). 28,760. See IV.

VI.—Complete Specifications

18,155 (1926). Calico Printers' Assoc., Lantz, and Watson. Production of aniline black on textile fibres. (279,164.)

21,074 (1926). British Dyestuffs Corp., Shepherdson, and Thornley. See IV.

31,765 (1926). I.-G. Farbenind. Dyeing cellulose acetate silk. (262,830.)

VII.—Applications

Clay Reduction Co. Production of aluminium compounds. 28,326. Oct. 25. (Norway, 25.10.26.)

Ebers. Preparatory treatment of crude heavy spar. 28,353. Oct. 25.

I.-G. Farbenind. 28,209. See II.

Johnson (I.-G. Farbenind.). Production of green hydrated chromium oxide. 28,213. Oct. 24.

Metallbank u. Metallurgische Ges. Production of alumina. 28,519. Oct. 26. (Switz., 26.10.26.)

Pauling. Combustion of ammonia. 28,250. Oct. 24. (Ger., 22.10.26.)

VII.—Complete Specifications

3928 (1927). Komlos, Komlos, and Engelage. Manufacture of carbon disulphide. (265,994.)

15,515 (1927). I.-G. Farbenind. Maintaining the stability of dibasic calcium hypochlorite. (276,307.)

*11,384 (1927). Gaillard. See XVI.

*25,887-8 (1927). Caro and Frank. Production of cyanamides or mixtures containing them. (279,419-20.)

*28,250 (1927). Pauling. Combustion of ammonia. (279,511.)

*28,326 (1927). Clay Reduction Co. Production of aluminium compounds. (279,515.)

VIII.—Complete Specifications

20,670 (1926). South Metropolitan Gas Co., and Lamprey. Refractory bodies such as carbonising retorts. (279,201.)

26,740-2 (1926). Studien-Ges. f. Wirts. u. Ind. Cementing of porcelain. (260,592-3, and 274,408.)

IX.—Applications

Borgestad Fabr. Building material. 28,795. Oct. 28.

Bowran & Co., Ltd., and Craggs. Heat non-conducting composition. 28,785. Oct. 28.

Knudsen. Building-material. 28,796. Oct. 28.

IX.—Complete Specifications

15,301 (1926). Kraus. Building cement or plaster. (253,929.)

6956 (1927). Chamberlain. Protection of wood against rot and decay. (279,313.)

16,031 (1927). Pickstone. Manufacture of cement mortar, artificial stone, concrete, etc. (279,355.)

X.—Applications

Aluminium-Ind. A.-G. Electrolytic extraction of aluminium. 28,392. Oct. 25. (Ger., 22.11.26.)

Gower, and O'Brien and Partners. Electroplating aluminium etc. 28,320. Oct. 25.

Jirotska. Refining aluminium etc. 28,755. Oct. 28.

Meyer. Manufacture of steel. 28,575. Oct. 27. (Ger. 6.12.26.)

Robson. Roasting zinc sulphide ores. 28,265. Oct. 24.

Witter. Purifying tin ores etc. 28,667. Oct. 27.

X.—Complete Specifications

18,035 (1926). Powell, Deering, and Johnson, Matthey & Co., Ltd. Extracting metals. (279,156.)

22,987 (1926). Klein and Brown. Treatment of ores etc. containing titanium and iron. (279,219.)

24,715 (1926). Nilson. Manufacture of low-carbon metals and alloys. (260,232.)

27,924 (1926). Weishan. Production of soft iron. (278,303.)

31,749 (1926). Smith. Impregnating metals etc. with aluminium and aluminium alloys. (279,273.)

32,043 (1926). Marks (Kemet Laboratories Co.). Thorium alloys. (279,274.)

12,662 (1927). Bährmann. Superheating blast furnace and cupola furnace slag and addition of certain lacking constituents. (271,087.)

*29,351 (1926). Wittek. Reducing zinc ores. (279,370.)

*7542 (1927). Krupp A.-G. Sintered hard metal alloys. (279,376.)

*25,769 (1927). Internat. Nickel Co. Chill cast iron alloys. (279,414.)

*25,770 (1927). Internat. Nickel Co. Gray iron alloys. (279,415.)

*26,069 (1927). Corson. Alloy. (279,425.)

*27,621 (1927). Hoyois. See II.

*28,041 (1927). British Thomson Houston Co., Ltd. Alloys. (279,490.)

XI.—Applications

Aluminium-Ind. A.-G. 28,392. See X.

Elliott. Electric accumulators. 28,413. Oct. 26.

Gower, and O'Brien & Partners. 28,320. See X.

Hitchen. Electric batteries. 28,703. Oct. 28.

Kugel. Electrolyte for lead accumulators. 28,745 and 28,805. Oct. 28. (Ger., 6.11.26 and 24.5.27.)

Petithory, and Siemens Bros. & Co. Electric insulating-material. 28,789. Oct. 28.

Soc. Anon. d'Ougrée Marbais. 28,734. See II.

Surjaninoff. Electric induction furnaces. 28,648. Oct. 27. (Austria, 30.10.26.)

XI.—Complete Specifications

23,815 (1926). Stichling. Electric batteries. (279,228.)

14,861 (1927). Brown, Boveri, et Cie. Electric furnaces. (272,227.)

XII.—Applications

Soc. Française de Centrifugation, and Rozieres. Recovering fatty material from emulsions. 28,374. Oct. 25.

Vidal. Production of fatty bodies soluble in water. 28,471. Oct. 26. (Fr., 5.11.26.)

XIII.—Applications

Bakelite Corporation. Phenol resins. 28,629—30. Oct. 27. (U.S., 10 and 11.11.26.)

Nittinger. Producing bright paints. 28,218. Oct. 24.

XIII.—Complete Specification

18,446 (1926). I.-G. Farbenind. See XX.

XIV.—Complete Specifications

242 (1927). Burrage. Vulcanisation. (279,280.)

12,326 (1927). Rubber Latex Research Corp. Stabilised latex. (279,336.)

*24,457 (1927). Baer. Making an elastic caoutchouc-like body. (279,406.)

XV.—Application

I.-G. Farbenind. Manufacture of hardened casein products. 28,480. Oct. 26. (Ger., 26.10.26.)

XV.—Complete Specification

*27,406 (1927). I.-G. Farbenind. Manufacture of solutions of gelatin in organic solvents. (279,443.)

XVI.—Complete Specifications

*11,384 (1927). Gaillard. Obtaining superphosphates with a low percentage of moisture. (279,380.)

*25,891 (1927). Caro and Frank. Producing an alkaline-reacting nitrogen fertiliser. (279,421.)

*25,887—8 (1927). Caro and Frank. See VII.

XVII. Complete Specifications

27,450 (1926). Raffinerie Tirlemontoise. Curing masses. (274,799.)

27,451 (1926). Raffinerie Tirlemontoise. Removal of false grain from sugar syrups or molasses. (274,800.)

27,455 (1926). Raffinerie Tirlemontoise. Process for decolouring sugar crystals. (278,302.)

XVIII.—Complete Specification

8535 (1927). Commercial Solvents Corp. Art of butyl-acetonic fermentation. (278,307.)

XIX. Applications

Bau. Treating flour. 28,700. Oct. 28.

Ellis. Manufacture of cattle foods. 28,412. Oct. 26.

Lutax, Ltd., and Sutcliffe. Treatment of food etc. 28,540. Oct. 27.

XIX.—Complete Specifications

18,065 (1926). Epstein. Egg product. (279,159.)

*27,934 (1927). Perino. Manufacturing a vegetable alimentary product. (279,487.)

XX.—Applications

Chem. Fabr. vorm. Schering. Manufacture of alkylisopropylphenols etc. 28,388. Oct. 25. (Ger., 26.10.26.)

Manufacture of condensation products from cresols and ketones. 28,389. Oct. 25. (Ger., 26.10.26.)

Manufacture of decomposition compounds from condensation products of cresol etc. 28,390. Oct. 25. (Ger., 26.10.26.)

Manufacture of higher alkylated guanidine derivatives. 28,674. Oct. 27. (Ger., 28.10.26.)

Chem. Fabr. vorm. Schering, and Jordan. Manufacture of condensation product from *m*-cresol and acetones. 28,803. Oct. 28.

Holzverkohlungs Ind. A.-G. Production of acetone. 28,220. Oct. 24. (Ger., 4.11.26.)

I.-G. Farbenind. Manufacture of stable solid solutions of salts of aromatic sulphonic acids. 28,616. Oct. 27. (Ger., 27.10.26.)

Manufacture of organic compounds containing oxygen. 28,747. Oct. 28. (Ger., 15.11.26.)

Imray (I.-G. Farbenind.). Improving perfumes. 28,876. Oct. 29.

Johnson (I.-G. Farbenind.). Production of esters of silicic acid. 28,210. Oct. 24.

XX.—Complete Specifications

18,377 (1926). Binz and Râth. Production of organic arseno compounds. (255,892.)

18,446 (1926). I.-G. Farbenind. Treating decamphorated oil of turpentine. (255,896.)

28,308 (1926). Râth. Preparation of means for fighting bacterial diseases. (262,080.)

30,219 (1926). U.S. Industrial Alcohol Co. Dehydrating alcohol by distillation. (268,728.)

8495 (1927). Verein. f. Chem. Ind. Recovery of high percentage acetic acid from solutions of acetylcellulose in acetic acid. (268,778.)

*8536 and 10,648 (1927). Commercial Solvents Corp. Catalysts for synthetic methanol production. (279,377—8.)

*11,080 (1927). Poulenc Frères, and Fourneau. Manufacture of orthochloroparaaminoglycinamidephenylarsinic acid. (279,379.)

27,511 (1927). I.-G. Farbwind. Manufacture of physiologically-active extracts. (279,445.)

XXI.—Application

Chamberlain and Periam. Light-sensitive films etc. 28,502. Oct. 26.

XXI.—Complete Specification

*14,366 (1927). Gschöpl. Production of natural colour pictures. (279,381.)

XXII.—Application

Du Pont de Nemours & Co. Pyroxylin compositions. 28,360. Oct. 25. (U.S., 25,10,26.)

XXII.—Complete Specification

*28,360 (1927). Du Pont de Nemours & Co. Pyroxylin composition. (279,520.)

XXIII.—Application

Burgess (Elrod). Sewage-purifying device. 28,172. Oct. 24.

XXIII.—Complete Specifications

2452 (1927). Rosenheim. Increasing base interchange capacity of glauconite etc. (265,578.)

*27,817 (1927). Frank. Separating tarry substances from water. (279,465.)

*27,828 (1927). Selden Co. Base-exchange bodies. (279,466.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number: *British India*: Bleaching and dyeing plant (368); Iron and steel (369); Centrifugal pumps (A.X. 5425). *Canada*: Glue (371). *China*: Air compressors, transporting gear (387). *Colombia*: Dynamite, detonators (A.X. 5420). *France*: Briquetting plant and presses (376). *Holland and Dutch East Indies*: Soaps, perfumes, etc. (381). *Hungary*: Leather and tanning materials (382). *Norway*: Raw materials for soap and margarine works, chemicals (384). *South Africa*: Structural steel (A.X. 5424). *United Kingdom*: Fish scale essence (8143/27).

Rubber Restrictions

It is officially announced that no change will be made for the present in the regulations which govern the export of rubber from Ceylon and Malaya. If the Governments concerned consider any changes to be necessary, right is reserved to make them as from February 1, 1928, due notice to be given.

An Old Publishing Firm

In connexion with the change of address of J. & A. Churchill, Ltd., medical and scientific publishers, from 7, Great Marlborough Street, to larger premises at 40, Gloucester Place, Portman Square, London, W.1, the firm has sent an interesting brochure from which we learn that the firm was founded in 1825, by the late John Churchill, the grandfather of the present partners, Messrs. A. William and J. Theodore Churchill. The firm has published the Medical Directory since 1845,

and includes amongst its authors many distinguished names, such as Crookes, Michael Foster, Frankland, Huxley, Ramsay, Tilden, Watts and many others.

News from Advertisements

Chief chemist, also assistant chemists with knowledge of artificial silk viscose process, required (p. vi).

A meeting of the Chemical Society Research Fund Committee is announced (p. vi).

A filter (No. 5 Sweetland) is for sale (p. vi).

Various sets of this JOURNAL and other books are offered (p. vi).

Two patents are available for negotiation (p. vi).

There are now 126 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

THE HIGHER COAL-TAR HYDROCARBONS. By A. E. Everest, D.Sc., Ph.D. Pp. xiii + 334. London: Longmans, Green & Co., Ltd., 1927. 18s.

SURVEY OF RADIOLOGICAL RESEARCH IN THE RESEARCH DEPARTMENT, WOOLWICH. R.D. Report No. 71. Research Dept., Woolwich. Pp. 17. H.M. Stationery Office, 1927. 1s. 6d.

THE PRODUCTION OF FORMALDEHYDE BY OXIDATION OF HYDROCARBONS. By W. Ledbury, M.Sc., A.I.C., and E. W. Blair, B.Sc. Chemistry Research Special Report No. 1. Department of Scientific and Industrial Research. Pp. iv + 54. H.M. Stationery Office, 1927. 1s. 9d.

A REPORT ON AN INVESTIGATION INTO THE DESICCATION OF SUGAR BEET AND THE EXTRACTION OF SUGAR, WITH A NOTE ON THE TREATMENT OF SUGAR-BEET EFFLUENTS. By B. J. Owen, M.A., D.Sc., Ministry of Agriculture and Fisheries. Pp. 84. H.M. Stationery Office, 1927. 2s. 6d.

THE BITUMINOUS SANDS OF ALBERTA. By K. A. Clark and S. M. Blair. Part I.—Occurrence. Part II.—Separation. Part III.—Utilisation (in preparation). Report No. 18. Scientific and Industrial Research Council of Alberta. Pp. 36. Edmonton: W. D. MacLean, 1927.

QUANTITATIVE ANALYSE DURCH ELEKTROLYSE. By A. Classen. 7th edition, revised by A. Classen and H. Danneel. Pp. ix + 399. Berlin: J. Springer, 1927. Paper, 22-50 cm.; bound, 24 cm.

SCHLIESS- UND STRENGSTOFFE. By Dr. P. H. Naumann. Technische Fortschrittsberichte. Fortschritte der Chem. Technologie in Einzeldarstellungen, edited by Prof. B. Rassow. Band XVI. Pp. xi + 199. Dresden and Leipzig: T. Steinkopff, 1927. Paper, 12-50 cm.; bound, 14 cm.

BERICHT ÜBER DIE 15. Hauptversammlung in Wien vom 6—10, October, 1926. Pp. 249. I.V.L.I.C. Ober-Ramstadt (Hessen): Collegium, Zeitschrift des Internationalen Vereins der Lederindustrie-Chemiker, 1927. 4 m.

KOLLOIDCHEMIE DER STÄRKE. By Prof. M. Samec. Band II. Handbuch der Kolloidwissenschaft in Einzeldarstellungen, edited by Dr. W. Ostwald. Pp. xix + 509. Dresden and Leipzig: Th. Steinkopff, 1927. Paper, 30 cm.; bound, 32 cm.

CHEMICAL ENGINEERING CATALOG, 1927. Twelfth Annual Edition. Pp. 1160. New York: The Chemical Catalog Co., Inc., 1927. \$3-00 per copy to those in the Chemical Industry outside the United States and Canada.

FIELD EXPERIMENTS ON SOILS AND CROPS. Bulletin No. 272. Kentucky Agricultural Experiment Station. Pp. 285—349. Lexington, Kentucky: The University of Kentucky, 1926.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, NOVEMBER 18, 1927

No. 46

EDITORIAL

Research at High Pressures

THERE seems to be no likelihood that there will be any diminution in the quantity of chemical research or any decline in its importance. On the other hand, we have every reason to expect that the discoveries of the next generation will surpass those of the past and the present. No doubt many branches of chemical research will become obsolete; the methods employed in them will, at some time, have yielded so much of importance that subsequent work will involve no new principles and will discover merely neater or more economical ways of making substances whose properties are already known. Many new synthetic dyestuffs may be prepared, but they will hardly make such changes in organic chemistry and in industry as resulted from the discovery of aniline, alizarine, mauve, and Congo Red. We have other fields to explore and new paths open to us. It is a long time since it was found out that the raising of the temperature could have so great an effect on the starting or the speed of a chemical action. It is only quite recently that high pressures have been required in the manufacture of chemical compounds on an industrial scale; that this new device is of great importance is obvious, and we think that very few of us know much of its possibilities or have had any opportunity of seeing how experiments may be made with this new contrivance, or how it may most effectively become a means for increasing the happiness and prosperity of mankind. The study of chemical actions at high pressures involves engineering plant and engineering knowledge: the days of the pneumatic trough are over; there are few places where the modern developments in this direction can easily become available, and we are therefore particularly interested to read of the provision of equipment of two high-pressure gas research laboratories at the Imperial College of Science and Technology, London. Imperial Chemical Industries, Limited, and the Department of Scientific and Industrial Research are helping to finance this new department in a generous fashion, and we feel sure that many students will be glad to learn to work in the new labs. under the supervision of Prof. Bone and his assistants. High pressures, high temperatures, and high voltages will in time revolutionise the chemical industry, and if X-rays, α -rays, and electrons can also be harnessed for the

convenient use of the manufacturer no one will be surprised. Every house now has its water, gas and electricity laid on; what further services will be commonplace installations in chemical labs. fifty years hence? Shall we have a tap for liquid air and another for compressed α -rays? Shall we have a switchboard that will give us temperatures, pressures, and conditions we now do not even contemplate? We must wait and see; meanwhile the Department of Chemical Technology of the Imperial College will lead us a good many steps nearer to the knowledge of the future.

Transport

There can hardly be any serious need to emphasise the importance of transport in our modern world. Yet the problems which we have to face cannot be entirely new. The Carthaginians well knew what it meant to handle a large trade in perishable articles, and even in Pompeii, if we remember aright, there are signs that a system had been introduced which regulated traffic with a characteristic Roman directness, though we do not suggest that our modern roads should be reduced in width, or large stones placed to catch erring wheels. If it is no consolation to reflect, while the escalator carries us down in the tubebound torrent, that the method is very similar to that which might be used for soap or any other kind of package, yet we are glad to be reminded by Mr. Pooley that no country is more fertile in the production of handling apparatus than our own, and we think he is equally right when he adds that, owing to the age of our industry generally and its growth in constricted quarters, no country is faced with greater difficulties in applying such apparatus. When a new works is to be erected, the problem of ensuring an appropriate flow of material is very different from that presented by an existing plant which requires to be modernised. In these matters, the fresh, untrammelled point of view is of the greatest importance, and we think that an article such as that by Mr. Pooley will be of considerable assistance in calling attention to the many devices which are now available for use in the factory. The economic aspects of the question are considered by Mr. West, who points out the chief questions which must be faced and answered, even if but partially, if efficient and successful working is to be

maintained, whilst Major Hatcher deals with what is probably the most important part of a conveyor, the means by which its power is transmitted. The subject is a very large one indeed, as may be illustrated by reference to the important volume on "The Mechanical Handling and Storing of Material," by G. F. Zimmer, published by Crosby Lockwood & Son, at the price of three guineas. This book, republished in 1922, contains over 800 pages, and deals exhaustively with the automatic and semi-automatic handling and storage of commercial products. When the book was first published in 1905 it was the first book of its kind, certainly in English, and probably in any language. Since then it has attained its third edition, and the care with which obsolete matter has been deleted or replaced by new material in each edition has enhanced its reputation. The treatment is complete and thoroughly practical, the illustrations are abundant and to the point, and the production is excellent. It is a curious thing that, as far as we are aware, it is very difficult to ascertain theoretical expressions for the design of particular types of handling apparatus. Zimmer gives all the details one could want in practice, but we should like to know if the theory of the subject has been developed. Perhaps some chemical engineer could enlighten us.

Chemistry and Man

A suggestive paper on "Hormones" was recently read before the South Wales Section of the Society by Mr. D. H. Hey. The chemistry of hormones is important enough, but Mr. Hey went into matters of more fundamental concern when he pleaded for a better understanding of life. It is possible, if we understand Mr. Hey aright, that the sinister power of scientific research may eventually frighten us. We must, he says, bend our steps in the direction of discovering how, by chemical means, we shall be able to control those unhealthy conditions of mind which are responsible for crime and immorality.

But is it suggested that we should all depend upon chemical materials to control our passions and inspire us to well-doing? If this be so, how can we ever escape the charge of absolute materialism and entire disregard of the inherent nobility of man?

Fifty or sixty years ago, what was perhaps wrongly called the conflict between science and religion was largely brought about, we think, by the narrowness of outlook shown by many learned specialists. As years passed broader views prevailed, and it came to be realised that the mind of man was large enough to comprehend not only the control of natural forces, but also a more intangible spirituality of existence. To-day scientists—and chemists in particular—are in danger of having thrust upon their shoulders the mantle of materialism. Humanity is becoming aware of the power of science, and, misapplying it in various directions, is seeking to excuse itself in a confusion of thought which affirms that science, wholly materialistic in outlook, is responsible. We are told that preventive medicine enables armies numbered in millions of men to be kept in the field in the time of war without the fear of pestilence or destruction by disease. Preventive medicine, therefore, is responsible for world wars! Chemistry has taught us how to make fearsome high explosives and toxic gases.

Engineering and aeronautics have taught us how to build tanks and bombing aeroplanes; physics may soon give us a terrible "death ray." Therefore these branches of science are responsible for war!

The argument is absurd, for the misapplication of scientific discovery is a responsibility which the whole of humanity must shoulder, and scientists must take only their share of the blame.

It is not sufficient, however, to put forward a destructive defence on behalf of science. Scientists must be constructive in thought and action, not only in their own specialised fields, but also in the world of humanity. Science must not comprise merely the wizardry of witch doctors, the avarice of alchemists and the barbarism of blood-letters; she must not only administer to the creature comforts of man and advance his control over natural forces, but she must be worshipped by those who, whilst paying her a worthy homage, have still time to prove to their fellow-men that they envisage a nobler humanity and refuse to accept the charge of materialism.

We have often pleaded that man cannot live by chemistry alone, and asserted our conviction that the chemist brings profit to himself and the world at large by his comprehension of the value of art and literature, music and philosophy, and the humanities in general. Men will give him credit for adding to the comfort of their lives—whether Sir Alfred Mond's measure of relative comfort to-day and in the past is correct or not—but they will give him the greater credit if, in addition, he moves amongst them, plays his part in the higher organisation of humanity, and shows himself to be a man first and a chemist second.

Inspiration to a higher culture and a nobler humanity is not vested in the pure research chemist, who may at first sight be considered to have the better opportunity, by reason of his temperament and environment. In his delight of the beauty of truth, he may be as selfishly narrow as the industrial chemist who thinks of naught but what may fructify upon the credit side of the balance sheet. The industrial chemist has, indeed, a wide scope in the study of human inter-relationships. The idea of the nobility of all work well done and the development of a newer craftsmanship are steps along the road, away from materialism and towards a higher ideal, but they cannot be taken in an atmosphere of distrust and suspicion. It is not too much to claim that the chemical industry is taking a lead in improving human inter-relationship. The late Lord Leverhulme gave us evidence of this in his Messel Memorial Address, and the recently-announced labour policy of Imperial Chemical Industries, Ltd., affords additional proof. We welcome such great gestures in the drama of the understanding of life.

Man's inhumanity to man may be intensified, but is certainly not caused by chemical or general scientific research and endeavour. All the same, however, scientists must show by constructive action that they repudiate the charge of being responsible for a deadening materialism. Then neither will the Bishop of Ripon need to counsel a ten years' holiday for science, nor shall we have to await the discovery of chemical substances for the control of unhealthy conditions of mind in order to progress to a nobler humanity.

HIGH PRESSURE GAS RESEARCH. NEW DEVELOPMENTS AT THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

For some months past there has been a movement to finance and develop on a more permanent basis the research work on gaseous combustion at high pressures continuously carried out since 1920 under the direction of Prof. W. A. Bone, F.R.S., in the Department of Chemical Technology of the Imperial College of Science and Technology, London. In view of the special experimental technique developed, and of the highly-skilled staff of research assistants engaged upon the work, it has been felt that the College is in a specially favourable, if not unique, position for offering facilities for training selected post-graduate students in high-pressure gas research methods, and in the design of apparatus and plant in connexion therewith, which are matters of growing importance in relation to new developments in chemical industry.

Up to now the heavy expenses of the researches have been defrayed out of grants made by the Government Grant Committee of the Royal Society and the Department of Scientific and Industrial Research; but in view of the future new developments now contemplated, it became necessary to have these supplemented from other sources. Accordingly, on hearing of the position, Imperial Chemical Industries, Limited, generously gave the sum of £3,000 for the provision of further equipment, and has promised a further annual subsidy towards the running costs; and at the same time, in order to support and expedite fundamental research work on high-pressure reactions, the Department of Scientific and Industrial Research has agreed to increase its present grant by an amount sufficient to pay the salaries of the staff of four research assistants *plus* a mechanical assistant, on condition that the College provides, out of its own resources, an instructional assistant in connexion with the work.

Accordingly two new high-pressure gas research laboratories are now being equipped under the scheme, namely, (1) 56 × 35 feet, divided into four sections by steel partitions, for the accommodation of high-pressure explosion bomb installations, and two pressure catalytic tube units with accessories, and (2) 36 × 33 feet, in which means and apparatus for preparing, storing, and compressing gases, the determination of compressibilities, the testing and calibration of standard gauges, etc. will be installed.

Outside the building is an experimental gas generator plant and a 3000 cb. ft. gas holder for use as required. There are also 100 cb. ft. and numerous 10 cb. ft. gas holders available for storage. The equipment, when complete, will include (*inter alia*), (a) two gas compressors, one working up to 200 and the other up to 1000 atmospheres pressure, (b) a wide range of explosion bombs capable of withstanding explosion pressures of 100, 1000, 2000 and 20,000 atmospheres, respectively, and (c) catalytic-tube units capable of withstanding pressures up to 500 atmospheres at 500° C.

It is expected that most, if not all, of the new equipment will have been installed ready for operation by the end of March next. There will then be room to

take a limited number of selected post-graduate research students for a systematic training, extending usually over not less than two years, in high-pressure gas research methods. The work will be organised and carried out under the personal direction of Prof. Bone, who will be assisted in it by Drs. D. M. Newitt and D. T. A. Townend, each of whom will be in charge of two research groups, and Mr. W. E. Stockings, M.Sc., who will be in charge of the gas preparation and compressing arrangements, and also act as the instructional assistant.

As the number of vacancies for qualified students in connexion with the work is limited, early application should be made to Prof. Bone at the Imperial College of Science and Technology, London, S.W.7.

WORKS TRANSPORT FROM THE ECONOMIC POINT OF VIEW

By J. H. WEST, A.C.G.I., A.M.Inst.C.E.

Transport into, within, and out of a works may be compared to the alimentary and blood circulations of a human body. Any interference with its regular operation in any part of the system will cause economic ill-health, and if of a serious nature, and allowed to remain unremedied, may ultimately prove fatal. Hence a close study of the various conditions to be satisfied if the circulatory organs are to be maintained in good health, and also of the symptoms and remedies required in case of disorders, is very desirable.

From the economic point of view, we are concerned with but two factors, which are really only one, *viz.*, time and money. We are not dealing here with the technical aspect of various methods of transporting and handling materials. All we need concern ourselves with is whether, to put it bluntly, the staff, labour and appliances available can handle the stuff quickly enough, cheaply enough, and without breakdowns or other interruptions, or whether it would pay to make improvements.

Take the railway sidings of a large works. Perhaps the works has been considerably extended during the last few years, but the sidings remain as they were twenty years ago, and now have to handle double the traffic they were originally intended for. What is the result? Delay in getting materials to where they are wanted and hence reduction of output, charges for demurrage on trucks not promptly unloaded, often double handling because urgent goods have to be unloaded elsewhere than at the proper place, unnecessary night work, increasing the cost of shunting and unloading, and reduced opportunities for repairing the permanent way. On the other hand, to extend the sidings and adapt them to present and possible future requirements is a very expensive business. Will it pay to do it? That is a question which can only be answered after a thorough examination of the cost of the work and of the saving to be effected. Probably a detailed study of the actual conditions during a month or three months will be necessary to ascertain accurately the loss of money which is occurring from the causes mentioned above and other similar ones. Then, if the interest on the capital required to extend the sidings, plus the extra cost of upkeep and depreciation do not exceed the saving to be effected, the job is worth doing.

Similarly, in the case of any internal transport problem, whether it is a matter of moving a few tons of material per day only a few feet, or of taking hundreds of tons per day from one end of the works to the other, the economic questions always are :

- (1) What is it costing by present methods ?
- (2) Are the present methods being worked in the most efficient and economic manner possible ? ; and
- (3) Could it be done cheaper and better some other way ?

These questions often cannot be answered anything like correctly without a good deal of trouble being taken, for it is rarely the case that works costs are analysed to a sufficient extent for the exact cost of any given transport operation to be ascertainable from existing figures, but the trouble involved is, in the writer's opinion, well worth while, for it is only by this means that the management can ascertain what the actual cost is, and whether it can be improved upon. The investigation must, of course, take into account all the items of cost involved, such as a fair proportion of salaries and other overheads, including interest on the capital cost of the handling plant, depreciation, wages, fuel or steam, power, stores such as oil and waste, repairs and replacements, losses caused by breakdowns, loss of or damage to materials, and so on.

Furthermore, the investigation should extend over a sufficiently long period of time to yield figures which represent average conditions, say three months at least, unless the conditions in a given case remain very constant from day to day and from week to week, and even then a short period might either include or miss a bad breakdown which would alter the results enormously. Obviously, the longer the period taken the more closely the results will approach the true average. To avoid the trouble of making such an investigation as that suggested, it may be considered good enough to estimate the various items of cost, but this procedure is, in the writer's opinion, very risky, and may involve such serious errors as to make the results misleading and valueless, particularly with regard to such items as power absorbed and repairs.

However, with this word of warning we may assume accurate costs to have been obtained, and pass on to the consideration of how improvement may be sought. Taking the simpler cases of hand manipulation first, considerable saving can sometimes be effected by close attention to details. The substitution of piece work for day work, the provision of more suitable shovels or other implements, more convenient barrow runs or stagings, or the substitution of narrow-gauge tipping trucks for barrows may help. Simple details like these are often overlooked just because they are simple, and nobody bothers to ask the men whether their work is made as easy and convenient as possible for them. Yet the easier it is made the cheaper it can be done.

In cases where it is a question of replacing hand work by mechanical appliances, or of replacing an inefficient mechanical appliance by a more efficient one, there is now available such an immense variety of appliances of all kinds that the choice of the most suitable for any given case is sometimes no easy matter.

However, before even considering making a change it is well to be sure that the best is being got out of the existing arrangement. Is the appliance in thoroughly good working order and adjustment, and running at the right speed ? Or is it consuming too much power, or giving a poor output ? Further, is it being utilised in the most efficient and economical manner having regard to the daily tonnage to be handled and the hours it is working ? There should be no hurry to make changes until these and similar questions have been answered, and any necessary tuning up carried out. Should improved methods seem called for, a fresh investigation has now to be made to ascertain the capital and working costs of the most likely schemes so that they may be compared with each other and with the existing costs, in order to find the best economic solution. Here, unfortunately, it is rarely possible to obtain actual working costs unless a similar appliance to that under consideration is already in use in some other part of the works, or figures can be obtained from some other works where it is in use. Guarantees of the power required can usually be obtained from the makers, but it is difficult to estimate repairs and upkeep, and still more difficult to compute the chances of a breakdown.

This question of the possible breakdown of mechanical appliances is a very important one, particularly if the trouble is serious and no alternative method of supply is provided. It is not, of course, suggested that handling appliances are any more liable to breakdown than other classes of machinery, but unless the avenues of supply are duplicated, which is rarely the case, the stoppage of the only avenue will probably have much more serious effects upon output than the breakdown of a unit of process plant where duplication or, at any rate, sub-division into multiple units, is more usual. Hence everything possible should be done to provide regular attention and examination, and to have a reasonably complete set of spare parts on hand, but some accident may occur which involves, for example, sending away for a casting, and several days' complete stoppage. It is an old and very true saying that it is not while a plant or machine is running, but when it has broken down that it becomes really expensive. Some alternative method of supply should, therefore, be available, otherwise serious loss of output will result. Money is often grudged for spare parts, but their presence in the stores is an insurance policy against prolonged breakdown. This question of spare parts and emergency replacements provides a strong argument against using foreign-made appliances, for which it will take much longer to obtain replacements.

Turning next to the human element, it should not be necessary to emphasise the need for expert supervision in each department, whether railway, canal or internal handling, such as cranes, elevators, conveyors, ropeways, pumps, and so on. Yet how many pounds are lost every week in some works through lack of a thorough knowledge of railway rates and regulations, or inefficient organisation of road transport, and how many mechanical appliances are condemned as inefficient, or, worse still, left running in an inefficient manner, through sheer lack of competent management and fair treatment ?

Then, almost if not quite as important as spare parts for appliances is the question of relief men for skilled transport work. If a locomotive, crane or lorry driver is away through accident or illness, is there anyone to take his place? Yet the absence of a relief is as bad as if the machine were disabled, whilst the employment of an inexperienced man may result in accident or damage.

Cheap and efficient transport is undoubtedly a very important factor in works economics; in fact, it may be truly described as one of the main essentials of successful working, so that it deserves, and will amply repay, very careful study; and it is hoped that this short article may prove useful in calling attention to some of the more important economic aspects of the question.

CONVEYOR DRIVES AND GEARING

By MAJOR E. C. HATCHER

Possibly the most important part of a conveyor is its power transmission system, consequently, time given to a careful consideration of the most suitable form of drive for a particular type of conveyor is well invested. Generally speaking, there are four forms of drive, each of which, under certain circumstances, has merits of its own; these are as follows:—

1. Belt drive
2. Chain drive
3. Open gear drive
4. Totally-enclosed gear drive.

There are, of course, also various combinations of the four systems. To consider the merits of each system it is as well to keep in mind certain factors: namely, cost of transmission unit, cost of installation, durability, efficiency, amount of space taken up, silence, and accessibility.

In the case of the belt, this form of drive can only be satisfactorily employed where the difference in speed of the prime mover and conveyor shaft is small and where the speed of the conveyor shaft is relatively high, so that only a low torque has to be dealt with. It is also usually very difficult to arrange for the long run of belt which is absolutely necessary if this type of drive is to function satisfactorily.

The principal advantages of the belt drive are:—Low cost of material, low cost of installation, flexibility and quietness in operation. Where the main drive of the conveyor is provided by one of the three other systems, the belt drive can sometimes with advantage be employed between the prime mover and the first stage of the transmission system, particularly where changes of speed are sometimes required, stepped pulleys being used in conjunction with the belt. A belt used in this way is sometimes a very useful safety link when employed on the drive of a conveyor which has a tendency to "pile up" and jam.

The chain drive suffers in many respects the limitations of the belt drive, particularly so far as speed ratios are concerned. It is possible, however, to transmit heavy torques by means of the standard type of roller chain. One of the disadvantages of the roller chain

drive is that it cannot be satisfactorily employed in connexion with high-speed prime movers unless very carefully protected and running in an oil bath, in which case the unit becomes unwieldy and expensive. The silent inverted tooth chain is somewhat better than the roller chain in this respect, but is considerably more expensive. A well-designed drive of this type is very efficient, and has a reasonable life if not overloaded, and if well protected from dust etc. This form of drive is comparatively flexible, but should be provided with a breaking link where used in conjunction with conveyors that are likely to jam.

Chain drives are sometimes used to drive to the top terminal of an elevating conveyor, and in such case it is most important to avoid having one chain sprocket vertically above the other chain sprocket, since such an arrangement induces rapid wear and the provision for adjustment is almost impossible, except by means of a jockey pulley, which is an added complication. Sprockets and chains have relatively low cost, but it must not be forgotten that a substantial mounting of the sprockets and sprocket shaft is necessary, and provision for adjustment is essential.

As a connecting link on the slow-speed end of the transmission system, a chain drive can in some cases be introduced with advantage, particularly where some safety device is required, a breaking link in the chain offering a cheap and simple solution. A certain amount of flexibility is also introduced to a rigid gear system. Where such an arrangement is employed, a speed reduction between the driving and driven sprocket should be introduced, using this mechanical advantage and reducing the amount of torque to be exerted by the gear shaft; smaller gearing can then be employed. Chain drives must be carefully protected to prevent entanglement with operators' clothing, and except at very low speeds are invariably noisy.

The open spur gear drive is probably to-day the most generally used form of conveyor drive. The apparent advantage of the open gear drive system is the relatively low cost of gears; for heavy slow-speed work, rough-cast gears can be employed, and replacements are easily obtained. When looked into carefully, however, it will be seen that the disadvantages of this system of drive are very considerable. The low gear cost is very much affected by the fact that the cost of installation is high and that whilst rough-cast gears can be used, they are exceedingly inefficient and are noisy in operation.

Since it is invariably impracticable to employ a speed ratio of more than 6 to 1 per train of spur gear, it will be seen that to use this system on a slow-moving conveyor, a large number of gears must be used, the result being a cumbersome, noisy and inefficient form of drive. Open gears are also unsatisfactory when used in a dusty and gritty atmosphere, and the care of adequately protecting this form of drive is considerable. Herring-bone gears are, for most applications, more satisfactory in every way than the spur, but the cost often makes their use prohibitive.

In the case of some types of conveyors where the turning effort on the conveyor shaft is very high and the speed low, open spur gears can be satisfactorily used in conjunction with a totally-enclosed speed reducer.

Totally-enclosed gears or speed reducers embrace a large variety of types, including standard worm drives, epicyclic, concentric spur, and the H-R gear manufactured by J. Stone & Co., Ltd., of Deptford, London. The last-named combines the advantages of all the types, being a standard form of gear box in which any speed ratio from 6 to 1 to 100,000 to 1 can be provided. This should not be confused with a variable-speed gear. The H-R gear uses the worm gear as its base, and its patented arrangement permits the use of the most efficient thread angles under all conditions. Whilst this gear is highly efficient for comparatively small speed ratios, its efficiency as compared with other forms of gearing increases as the speed ratio increases.

Because of its special construction, only the smallest number of teeth are necessary on the final driving wheel. Consequently the maximum tooth pitch can be employed. In addition to this feature, since the speed of the prime mover is scientifically broken down before reaching the final driving wheel, the rubbing velocity between this wheel and its driving worm is very low, thus permitting an extremely high loading factor. As a result, the

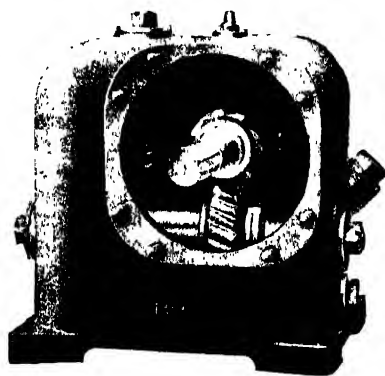


Fig. 1

H-R gear is for a given torque output the smallest and most compact speed reducer on the market.

An important point to keep in mind when considering a conveyor drive is that the totally-enclosed gear is invariably a self-contained unit, and has only to be connected to the conveyor shaft. Consequently the cost of installation is low. The H-R gear is absolutely silent in operation, which is a most important point, particularly when running in a factory and in close proximity to the factory operatives. This gear is also foolproof, and requires no protection from the point of view of Board of Trade Regulations, and can, of course, be run under any atmospheric conditions. Indeed, cases have been known where the gear has been almost buried in dust, etc.

Durability is, therefore, a very strong point, and although this type of gear is somewhat more expensive than the alternatives, its long life, requiring no attention, more than compensates for this extra cost. It is, of course, understood that this type of gear runs continuously in an oil bath.

In addition to the standard type of H-R gear shown, Fig. 1, a new type is being introduced known as the

H-R balanced drive, which, whilst retaining all the advantages of the standard gear (except that of high ratios, the maximum in the balanced gear being 300 : 1), has a greater shock-resisting capacity. This gear pro-

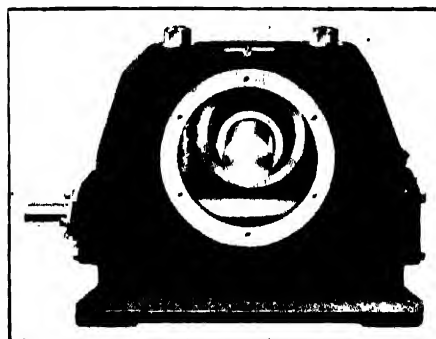


Fig. 2

vides for the final driving wheel to be driven on both sides of its periphery, thus doubling the number of teeth in contact, and, therefore, the capacity of the wheel. The radial load on the slow-speed shaft is also eliminated, as is also the end thrust on the high-speed shafts. An example of this gear is shown in Fig. 2.

The H-R gear is being increasingly standardised by conveyor manufacturers, and there is no doubt that the time is fast approaching when nothing but totally-enclosed speed reducers will be employed on conveyor drives, except in special cases, such as referred to herein, since experience is proving them to be the most satisfactory and economical, when all factors are taken into consideration.

TRANSPORT IN CHEMICAL WORKS

By H. J. POOLEY, M.I.Chem.E.

Economy in power receives the careful attention of every manufacturer, but economy in man-power is, without doubt, the most acute aspect of the problem, particularly in view of what we still regard as the recent upheaval in labour conditions following the war. The most expensive unit in the equipment of any works is the man with a shovel and a barrow. Even this class of work can be cheapened with the use of specialised implements to an extent which can make an extraordinary influence on the year's balance sheet. There is no country more fertile in the production of handling apparatus than our own, and equally owing to the age of our industry generally and its growth in constricted quarters, there is no country faced with greater difficulties in their application. It is safe to say that no chemical engineer will set out to design a works on a free site without making his first consideration the passage of material, from intake to output in every stage, as free as the flow represented on his flow-chart diagram. His task, confronted with an existing plant, requires much greater ingenuity and resource.

The object of this short article is to place before manufacturers in a concentrated form typical examples of the class of plant available, probably not with the expecta-

tion of disclosing anything novel, but with the hope that the presentation of a selection of these devices and some reference to their advantages and limitations may arouse an interest in dealing with some problem hitherto faced with difficulties.

Transport in chemical works, or in any other factory, may be divided and sub-divided, but will resolve itself, in the main, into three groups:—

- (1) Intake and disposal of raw material.
- (2) Transport in process of manufacture.
- (3) Disposal of the finished produce and waste.

The ideal arrangement is one, obviously, in which material arrives at a rate nearing that of its consumption and passes from stage to stage without intermittence. Such conditions are far to seek, but the user will approach nearest to that ideal when he can arrange his intermittent stages as few as possible and in such a manner that

through abrasion affecting the main structure or the bearings. It is obviously a problem on which it is not possible to generalise, except, perhaps, in this one fact, that there is no investment in which a manufacturer can dispose of his capital with greater security as to the results.

With these few remarks the writer will proceed to show, with brief descriptions, typical instances of handling plant, keeping, as far as possible, to the three broad groups mentioned earlier.

In the case of many materials which are mined or quarried, in the distant vicinity of the works, the cable ropeway with all its simplicity, its low cost of installation and upkeep, and the manner in which it disposes of the difficulty of uneven ground, must be placed amongst the most satisfactory methods of transport, and, since it is not actually transport in the chemical works, it is not referred to in detail, but is so pertinent

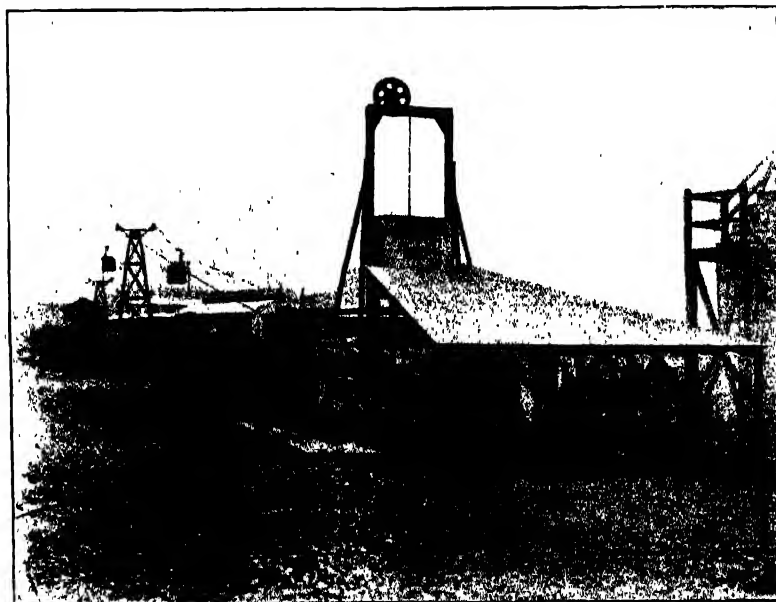


FIG. 1

re-handling occurs seldom and inexpensively. Again, he will approach nearer the ideal if, in the necessary moving from point to point, some essential stage of the manufacture can be combined in the transporting operation. Further, it may be found highly advantageous to adopt measures to produce the material in a form which will lend itself to a more convenient transporting appliance than its ordinary state would permit. Reference will be made to cases of this description a little later.

The determining factor of the transport scheme may originate at the very point of arrival, be it barge or larger vessel, rail wagon or road, and, again, in bulk or otherwise. Consideration, for instance, must be given to the relative economy between rapid unloading and bulk storage on the owner's premises, as against the cost of demurrage for rolling stock or ships bottoms, and the value of berthing space in either category. A system which may be ideal for one material may fail entirely in another case, on account of chemical action, wear

to the charge on costs that it should at least be mentioned briefly. An installation of this character by Messrs. Robert Dempster & Sons is illustrated in Fig. 1. Cement works, limestone quarries, and peat users will find this of much service in many instances.

MATERIAL ON ARRIVAL

In most cases at large works material will arrive in bulk, and may be handled in a large variety of ways, according to the material itself and its nearness to the point of original storage.

Grain and light materials, such as many oil seeds, sawdust, etc., are usually handled in pneumatic elevators and delivered direct to the silo or bulk warehouse, a particularly satisfactory method in view of the simplicity of the pipe ducts, their weatherproof character, and the ease of control and distribution. Where a barge can be brought close alongside a factory, a vertical elevator capable of adjustment in a vertical direction and elevating

to a height from which chutes can reach all points of service or storage is convenient and cheap.

The handling of coal, however, will appeal as a problem concerning every manufacturer, and whereas installations may vary from those of the huge gas and power gas undertakings to the comparatively small steam power installation, the general conditions governing differ only in degree. When arriving by wagon the first operation is its discharge, with a view not only to saving time and labour, but having in mind the early release of the wagon, the saving in demurrage, and congestion of the siding. The electric capstan (see Fig. 2) is a particularly handy

The limitations of these devices is found in the necessity for discharging always at the one point. They are particularly applicable where the material is next removed by one of the various forms of conveyors, or in the rare case where the elevation of the rail is such that the material finds its way straight into the usage hoppers. It is a system frequently used in conjunction with the automatic railway, to which it will perhaps be convenient now to refer.

In Fig. 4 is illustrated a double line of this description. It is applicable to situations where the point of arrival is some little height above the point of usage or storage or

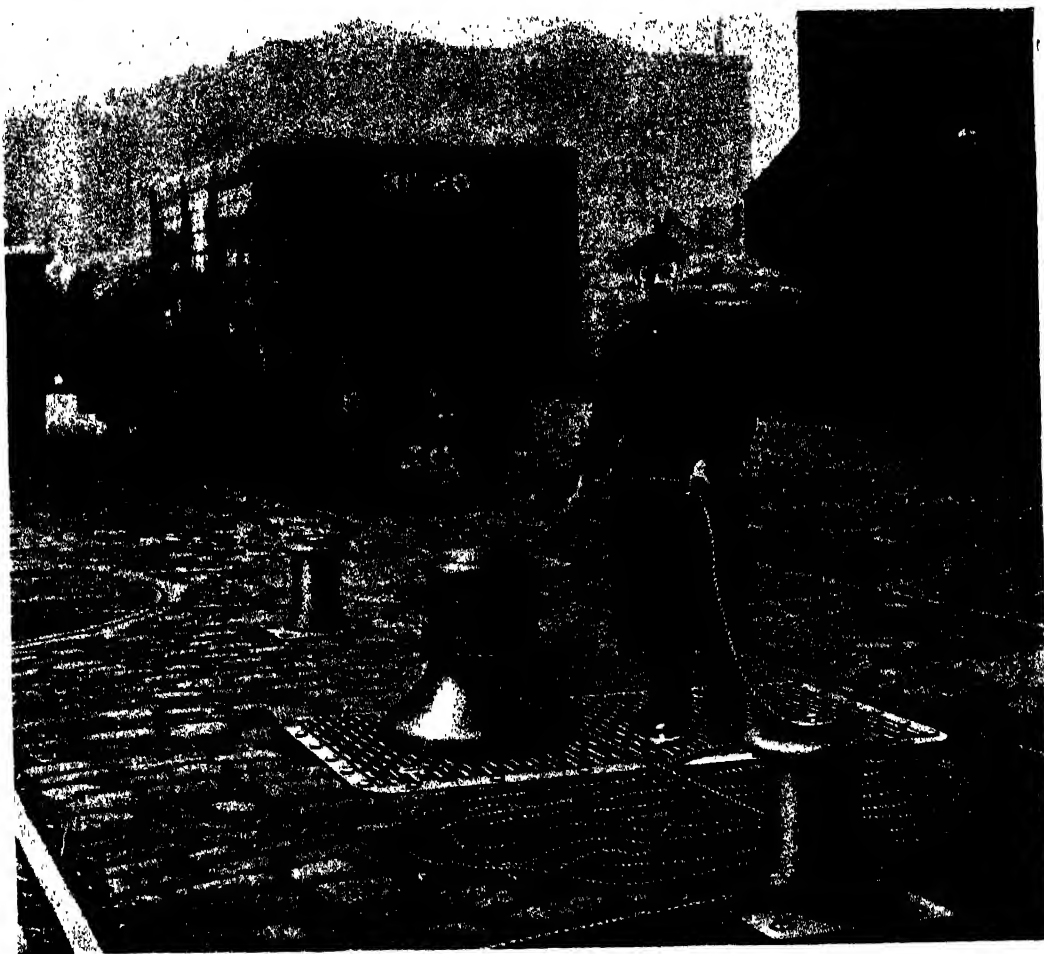


FIG. 2.—Electric Capstan (Thos. Broadbent and Sons)

method of moving single trucks, and one which is too seldom seen in extensive use, either in the work described, or in such operations as furnace and stove trolley loading and unloading. The actual discharge may be rapidly effected in two ways. For end-tipping wagons the electric or hydraulic ram is speedy and effective. (Fig. 3.) For side-tipping wagons the revolving cage laid in the track alongside the hopper or elevator boot accommodates the entire wagon, which is clamped in the revolving frame and the latter caused to make one revolution, thus disposing of the contents and re-setting the wagon on the lines for prompt removal (inset of Fig. 3).

ultimate discharge. The track is inclined at a level suitable to the relative point of reception and discharge, and will operate at any inclination steeper than 1 in 33. The truck is loaded from the hopper or by crane grab or whatever method is favoured. It is given a starting impulse by the single operator, gathers momentum and proceeds till the pre-determined point at which a simple barrier is placed across the track immediately before the point of discharge. The wagon gives impulse, via the cable, to a pendulum type of momentum accumulator, which is so weighted that on automatically returning to position it carries sufficient energy to return the empty



FIG. 3.—(Babcock and Wilcox, Ltd.)

truck to the starting point. The weight of the pendulum is adjustable to ensure this result. The wagons are of special construction, with double-side discharge, auto-

Where a large number of points has to be served, or when the coal, as is so frequently the case, arrives at certain periods in a quantity far in excess of immediate requirements, the most usual system of transport is by means of the electric telfer with grab. Briefly, the telfer is an electric hoist trolley, suspended from its track, which may be the upper or lower flange of an H-section joist, receiving its current from an insulated length of collector wires, usually above and alongside the upper rail and usually operated from a cab built in one with the trolley (Fig 5). They are, however, made suitable for distant control, and in some cases, particularly for internal use, with the operator walking below and controlling from that position. Their operation is limited to the area almost immediately below the track, but as the track is comparatively inexpensive, and makes little call on ground space, and as the rail may be conveniently taken to all points of the works, it is a system which has much elasticity. It is employed not only for coal, but for unloading all kinds of work material, as, for instance, salt, chalk, rock phosphate, ores of all description, and so on. As compared with the travelling jib cranes, it has the advantage that the mass moved in addition to the load is comparatively small, whilst all working parts are comprised in the hoist, which can be quickly run into the workshop for repairs or for protection when not in use, and in this respect has an advantage over non-protected conveyors. It is essentially a one-level transporter, and the cost of reaching the highest part has its influence on the whole of the track, and, conversely, where it is desired to pass under bridges and into buildings, the highest point is limited by the highest point of the latter. For dumping coal in the open it is almost ideal. Most coal-unloading operations are intermittent, and the telfer has the advantage that

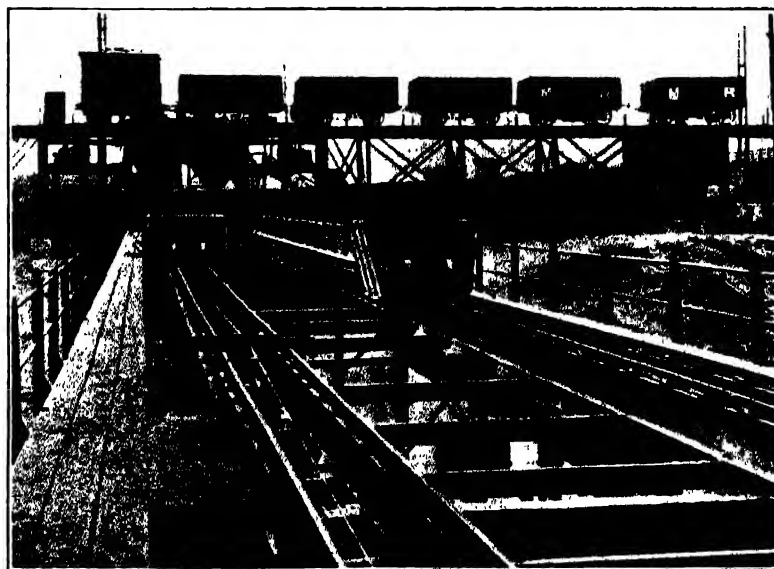


FIG. 4.—Automatic railway (Babcock and Wilcox, Ltd.)

matically controlled at the pre-determined point, and the discharge is instantaneous and complete. Beyond the one man referred to at the point of arrival, there is no cost in operation.

by suitable extension of the track it can be brought into the works proper, and utilised (Fig. 6).

A method of coal storage and reclaiming receiving some consideration is that of the cable drag scraper,

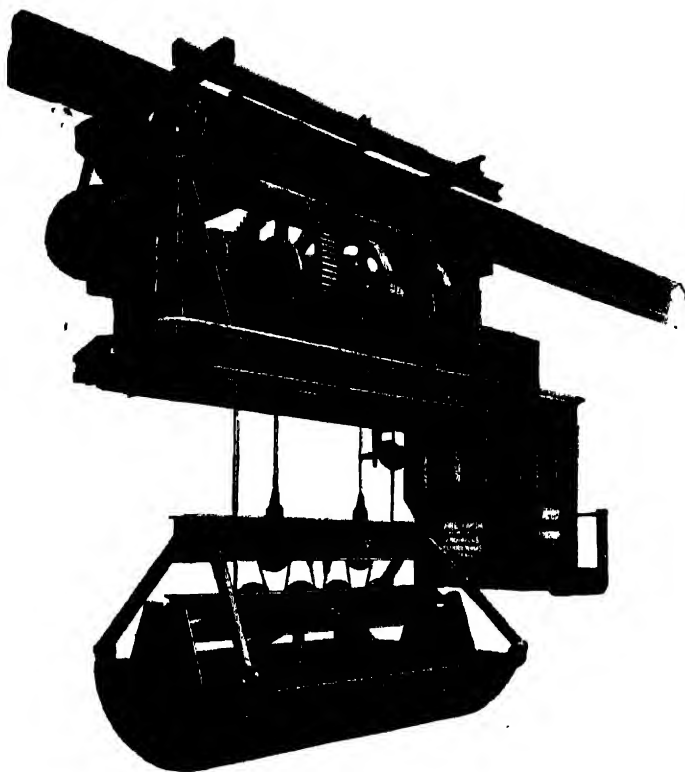


Fig. 1. Electric trolley with 8 ton grab (Robert Dempster and Son)

furnished by the Underfeed Stoker Co. It depends on outside help to bring the coal or other raw material to

Briefly, it comprises a winding mechanism at the distribution point, a tail block mounted on a rail car running round the limits of the field (or alternately a series of posts for anchorage) and a steel toothed drag skip attached to the cable. Controlled from an elevated operating cabin commanding a view of the whole area, the winding drum drags the whole skip backwards and forwards, full and empty, distributing the accumulated pile at the arrival point. The location of disposal is changed by the simple operation of moving the tail-block. Such a device will deal with 600 tons per hour on a radius of 100 ft., controlled by one man, and dispensing with special structures and tracks. For reclaiming, the skip is reversed on the cable.

Fig. 7 depicts the scraper returning empty. In the work of reclaiming, the load must be brought to the skip elevator for raising to the necessary height for distribution by chutes and conveyors to the feed hoppers of the plant concerned.

The next device to come under review is the skip elevator (Fig. 8), which is specially suited to hopper charging at one point. The makers (Underfeed Stoker Co.) make extensive use of it for feeding the Stoker magazines through the agency of their travelling weigh-larry, thus avoiding permanent overhead bunkers in the boiler house.

The hoist consists of a track, vertical or inclined according to the local requirements, a winding motor and cable, and a rectangular bucket, which, in the automatic form, rises and falls continuously until stopped. The loader is automatically controlled by the passage of the skip itself under the track hopper, whilst suitable buffers at the top discharge point tip the skip. Where the hopper or receptacle is provided

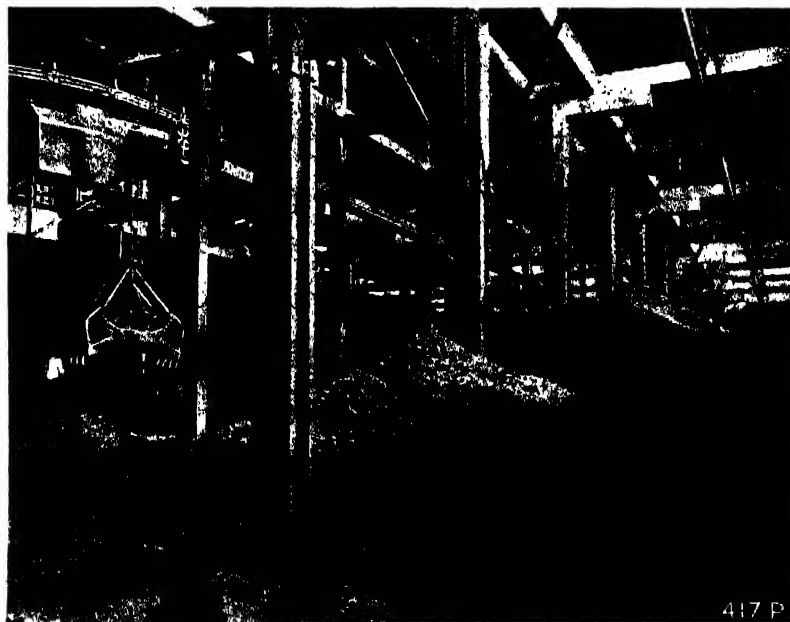


Fig. 6.—Trolley (J. Fraser and Co.) unloading rock phosphate direct to the store

the edge of the storage area, and to remove it when reclaimed, but justifies its cost in all that pertains to the storage area.

with a cover, the skip may be caused to open the latter during tipping.

The maximum capacity is 600 tons per hour. A

semi-automatic type is made for intermittent loading and for less extensive duties.

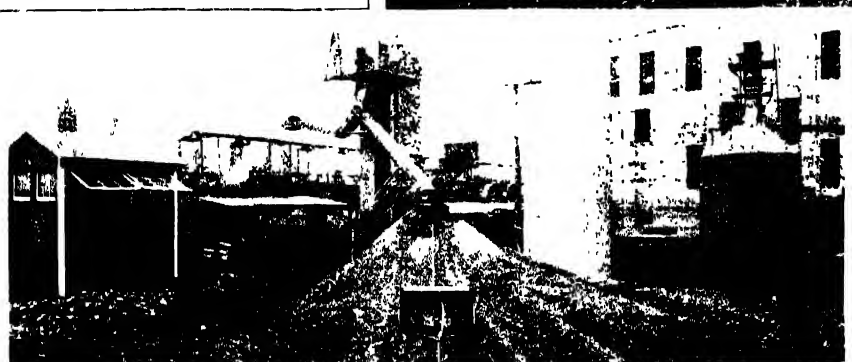
To the credit of such an elevator must be placed the following points: All moving parts are kept out of reach of the load, and are thus free from abrasive or corrosive action. The bucket alone suffers attack, and can be easily and cheaply renewed. Economical in power on account of light moving parts. The power load does not increase with the height as in the case of bucket and tray elevators.

The next device to be con-

the objections often stated against such appliances, when dealing with dusty abrasive material. Their very wide use would seem to confirm their claims.



FIG. 7.—Cable drag scraper



sidered is bucket elevator and its near cousin the tray elevator—popular and adaptable appliances, particularly for dealing with regular supplies and for distributing—without attention—to various points at short or great distances.

The former, in its best form for heavy duties, is seen in the tilting bucket elevator, Fig. 9 (Babcock & Wilcox), which depicts four elevators, each with a capacity of 60 tons per hour.

In this model the stamped steel buckets have trunnion mountings, on which they swing, and are carried by the side chains; they are each provided with contact cams, by which they are tipped for discharging when coming into contact with the cams of a cross shaft, the position of which may be varied at will. The buckets are loaded by a rotary pocketed charger working in the charge hopper, and this ensures a full load without waste. In transit they swing always horizontally, whether the track be vertical, inclined or horizontal—in this they are distinguished from the ordinary fixed bucket elevator, whose operations are confined to a not very wide angle with the vertical, and whose discharge can only be at the head.

This form of elevator combines the duties of elevator and conveyor, thus adding to its versatility, which is further increased by the adoption, when required, of a transportable filler capable of operating at any intermediate point, being temporarily clamped down during use. The makers have studied very carefully wear in bearings and links, automatic lubrication, the relief of strain on the chain at curves with a view to minimising

In common with all bucket elevators they are unsuitable for dealing with damp clumping material, which,

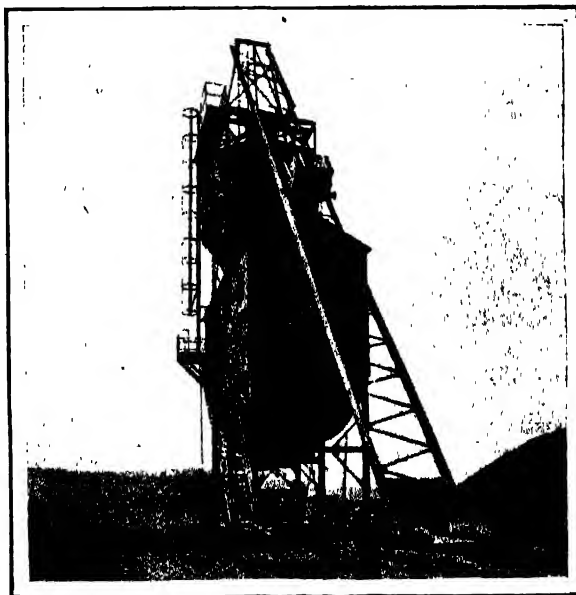


FIG. 8.—Skip elevator or hoist

for similar continuous vertical and horizontal stream transport, is best left to the push-plate or modified tilting tray type, combined with band conveyors.

Whereas the tilting bucket elevator entails the movement of a heavy mass of material other than the load, it is claimed that the chains are balanced, and that frictional resistance has been so far reduced that this seeming disadvantage becomes unimportant. As the cost of raising material in a 40-ton per hour outfit to a height of 40 ft. amounts to just less than one penny per ton, allowing fully for labour, power, and all overhead expenses, including repairs, the point would seem to be well taken care of.

Available space forbids dealing with the many other devices for bulk unloading and distribution, such as the various forms of jib-crane, either of fixed radius or on travelling tracks, nor of the interesting uses of the horizontal transporter, spanning up to 200 ft., and capable of covering any point of a limitless length of such width—nor the radial transporter dealing with any part of a circular space. Sufficient has been written to indicate the great importance now paid to cutting down expense in handling the raw material, justified in the

merely by the substitution of suitably-shaped arms at the requisite intervals in place of buckets, which entails an allowance for clearance, when passing the sprockets at head and foot or at turns.

MATERIAL IN PROCESS

Pursuing the ideal of a clear flow through the works, it becomes necessary to consider detail operations which may be combined in the transport, and for which the design must allow, and which in many cases may determine the design of the system. Such operations as crushing and grinding invariably entail a loss of height in the flow-level, and the same applies to weighing in bulk, the appliances for which have been so thoroughly perfected in this country. Magnetic separation, screening, etc. can be carried out without great sacrifice of height, and hand sorting and picking is obviously a case for the band, tray or apron conveyor. Where material is arriving fairly constantly, a generous hopperage system above the point of usage, when not ruled out

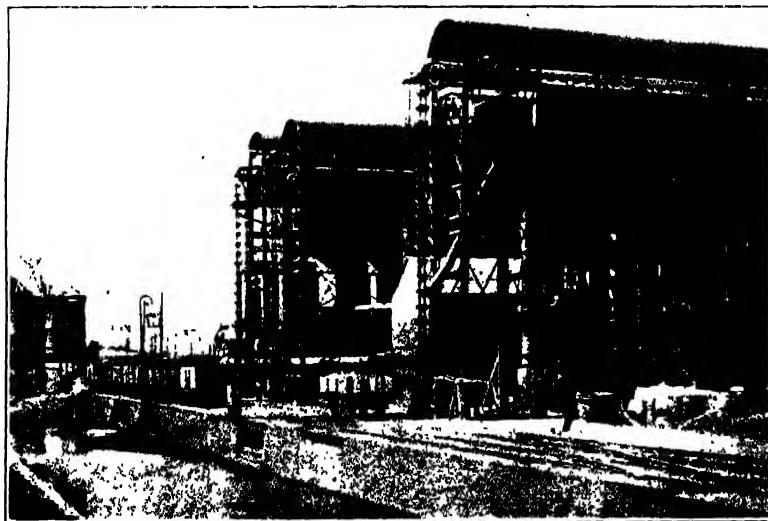


FIG. 9.—*Tilting bucket elevators and conveyors*

fact that the whole supply of the works exacts its toll of cost at that stage.

In handling packed goods on arrival, much of the plant already referred to becomes available with only suitable adaptation at the point of first attack. There is a sling, clip, hook, cage or skip suited to every need, which is attached to the chain end of the crane, telfer, overhead runway, or whatever means is employed. Much of the apparatus described later for handling finished goods is suitable for passing on such packages as bales, sacks and casks to their first store. A great deal of ingenuity has been expended on perfecting gravity devices for such packages, and the practice is growing of storing the raw material on the upper floors, and passing the packages away gradually downwards to chutes, spirals, roller-ways and similar non-power methods which are always available for use when called on.

Chain-operated elevators and conveyors adapt themselves to the requirements of cases, casks and sacks

by individual difficulties such as heating, packing and congealing, is of great attraction. Coupled with a weigher, automatic or controlled, it permits charges to be carried out and checked with the minimum of labour and time.

Where overhead space and lighting, or the intermittent arrival of material in heavy consignments obtains, there is much in favour of fixed charges, loaded to plant by such devices as the skip elevator and the weighing larry, moving on rails and visiting each point of charge as required. Either of these devices prevents material being held up in hoppers capable of feeding part of the plant or machines only, and those parts possibly immobilised for any reason.

Here is the much deplored extra step creeping in, but the problem of suitable transport is burdened with compromises. In this case, against the pause and its cost must be set the points of light, space and immobility in the important operating area itself, and the ability to have the main storage in cheaper quarters under the

best storage conditions, and free from a possibly damp and polluted atmosphere.

From the stage where chemical change in the materials takes place, the conflict of choice of suitable method and



FIG. 10.—(Fraser)

plant becomes increasingly severe, each case being study in itself, and most of them intriguing.

It is, therefore, increasingly difficult in this brief survey to present any adequate combination for uni-

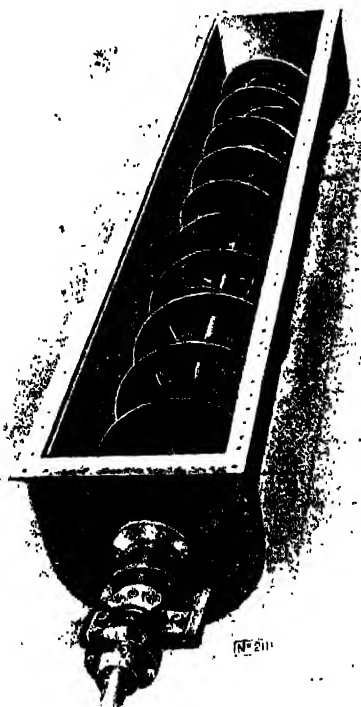


FIG. 11.—Mixer-conveyor (Scott)

versal sequence. A brief reference will be made to various appliances of typical character, and an example or two of specialised adaptation which may stimulate suggestion for other situations.

The vertical bucket elevator (Fig. 10) is suitable for all materials not heavily corrosive or of a clinging character. The chain driven push-plate conveyor and elevator deals well with wet goods of hard texture and of varying sizes, such as bones, and may suitably be combined with washing operations, as in the case of



FIG. 12.—Band conveyor

vegetable roots, beet, potatoes, etc., or with suitable grid plates, may act as a preliminary cleaner or screener, as exemplified in the feeding of bones to a grease-extractor.

The ordinary worm conveyor, while not the most efficient, still retains popularity for continuous horizontal conveyance of granular materials. It is reasonably cheap, and immune from breakdown, easily supported, free from wearing parts having any influence on the drive, providing due attention be given to the design and lubrication of the intermediate bearings (avoiding excess oil). It is self-supporting over fairly long spans, and, in any case, cheaply carried. It lends itself admirably to operations such as cooling, heating



FIG. 13.—Off-loader for band conveyor

and drying by the aid of jackets, air-currents, etc., and its constant disturbance of its load helps these operations, and provides a uniformity of product most desirable.

As an example of the combination of process and transport, a certain material, in a comparative short distance, required to arrive in a cool state with a new substance added—three operations in one—conveying, cooling and blending. By the use of the Scott patent mixer (Fig. 11), specially designed, the work was carried out in one stage. This mixer depends normally on the interweaving action caused by right and left-hand worms, mounted concentrically on one shaft. By jacketing the mixer, and altering the pitch of the outer spiral to give a slow

propelling motion, the necessary lag was provided to allow the mixing and cooling to be performed effectively in the short space available between the two process stages. A simple solution arrived at by selection and adaptation, but typical.

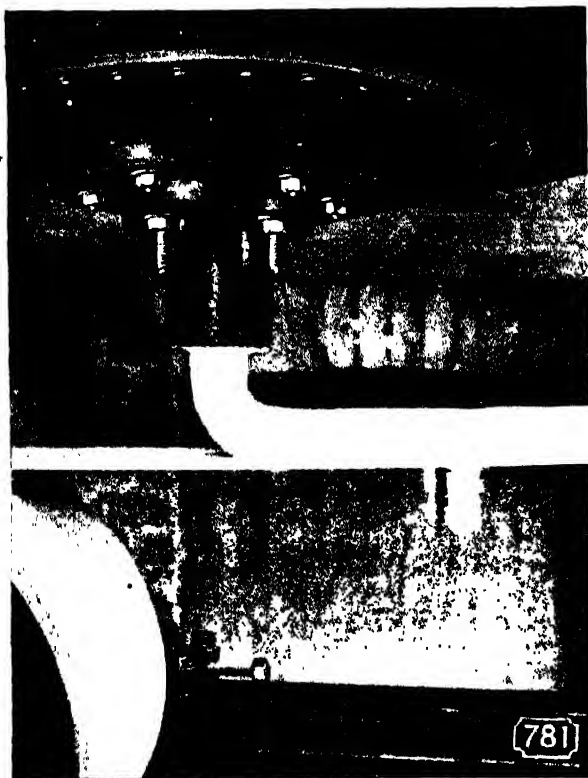


FIG. 14. —Scott patent vibrator

For rough irregular pieces, sodden but not fluid material, and similar goods not suitable for the screw, and also in fact for granular products, the band conveyor is admirable. Its construction is known to everyone, and is clear from the illustration (Figs. 12 and 13), by Fraser.



FIG. 15.—Pan conveyor (Fraser)

of Dagenham. It requires a more elaborate framing than the screw conveyor, and its drive is not so self-contained, but it is, in actual fact, most durable. The belt, of canvas or rubber or balata-treated canvas, has long life, and is suitable to most materials. By use of the throw-

off, which may be inserted at any point in the travel, the load may be off-loaded at any desired spot. While mainly a horizontal conveyor, it can work on an incline, limited by the natural angle of repose of the material comprising the load—as a rough guide, an angle of about



FIG. 16

28° with the horizontal. The belt is also suitable for the conveyance of cases, sacks, etc., but where a clear choice is permitted for these goods, the slat conveyor where wood slats support the goods, and are carried on side chains, is preferable.

The band conveyor is in every-day use in what may be termed the more detailed chemical manufactures in connexion with operations such as filling, branding, labelling, wrapping and packing, and there is no limit

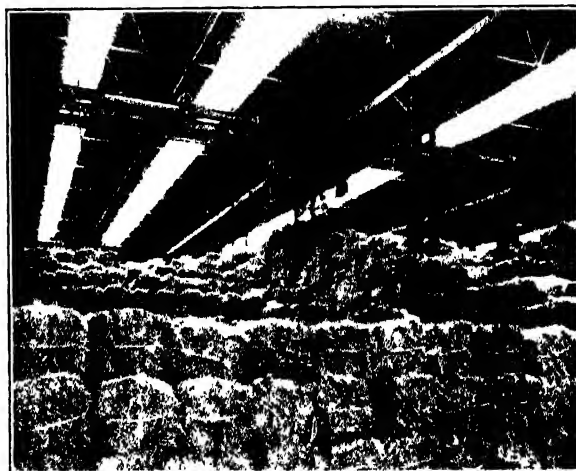


FIG. 17

to the variety of its applications in such service. The usual method is an arrangement of the machines in straight lines with operatives working on each side of the table over which the band passes, each unit or gang having a specified operation to perform before passing



FIG. 18

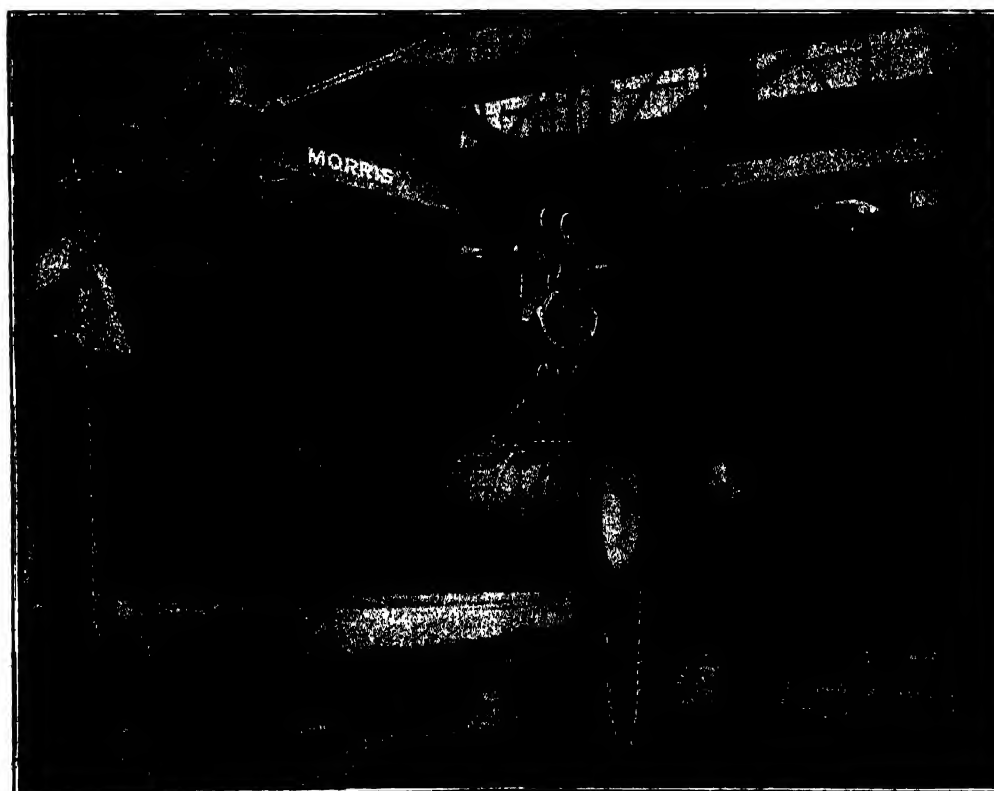


FIG. 19

the article forward, usually on the same band, while a cross band collects the finished goods for delivery to the final packing department. Before leaving this form of conveyor, another instance of adapting material to conditions suitable for a particular form of transport comes to mind. An article produced in a clay-like state required drying, and an inclined band-conveyor was installed, leading to a rotary kiln drier. For fuel economy the

result was a perfectly impartial drying right through the machine, a saving in labour of two men and a very considerable reduction in fuel consumption, a satisfactory product, and the avoidance of a great deal of annoyance, while the existing conveyor became satisfactory for its duty (Fig. 14).

The tipping tray conveyor, to which reference is made later, is ideally suited for handling a hot material, plastics



FIG. 20

material was made as dense and water-free as possible and manually loaded in heavy lumps, of irregular size, to the band. On reaching the drier these lumps balled together in the well-known manner, and such portions, dried on the outside, either reached the discharge only partially dried, or the heating had to be so forced to complete it that the more favourably presented material

and similar goods. In transit it presents a practically unbroken, level, metallic, flexible band, discharging at the ends, but capable, by special off-take appliances, of discharging at intermittent points when desired. An illustration of this appears in the remarks under the heading of "Disposal of Finished Products." A

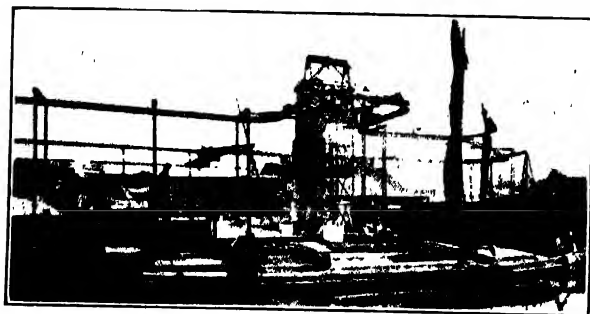


FIG. 21

was probably dry half way through the drier. The solution was eventually found by the employment of the patent "Christy" vibrator (George Scott & Son) in which, by imparting a vibratory motion to the paste in the storage hopper, the material, by readjustment of its crystalline structure, became sufficiently fluid to discharge itself in the shape of a cylindrical ribbon, in which form it entered the drier, still retaining its shape. The

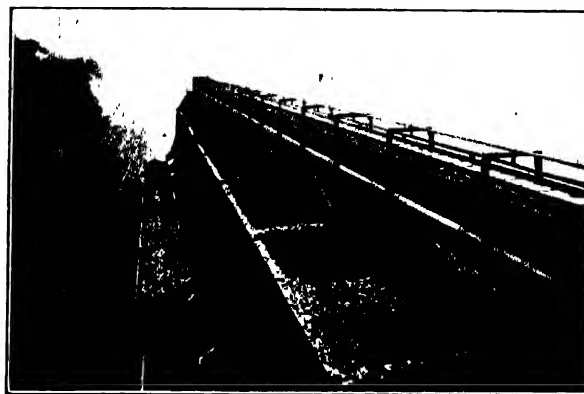


FIG. 22

variation, the Pan conveyor, is useful for the same work or for more liquid goods (Fig. 15).

The telfer can be made a very practical link in any chain of operations, where heavy masses of material must be moved intermittently from part to part of the plant or works, whether these be adjacent or distant. It

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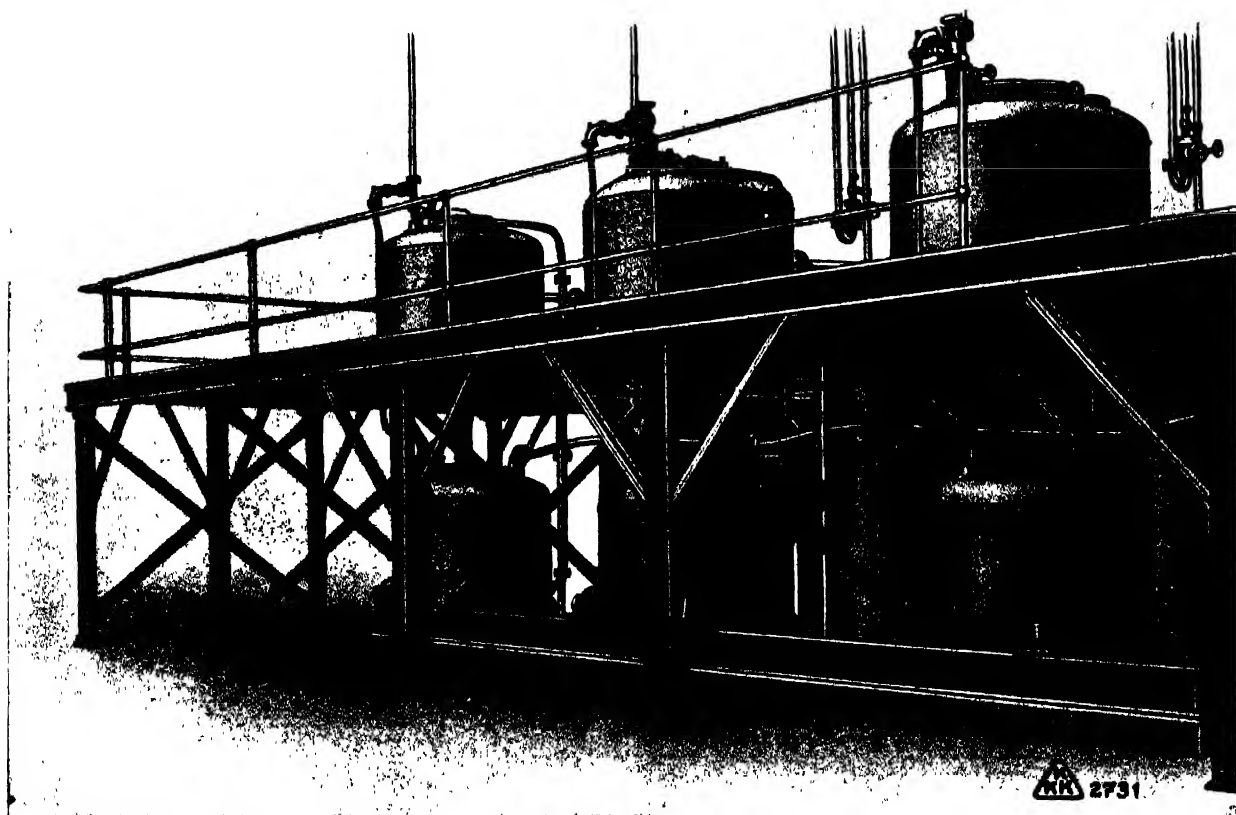
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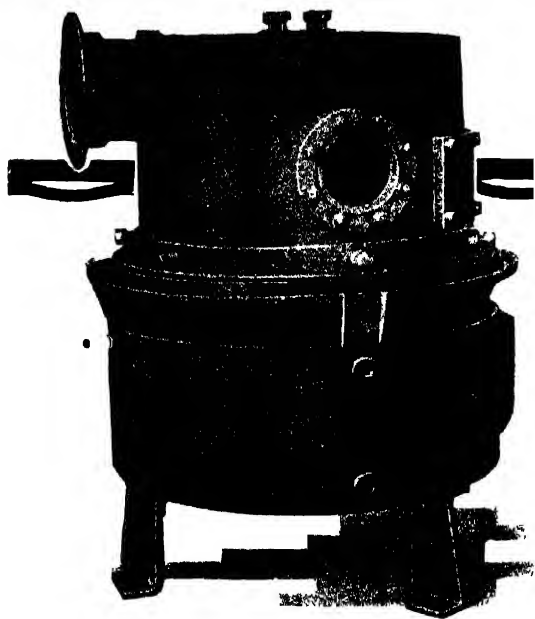
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has the charm of leaving the roadways and gangways unimpeded for other floor traffic, and, as the illustration (Fig. 16) depicts, can find support for its track by the

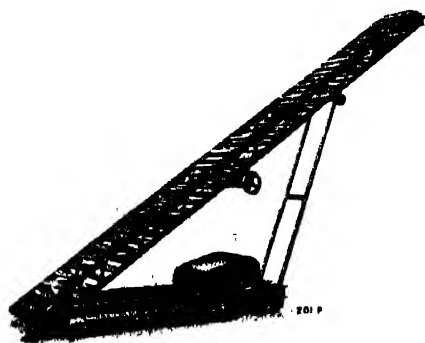


FIG. 23

assistance of works buildings. A combination of telfer and travelling crane presents many advantages in handling bulky goods, and an excellent example of this



FIG. 24

is shown in Fig. 17 (Morris) dealing with the espart bales in a paper works, these being conveniently stacked on arrival and ultimately transported to the grass boilers by the same apparatus.

Not every works provides the necessary head-room for a telfer proper, but the electric travelling hoist, as perfected by the firm of Morris, Ltd., and others, makes a very excellent substitute under the conditions. For minor operations and in smaller works, the hand-operated mechanism of the same character, running on light joist



FIG. 25.—Spiral chute for cases etc.

raiscarried from the roof or the ceiling beams of the rooms, can cover, at a low cost, every part of every department, and while rather detailed in this operation, will, when properly designed, cut out a host of manual operations. Several instances of the application of these devices are shown (Figs. 18 and 19).

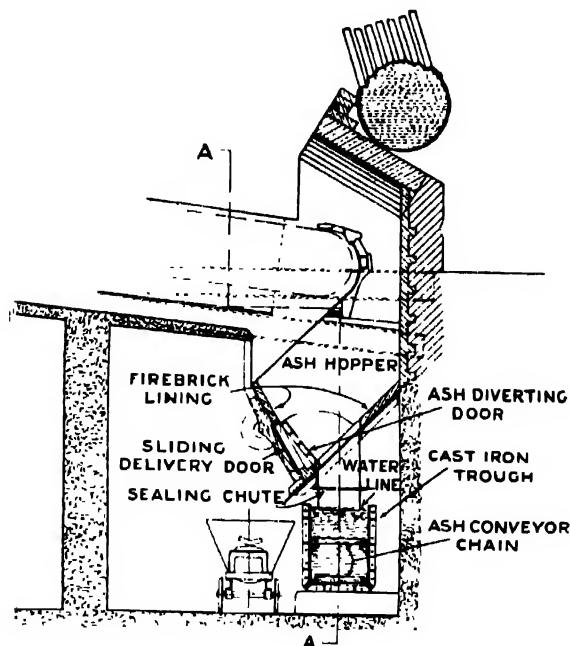


FIG. 26

In spite of every mechanical appliance, floor transit is almost impossible to avoid, but a multitude of ingenious appliances has been produced to save labour, time, floor space and congestion.

The electric truck, now seen on every railway platform, is a particularly economic, silent and handy method where

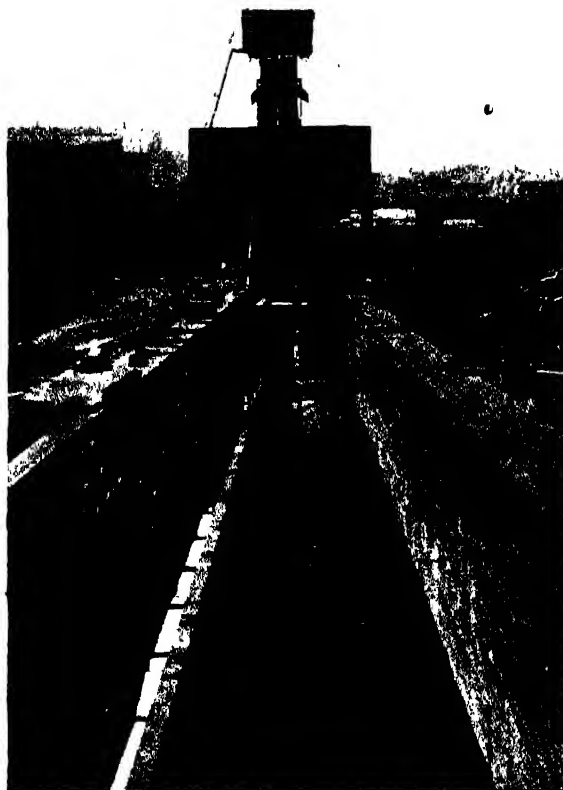


FIG. 27.— Discharge head of sluice ash discharger (Underfeed)

effected by the use of loose platforms, cages, etc. to fit the truck chassis, thus avoiding the frequent immobilisation of the more costly truck in loading and unloading operations. The same system has been developed by Herbert Morris, Ltd., in the case of the hand-propelled platform truck, in which the elevation of the platform is carried out on the truck itself by the depression of the traction handle to the draught position. An illustration of this is seen (Fig. 20) and is self-explanatory, but the multitude of its opportunities for man-power economy can only be realised by comparison with the chaotic bustle and congestion alternating with periods of idleness seen in many works and stores.

THE DISPOSAL OF FINISHED PRODUCT AND WASTE

As in the case of the raw material, this work is divided into bulk products and detailed packages, but now the latter predominate. Many of the appliances previously described for the unloading obviously apply to the off-loading, and there is no need to make special reference to them (Fig. 21). The advantage of a hopping system for bulk goods, delivering direct to railway trucks, requires no thought. A favourable instance of this will be seen in the arrangements for loading trucks with coke at the gas works, where the bunkers are situated at a satisfactory level for the purpose, and are fed by a tipping tray conveyor (Babcock & Wilcox, Fig. 22). In many cases, owing to the spasmodic deliveries of the coke, recourse has to be made to the system of storing in the open, exactly similar to that applying to coal, described earlier.

The handling of boxes and other packages in the process of packing can be admirably conducted with the use of the minimum of power by the employment of the

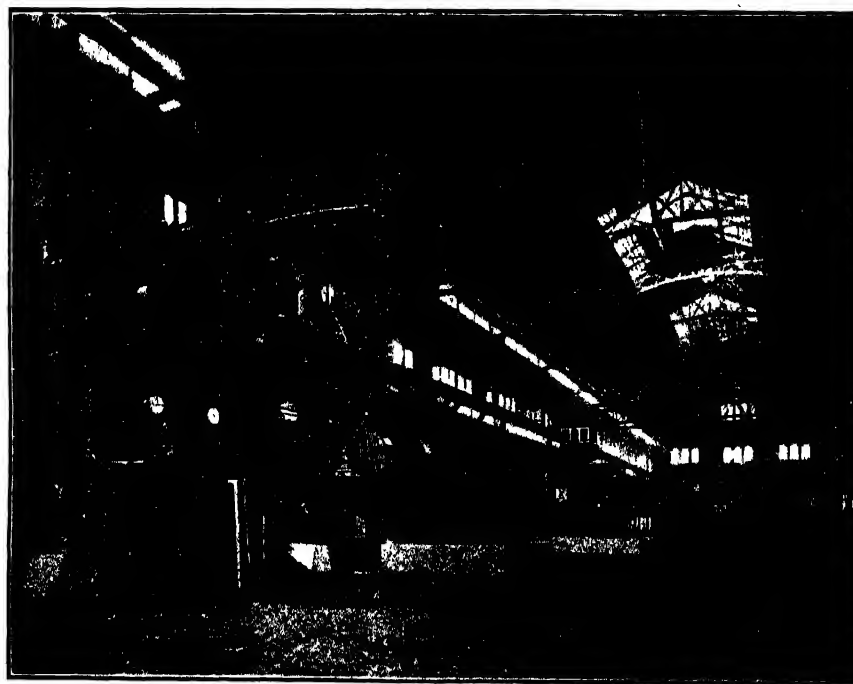


FIG. 28.—A combined handling plant dealing with the revivication of spent oxide (Dempster)

the floors are on the level and of suitable surface. Considerable economy in rolling stock of this nature may be

gravity roller track, of which several illustrations are here presented.

The rollers are mounted in ball bearings and of a width slightly in excess of the largest package concerned. The track requires an inclination of only 1 in 33 to enable the articles to propel themselves by gravity. Where it is necessary to descend from floor to floor immediately, the spiral form is a practical solution, requiring a diameter only of 8 ft. Where it is necessary to increase the elevation either to reach another floor or as a booster to give fresh elevation for further service on the same floor, a double-chain covers this section of the track with bars from side to side to engage with the article and

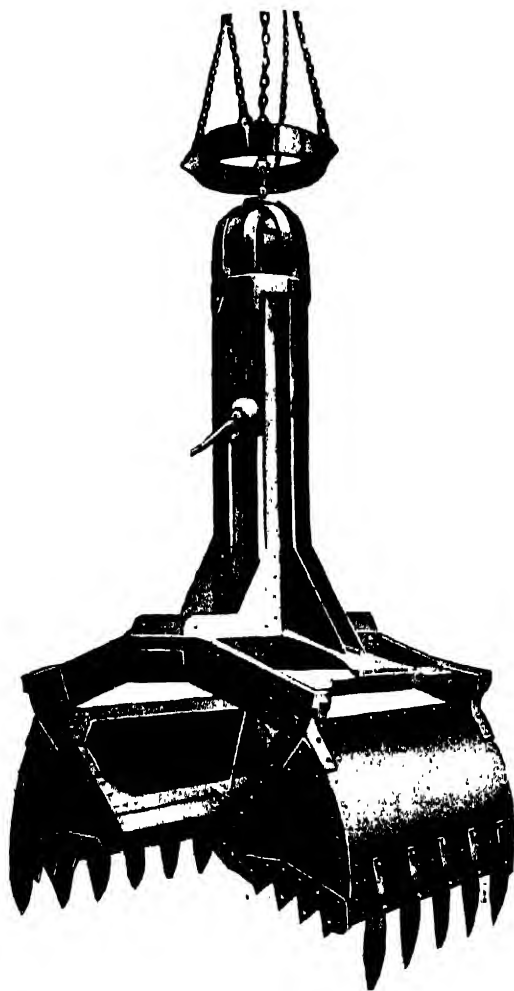


FIG. 29.—A single chain grab by Rose, Downs and Thompson

thus propel it on the same frictionless track till the desired elevation is reached. The inclination may be varied by the employment of adjustable standards to the track itself, and its adaptability is endless.

The roller system is admirably suited for loading direct to lorries, either from an upper or from a lower floor. A particular application of the band conveyor for dealing with casks and barrels has the merit that it does not interfere with the cross traffic on the same floor. Many of these appliances, such, for instance, as the

slack elevator, are available in a portable form. The illustration (Fig. 23, by W. J. Fraser & Son) shows one such device, while Fig. 24 (Herbert Morris, Ltd.) illustrates a hand-operating machine for stacking and unloading cases, sacks, barrels, etc. in restricted spaces.

The handling of ash and other such waste is the purpose of a variety of transporters, and becomes quite an important problem in a large boiler installation. Perhaps one of the happiest solutions of this problem is found in the water sluice of the Underfeed Stoker Co., which takes the form of a concrete trough in the ash tunnel at the back of the grates, either inclined at sufficient angle to permit the solids to be flushed away direct where the ground levels suit, or arranged horizontally with a drag chain conveyor and elevator for removing the solids and in one operation conveying them to the point of discharge, whether this be a hopper for loading wagons or a settling pit for removal by grab. The ash discharge is sealed in an inch or so of water, and this prevents the entry of air to the furnace—a point of very considerable importance. Moreover, the sudden quenching of the ash and clinker reduces the latter to a final state of division in which it is much more saleable, where any sale exists (Figs. 26 and 27).

The scope of this short article does not permit dealing more fully with many appliances and their application. The chief difficulty in taking an open view of transport in old-established works is the trammels of custom and usage, and this may effectively be avoided by bringing as much new brains as possible to bear on the subject.

CANADIAN HYDRO-ELECTRIC POWER

The Quebec R. L. H. & P. Co. has purchased all the properties and interests of the Corporation d'Energie Electrique de Montmagny and its two subsidiary companies. This places the power and lighting of a number of counties on the south shore of the St. Lawrence River, below Quebec, in the hands of Montreal power interests. The transaction involves holdings and property of a value of approximately \$2,000,000.

Construction work is progressing on the Grand Falls, New Brunswick, hydro-electric development of the St. John River Power Co. (subsidiary of International Paper Co.). This will be the largest hydro-electric development in the Maritime Provinces, and will be initially 60,000 h.p.

The Shawmigan Water & Power Co., Ltd., through its subsidiary, Beauharnois Electric Co., Ltd., has purchased, from the Montreal Cottons, Ltd., the Valleyfield Electric Co., which has been supplying power and light to the industries in Valleyfield and adjacent municipalities. This development will probably prove of importance in the further introduction of industries into the south-western section of Quebec. By this purchase the Shawmigan Co. has consolidated its position on the south shore of Lake St. Louis, and extended it practically to the international boundary of Quebec and New York. This will probably result in the development of industries in a large number of the smaller thriving towns and villages of South-west Quebec, where there is a plentiful supply of good labour and excellent transportation facilities.

"IN CANADA WITH THE EMPIRE MINING AND METALLURGICAL CONGRESS"

By A DELEGATE FROM GREAT BRITAIN

(Concluded)

Our itinerary then took us through the city of Calgary to Banff Springs Hotel, in the "Canadian Pacific Rockies," where rain and snow occasioned the cancellation of our intended visit to the Turner Valley oilfield, in south-western Alberta. Disappointment was natural, but the glorious mountain views on the second day of our stay seemed at the time generous compensation.

Next we visited the Galt mines of the Canadian Pacific Railway, at Lethbridge, where a sub-bituminous coal, suitable for domestic purposes, is being mined from one seam 4 ft. thick. On the same day our trains took us—the "Blue Train" to the collieries at Blairmore, Alberta, and the "Red Train" to those at Fernie, B.C., both in the Crow's Nest Pass through the Rocky Mountains. Here we witnessed the operation of coal cleaning and screening, mainly for the use of locomotives on the Canadian Pacific Railway Company. A visit was also paid to the generating station at Sentinel, Alberta, on Crow's Nest Lake, of the East Kootenay Power Company, which has here a stand-by plant operated by steam boilers, fired by pulverised coal, and intended to supplement their hydro-electric plants at Aberfeldie, on the Bull River, and at Elko, on the Elk River.

From the Crow's Nest Pass we proceeded westward to Kimberley, where we had one of the most remarkable experiences of the tour, being conducted through the workings of the famous Sullivan lead-zinc mine of the Consolidated Mining & Smelting Company of Canada, visited a fortnight previously by H.R.H. The Prince of Wales and his brother, Prince George. Here we indulged in Alpine climbing in great stopes large enough to hold a small cathedral and lighted up by searchlights. The mine has an extremely complex ore, and until some time during the war was of little value, owing to the difficulty of separation. The war crisis led, however, to successful research work, as the result of which this mountain has become the world's greatest lead and zinc mine. The ore brought out, after going through various stages of crushing in a mill, which takes it by gravity down to the track of the C.P.R., is transported in 68-ton cars to the great concentrator a few miles down the line. Here, in one of the best-designed plants to be found anywhere in the world, four thousand tons of ore daily—ultimately to be enlarged to six thousand tons a day—are treated to separate the intimately-mixed lead, zinc and iron sulphides. After very fine grinding, the ore goes to mechanically-agitated surge tanks, which feed the lead flotation machines, the reagents necessary for the lead separation—soda ash, sodium cyanide, coal-tar creosote, and water-gas tar having been added in the fine-grinding circuit. The first lead concentrate carries about 50% lead and 10% zinc. Cleaning machines bring this up to 65% lead and 5% zinc, the concentrates being filtered and sent to loading bins preparatory to shipment to the trail smelter.

Preparatory to the flotation of the zinc, copper sulphate is added to the tailing from the primary lead machines, forming the feed to the zinc machines. The

pulp, heated to 25° C., with added water-gas tar, proceeds to M.S. machines, which make a lead-zinc concentrate, a zinc concentrate, a zinc middling, and a tailings product. The first is put over Plato & Wilfley tables, making a lead-iron product, which is returned to the fine-grinding circuit, and also a zinc concentrate and a zinc-iron product. The tailings are classified to form a concentrate, and the zinc middlings from the flotation machines, together with the classifier concentrate and the zinc-iron middling from the tables, are reground in a Hardinge ball mill in closed circuit with a rake classifier, and are then retreated in a flotation machine, which produces a concentrate that goes back to the tables and a tailing which goes back to the zinc-roughing flotation machines. The zinc concentrate from the primary zinc flotation cells, added to that from the tables, is thickened in Dorr thickeners, filtered in American filters, and sent to bins for despatch to the smelter at Trail.

The following morning found us at Kootenay Landing, where the trains were taken on board ferries, whilst we, on the s.s. *Nakootin*, took a trip down Lake Kootenay, first to the Bluebell lead mine at Riondel, and in the evening landed in the rain at the city of Nelson—a very charming place in the sunshine, I believe. Dinner was enjoyed in the new buildings at Lower Bonnington Falls of the West Kootenay Power & Light Co., Ltd., after a visit to the hydro-electric power development at Upper Bonnington Falls, where 60,000 h.p. is generated for use at the mining, milling, and smelting plants of the Consolidated Mining & Smelting Company and other industries in the neighbourhood. The next morning we arrived at Tadoussac (Trail), doomed to devote two hours or thereabouts to the detailed examination of the greatest metallurgical plant in the British Empire, which my metallurgical confrères declare calls for no less than a month of concentrated study. The plant covers 250 acres, and includes a zinc smelter, a copper smelter, an electrolytic zinc-reduction plant, electrolytic lead and copper refineries, a gold and silver refinery for the "impurities" of the ore, a hydrofluoric and hydrofluosilicic acid plant, a sulphuric acid plant, a bluestone plant, a copper-rod mill, and many auxiliary plants.

Away then, jogging and bumping along the horse-shoe and hairpin bends of the Kettle Valley Railway, through the mountains to Princeton, from which station we proceeded on a train of observation cars to climb the 5000 ft. of Copper Mountain. Access to the mine on the summit was secured by a cable elevator hauled up the face of a cliff, giving the mining engineers of the Empire an excellent view of the gorge a mile below, where their careers would come to a sudden finish should anything happen to the slender wire rope upon which their lives depended. The concentrator, to which we returned late in the evening, has a daily tonnage of 2000 tons, and in 1926 some 669,306 dry tons was treated, containing 3985 oz. of gold, 137,480 oz. of silver, and 17,752,253 lb. of copper. The concentrate produced is sent for refining to the Trail smelter of the Consolidated Mining & Smelting Co., Ltd., though the copper mine and concentrator is one of the properties operated by the Granby Consolidated Mining, Smelting & Power Co., Ltd.

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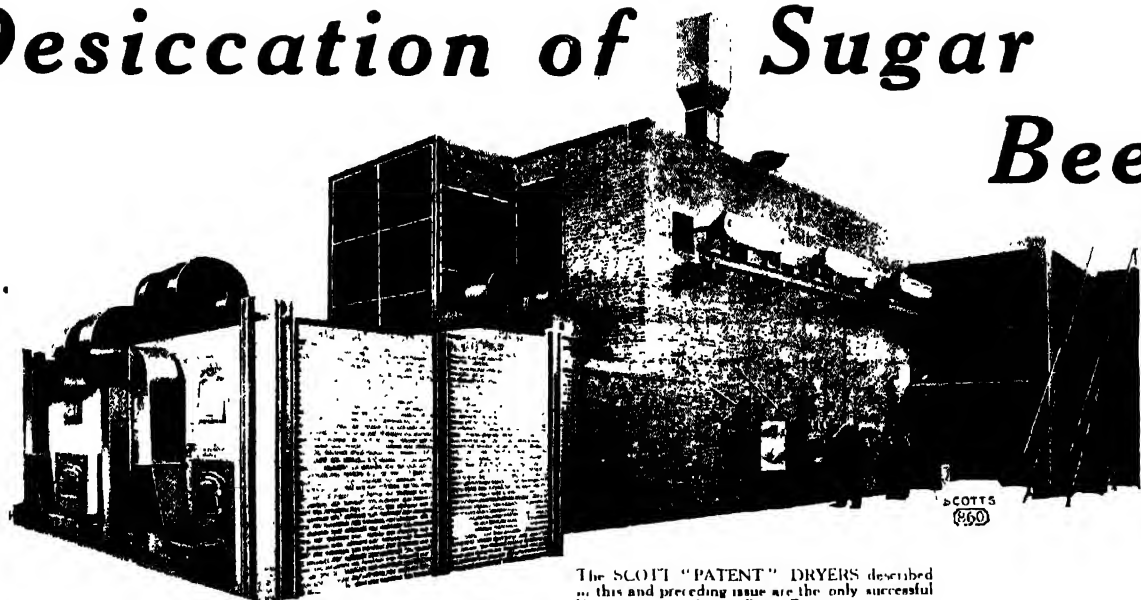
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From Copper Mountain we passed on to Vancouver and Victoria, where three very pleasant days were passed in recreation, apart from the short Vancouver technical sessions. In Vancouver also the writer had an opportunity of inspecting the operations at one of the great lumber mills, where huge Douglas fir or cedar logs 5 or 6 ft. thick were sawn up into planks and laths of every size and converted into panelled doors.

The steamer which brought us from Victoria to Vancouver made a détour up the Howe Sound to enable us to visit the concentrator of the Britannia Mining & Smelting Co., Ltd., beautifully situated on Britannia Beach. The plant, which has a daily capacity of 2500-3000 tons of ore, produced last year concentrate containing 9995 oz. of gold, 148,113 oz. of silver, and 30,954,479 lb. of copper, as well as iron pyrites, which is exported to sulphuric acid plants.

From Vancouver the Congress trains proceeded by the Yellowhead Pass into Alberta, where at Jasper we spent two most enjoyable days in the National Park, enjoying motor drives to Mount Edith Cavell and other points, hiking through the woods, golf, and other pleasant variations from the examination of ores and machinery. Again passing eastward through Edmonton, we detrained at Wainwright to see the oil and gas wells at that point. Here, up to the present, production has not reached the point at which it can be considered an economic proposition. Elsewhere in the province, however, natural gas is produced in large quantities and conveyed by pipe line for many miles to serve industrial plants and domestic consumers in places like Edmonton, Calgary, and the smaller towns. Gasoline is produced in the Turner Valley by chilling the natural gas, but one crude-oil well has been discovered.

From Wainwright our route took us by way of Saskatoon, Winnipeg, Fort William, Port Arthur, and Cochrane to Noranda, the centre of the new Rouyn copper-mining district of North-Western Quebec. Here, in what was three or four years ago a primeval forest reached only by aeroplane or canoe, the Noranda Company is building a new town and a smelter, which they expect to open before these lines appear in print. The Congress visited the new smelter in the morning of Sunday, September 25, and, incidentally, we had what must be the unusual experience of taking liquid refreshment in the interior of a reverberatory furnace. Provision is made in the plant for crushers in three stages; for eight ore roasters, two reverberatory furnaces, two Peirce-Smith converters, a copper refinery, a pulverised coal plant with eleven concrete storage silos for use in smelting operations, a Cottrell electrical precipitator, and a stack 422½ ft. high, 31 ft. in diameter at the base.

Our trains passed on from Rouyn, and after a night journey we reached Quebec, where after further technical sessions we entrained once more and travelled over the great Quebec Bridge to Thetford Mines, the centre of the asbestos country. Visits were made to the Black Lake, British Canadian, the Bell and other properties of the Asbestos Corporation of Canada, Ltd., and the mining and milling operations examined in some detail. The principal operations in the mill are the crushing of the ore and the mechanical screening and weighing of the various grades of fibre. The country is piled high with

mounds of waste asbestos sand, for which no economic use has yet been found.

The trains left Thetford on their last lap, reaching Montreal on Tuesday evening, and here the Congress Tour "A" came to an end, delegates separating some to return home to England, South Africa, or to some other distant corner of the world, and the writer to try in some measure to follow in the footsteps of Tour "B," and to see something of the power developments at Shawinigan Falls and Grand' Mère; the power, paper and aluminium works at the head of the Saguenay; and the collieries and steelworks at Sydney, Cape Breton Island.

Of these, undoubtedly the most remarkable is the immense concentration of energy at Arvida, in the Lake St. John district of Quebec, where cheap electrical power estimated to be capable of development up to 1,340,000 horse-power has justified the establishment not only of large pulp and paper mills and of a hydro-electric central station for the long-distance transmission of power, but of a plant which, with its accessories, will eventually cost about \$100,000,000, and is already engaged on the production of aluminium. At the moment the production of aluminium pig reaches only a million pounds a week, but when the new power plant at Chute à Caron across the river is completed with its ten great 80,000 h.p. generators, producing 800,000 h.p., the output of aluminium at Arvida will be 90% of the *present* world consumption. Production at the moment is from bauxite, previously dried and purified in American plants, but vessels are already coming up the Saguenay River bearing bauxite from British Guiana. These same boats will be taking out loads of wood pulp and paper produced at Port Alfred and elsewhere in this great forested district stretching hundreds of miles northward in the direction of Hudson's Bay.

At Shawinigan Falls I visited the two power plants of the Shawinigan Company, and the ingot, wire rod and wire mill of the Aluminum Corporation of Canada, as well as the calcium carbide plant of the Canadian Carbide Co. and the Laurentide paper plant at Grand' Mère.

Bringing my long journeyings to a close on the Atlantic coast, I paid visits to the famous No. 1-B submarine colliery of the Dominion Coal Company at Glace Bay, and ended up the day at the great ore and coal shipping pier, coke-ovens and steel works of the Dominion Steel Corporation, forming one of the subsidiaries of the British Empire Steel Corporation. This concern claims to derive quite an unusual proportion of its material from British territory, its coal coming from the Cape Breton mines; its limestone from local quarries; many of its firebricks are made in the plant; its iron comes from Bell Island, Newfoundland; and its fourteen ocean-going steamers, with a deadweight capacity of 70,000 tons, take steel products, sulphate of ammonia, and iron ore to Australia, New Zealand, Japan, Europe, South America, and the West Indies. The plant's capacity includes 580,000 tons of pig iron; 420,000 tons of steel ingots; 375,000 tons of blooms; 150,000 tons of billets; 240,000 tons of rails; 90,000 tons of wire-rods, wire, barbed wire, etc.; 60,000 tons of wire nails, fencing, etc. The sulphate of ammonia from the coke-oven plant is shipped almost entirely to the sugar plantations in Cuba and the West Indies.

above that it decided to put down for the 1927 campaign a larger machine to work alongside the first.

enter the lower drying chamber circuit prior to mixing with the re-circulated air in the circulating fan. Fig. 10

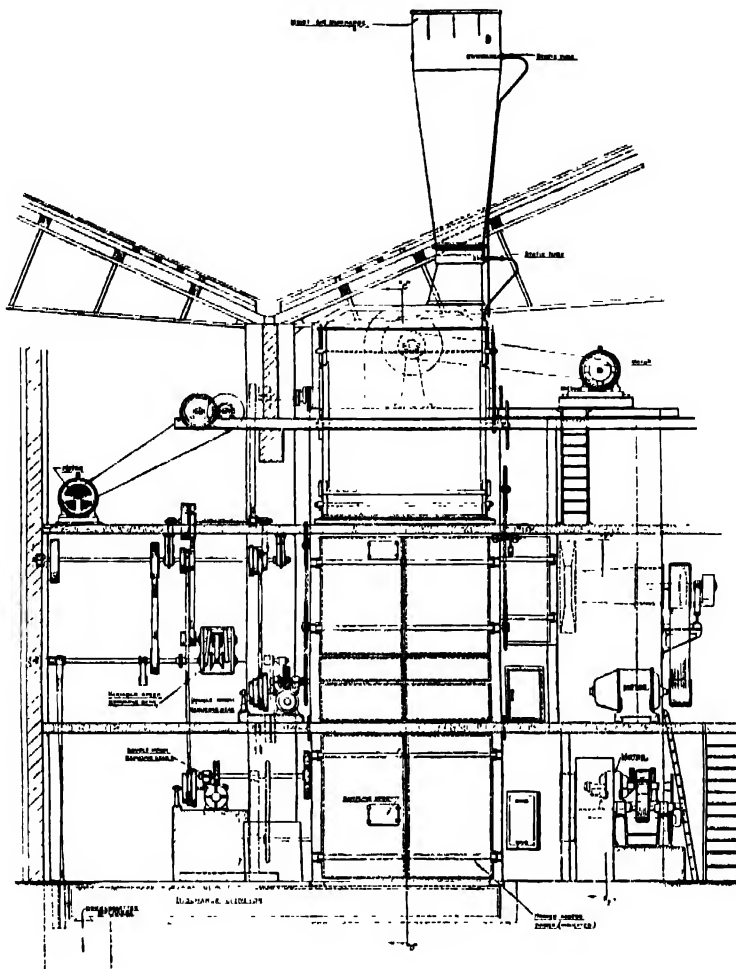


FIG. 9A

Band dryer for sugar beet

In order to minimise Customs charges, a portion of the material was provided in Italy to drawings sent out, but essential parts, such as fans, driving mechanisms, chains, control fittings, etc. were sent from this country. This plant is now erected and working. It is practically a duplicate of the earlier, except in several minor details which embody the results of experience with the earlier machine, the method of feeding the wet cossettes, the provision of a further drying band in the top drying chamber, and the use of oil fuel in the furnaces.

It is proposed to describe this machine in rather more detail. Figs. 9, 9A and 9B show an elevation of the complete machine, excluding the oil furnaces—these come on the right-hand end of the machine—and also an end elevation looking from the feed toward the furnace end. It also shows a section through the main flue showing five of the butterfly dampers controlling the flow of the hot furnace gases into the circulating gas passing through the upper drying chamber, and also the mixing chamber, wherein fresh atmospheric air and hot furnace gases

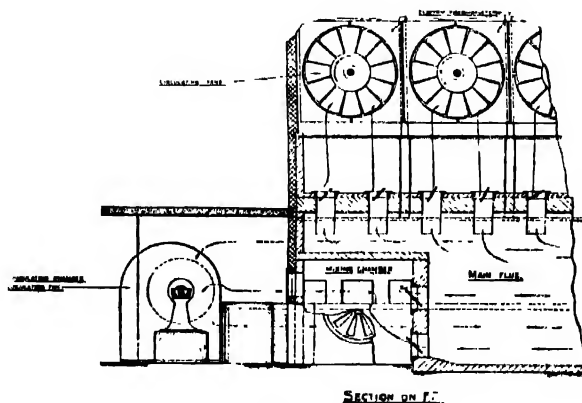


FIG. 9B

Band dryer for sugar beet

shows a section through the two drying chambers and a cross-section through the machine showing drying

chambers, flues, and a small section of the feed, elevator, etc.

DRYING CHAMBERS

The drying chambers measure approximately 49 ft. long by 9 ft. wide. The walls are of concrete slabs filling in the space between the steel members of the framing. Hinged double-walled steel doors at each end of the machine give access to the interiors and a series of doors midway along one side give access to the chambers, bands and chain.

DRYING BANDS

Four endless drying bands are provided in the top chamber and two in the lower or coagulating chamber. Each consists of a number of stout wire panels hinged together and attached to the endless band chains provided for moving the bands. These chains run on steel bars and pass over chain sprockets at each end

air is kept in constant circulation through the top drying chamber by the six large propeller fans directing the air horizontally over the full length of the chamber and through openings approximately half-way up the inner wall. Hot furnace gases from the main flue are gradually mixed into the air in circulation, this supply of furnace gases being regulated by the six pairs of butterfly dampers indicated. Part of the air is exhausted constantly through a pre-determined section of the top drying band by the main withdrawing fan placed on top of the dryer. The exhaust to atmosphere is through the Venturi shape exhaust head. The butterfly dampers are connected by adjustable rods to the control panel, and are operated from that point in accordance with the temperatures registered by electric resistance thermometers placed in the paths of the re-heated circulating air. One thermometer is provided for each circulating fan. The Cambridge indicating instrument giving the

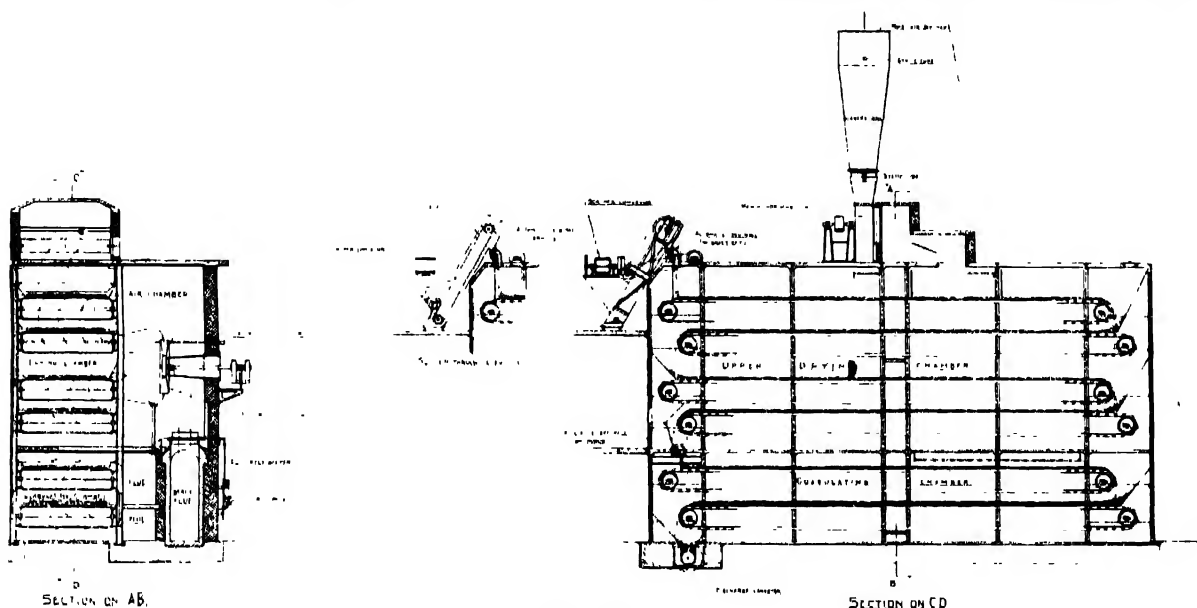


Fig. 10

Band dryer for sugar beet

of the machine. The driving shafts of the four top bands are coupled together by external driving chains and a double worm reduction gear box provided with a four-step belt pulley taking its drive from a similar pulley on a countershaft. The two bands in the lower chamber are also coupled together and to a similar double worm reduction gear. The bearings carrying the band chain sprocket spindles are placed outside the drying chambers, and special arrangements are provided for adjusting the working tension of the band chains. Beet cosettes are kept out of contact with the band chains by suitable protecting plates, and the beet is directed in its fall from band to band by steel deflecting plates arranged in the ends of the machine.

AIR CHAMBERS, FLUES, AIR CIRCULATION, CONTROLS, ETC.

The arrangement of the air chambers, flues, etc. will be clear from the cross-sectional view in Fig. 10. The

temperatures of all the thermometers is mounted on the control panel, which also carries a draught gauge indicating the pressure in the main flue and a differential gauge recording the difference in static pressure at the throat and outlet of the Venturi discharge head.

The fan for circulating the air continuously through the bottom drying chamber is shown on the left-hand side of the front elevation in Fig. 9, and the withdrawing fan shown on the right-hand side just above the extended main flue. The air is re-heated, before entering the circulating fan, by the admission of hot furnace gases from the main flue through two horizontal ports into the mixing chamber indicated in the part of the sectional elevation in Fig. 9b. It will be remembered that cold air is also admitted into the suction of this fan, and this passes through the rotary damper partly shown in the same view. These dampers are regulated by adjustable rods from the control panel, according to the indications of an electrical resistance thermo-

meter. The heated air is delivered below the bottom band and passes upwards through the bands and two layers of beet cossettes thereon. The air from the furnace end of the machine is withdrawn through a steel grid and returned to the main flue by the withdrawing fan, whilst the remaining air returns to the circulating fan.

Wet and dry bulb thermometers, also of the electrical resistance type, are placed in the air passages leading from the top of the dryer to the main withdrawing fan. In addition, certain other points of the machine are wired to the indicating instruments, so that temperatures can be taken in various parts of the machine by movable thermometers with plugging connexions. The operator can thus (without moving from the control panel) ascertain the air temperatures in various vital parts of the machine, and can alter these temperatures by regulating the necessary dampers. He also knows the draught conditions in the main flue, has a measure of the amount of air leaving the dryer from the reading of the differential draught gauge, has an indication of the hygrometric state of the air leaving the machine by the readings of the wet and dry bulb thermometers, and can make the necessary adjustments to obtain the best conditions. He has under his control, therefore, the complete working of the plant, apart from the feeding of the wet material. He is also in close touch with the firemen operating the furnaces.

During 1926 the operator recorded these various temperatures, the readings of the draught gauges and the ampère meters carried on panels alongside the control panel, and also recorded the weight of wet beet fed into the machine. For part of the season readings were taken every half hour, and for the remainder of the season every hour, and this season it is anticipated that the one operator will control the 100- and 70-ton machines and register the temperature readings etc. It is thus possible to trace any alteration in the operation of the plant and to vary the instructions given to the operator in accordance with the drying results obtained.

Given correct wet and dry bulb readings and reliable readings of the differential gauge registering difference in static pressures in the throat and enlarged sections of the Venturi head, it should be possible to obtain at any moment the approximate volume of wet air leaving the machine and the weight of water vapour contained therein. The arrangements of the machine did not permit of accurate results being obtained, but the provisions made gave valuable indications of the performance of the machine when starting up the plant in the first place. The readings also enable the operator to ensure that a correct volume of air is leaving the plant to give the best drying results and to ensure that the air is saturated as fully as possible. To correlate the readings of the wet and dry bulb thermometers and the differential draught gauge, the psychrometric chart (Fig. 3) and the curves in Fig. 12 were used. From the psychrometric chart the wet and dry bulb thermometer readings enable the dew point to be determined, and this defines the relative weights of water vapour and dry air in the mixture. By assuming that the density of the mixture as discharged is the same as the density of the same mixture at the dew point, and knowing the areas

of the throat and enlarged section of the Venturi head and the differences in pressure, all the data are provided for determining the volume of wet air discharged and the weight of water vapour contained therein. The volumes, in cubic metres per minute and the weight of water vapour in kilos per hour for one millimetre reading of the differential gauge are plotted in Fig. 12. To correct the results thus obtained the volumes and weights are multiplied by the square root of the differential gauge reading. The wet and dry bulb thermometers, the differential gauge reading, and the charts therefore provided a very valuable indication of the performance of the machine at any particular moment.

PASSAGE OF BEET THROUGH DRYER

The wet cossettes are transferred from the cutting machines to the 70- and 100-ton dryers by a scraper conveyer, provision being made to give a rough division of the beet for the two machines. They drop from the

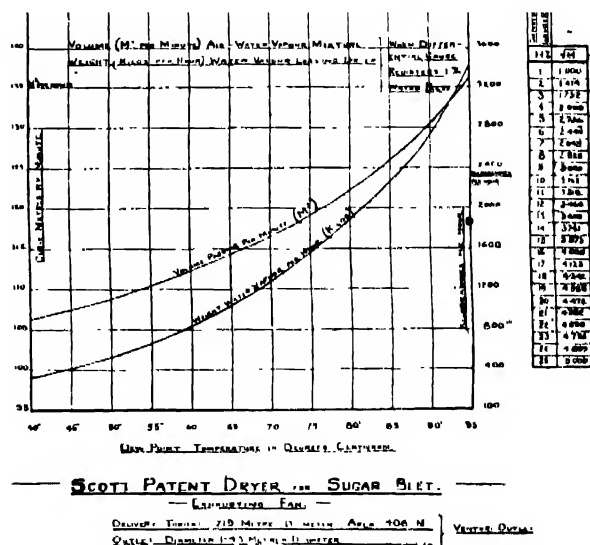


FIG. 12

conveyor into a hopper, one side of which is formed by an inclined elevator band made of light steel sheets hinged together and running over cast-iron spiders fitted to the top and bottom shafts and fitted with light steel lifting angles. This elevator is driven through belt and chain gear from the main countershaft. A variable reduction gear forms one link in the power transmission, thus permitting the speed of the elevator to be adjusted to suit the particular feed desired. The beet is discharged over the top of the elevator feed into an automatic, intermittently revolving feeder working inside a cast-iron casing and delivering beet into the dryer chamber in such a manner as to minimise leakage of air into or from the dryer.

This feed roll and feed elevator are directly coupled together for driving purposes, the speeds of both being controlled by the variable speed reducing gear. The wet cossettes drop from the feed roll on to the top drying band travelling thereon to the other end of the drying chamber, where they are discharged on to the second or

next lower band. In this manner the cossettes travel four times the length of the top drying chamber on the four bands provided before being discharged through the continuously revolving feed roll on to the top band in the lower drying or coagulating chamber. The cossettes are almost completely dry on entering the lower compartment, and the drying is completed on the top band in that compartment. The second and lower band runs at a much slower speed than the other five bands, and is specially provided for subjecting the dried cossettes to the coagulating temperature for the requisite period. The dried and coagulated product is discharged from the dryer by means of a screw conveyor through an air lock, and is delivered to the cossettes store.

It is not possible within the limits of this paper to describe fully all the mechanical details of the dryer, but probably the particulars given cover most of the important features. The design has been patented by the manufacturers.

DRYING RESULTS

At the moment full details of the running of the 100-ton machine are not available. Particulars of the early running taken from the log book have reached this country, but have not been completely analysed. Commercially, however, the results are quite satisfactory. Both machines are at work producing very satisfactory cossettes from a crop which, for Italy, is exceptionally high in sugar content. The fuel consumptions are extremely low, and there is no trouble from unconsumed fuel oil being carried forward to the cossettes from the burners. The cossettes answer satisfactorily the very delicate chemical tests used in the laboratory for determining the completeness or otherwise of the coagulation.

COMPARISON WITH OTHER SUGAR BEET DRYERS

Various other types of dryers have been used for drying the sugar beet cossettes, mostly in Italy. In an earlier part of this paper the greatly increased air circulation in the present machines as compared with the Loreo dryer (described in the White Paper) is referred to. This increased circulation is essential for a high thermal efficiency.

Another important difference between the "Scott" dryers and the earlier Loreo dryer is the form of the drying bands. The Loreo bands were constructed of a number of narrow steel plates with the ends turned over to form a hinged joint and connecting with the adjoining panels. These plates were perforated with a number of 3 or 4 mm. diameter holes, giving an approximate combined area through the bands for the passage of the air of from 16% to 28% of the whole band area. With the special wire panels described the area through the panels amounts to 47%. Further, small fragments of beet worked their way into the hinges of the plate panels, thus deforming and finally destroying these joints. No such trouble was experienced with the wire panels.

In the modified Loreo dryer considerable difficulty arose due to the Italian chains not being of equivalent quality to the English chains used at Sanguinetto. Also the air circulation provided, although greatly increased over previous practice, was not of the same order as at

Sanguinetto. Actually, the circulation in the "Scott" dryers is very much greater than the circulation provided in any other design of dryer used in this particular work.

At another Italian works a large German rotary dryer was put to work for the drying of beet cossettes, but even after two years' experimental running it has not been possible to produce from this machine satisfactorily coagulated cossettes. The drying appears to be quite complete, but the cossettes do not satisfy the coagulation tests, and are not satisfactory for sugar extraction.

From the arguments put forward earlier, it will be clear that very large air passages are necessary to give the amount of re-circulation required to permit of a low initial temperature in contact with the beet and give a low fuel consumption. It is not possible to give such areas through any reasonable size of cylindrical dryer except by greatly increasing the power used due to the high air resistance resulting from the higher velocities. In the Sanguinetto dryers it will be recalled that the air is passing both vertically up and down through the top drying chamber through cross sectional areas of approximately 360 sq. ft. Part of these areas are, of course, taken up by wires and hinges of the bands and the beet resting on the bands, but even making all possible allowances, the dimensions of an equivalent rotary dryer would be excessive.

It is therefore necessary, with the rotary type of dryer used, in order to obtain a reasonable fuel efficiency, to have a high initial temperature in the air in contact with the beet. In the German dryer the initial temperature decided upon was about 500° C., and in order to minimise the effect of this heat on the beet the hot gases entered with the wet beet. A number of different devices were used in conjunction with this dryer in order to obtain the desired coagulating conditions, but up to the moment without success.

CANADIAN INDUSTRIAL NOTES

The British Columbia Electric Railway Co., Ltd., is extending its gas plant at Vancouver, B.C., by the erection of a gasometer of 3,000,000 cu. ft. capacity, and gas-producing installation having a daily output of a similar amount. This is the first unit to meet the increased demand for gas, and will probably be shortly followed by another unit. The total value of the first unit is estimated at \$650,000. John Keillor, gas engineer of the company, has left for England, where the plant will be constructed.

The Canadian Paperboard Co., Ltd., has purchased a site on the waterfront at Toronto, and will erect the first unit of a mill, costing over \$1,000,000. The company will use about 1500 h.p. of electric energy obtained from the Ontario Hydro-Electric. The company has three mills operating at present on cardboard and pulp—Montreal, Quebec; Frankford and Campbellford, Ontario.

The revised statistics for 1926, issued by the Dominion Bureau of Statistics, show that the cement production was the highest ever attained in the country, being 7.2% higher than in 1926. The output was 9,041,411 bbls. Imports of cement amounted to 21,114 bbls., valued at \$77,866, whilst the exports were 285,932 bbls. The selling price of cement was slightly lower during 1926 than in the previous year.

HARRISON MEMORIAL LECTURE: PRESENTATION OF MEDALS

On November 8 a Harrison Memorial Lecture was delivered in the theatre of the Pharmaceutical Society by Mr. A. Saville Peck and Harrison Memorial Medals were presented to Mr. Peck and to Mr. Francis H. Carr, C.B.E., President of the Society of Chemical Industry.

In his lecture Mr. Peck paid tribute to the services given by Harrison to the cause of pharmacy and outlined the part he played in the discussion which eventually led to the amalgamation of the Pharmaceutical Conference with the Pharmaceutical Society. Speaking of Harrison's advocacy for the inclusion of biochemistry in pharmaceutical examinations, the lecturer said that pharmacy was not keeping pace with recent developments in biochemical methods. The newer animal products, with few exceptions, found no place in the Pharmaceutical Society's curricula, whereas vegetable drug treatment, except where of proved value, tended to decline. He concluded by advocating the establishment of a post graduate course in pharmacy.

After a vote of thanks to Mr. Peck had been passed, the chairman, Mr. H. Skinner, said that the lecture they had heard was the first, though in practice it was the second. Originally a prize was instituted for the pharmacist of not over five years' standing who contributed the best paper for the advancement of pharmacy and chemistry, but the response was unsatisfactory and the trustees established a Memorial Lecture to be given bi-annually, and decided that the first medal should be awarded to Mr. Carr, who gave the first memorial lecture. Mr. Carr was very well known to many of them, and he remembered that when he gave his memorial address on Harrison it was one of the finest things they had had in that lecture theatre. Handing then the medal to Mr. Carr, the Chairman said nothing could give him greater pleasure than to be able to hand him a replica of the medal and of the plaque; he trusted it would always remind him of a very dear friend.

Mr. Carr took the medal amid great applause, and replied that it was a very happy thought and a very gracious act that when instituting this lectureship on the new basis they should have given this medal in recognition of an address he gave there some year or less after Harrison's death. It added to the debt of gratitude he owed to the Pharmaceutical Society. It was some thirty-six years ago, when a boy of nineteen, that he first was introduced to pharmacy. It was in those laboratories that he devoted himself to what had been the greatest pleasure of his life, and there it was that he first met the man whom they had met to-night to honour. He was the first man he met when he came there, and he had exerted as powerful an influence on his life as his coming to that society did, an influence not only on his practical life but on his insight into character. For Harrison was first and foremost a man of character. He set an example which could help and had helped all who came in contact with him. He thanked them very cordially for the gracious act of presenting him with the medal.

Subsequently the Chairman presented another medal to Major Peck for the lecture delivered that evening.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

LIST OF MEMBERS ELECTED

November 11, 1927

- Aeschlimann, John A., bei Firma Hoffmann La Roche & Co., A.G. Basel 2, Switzerland. Chemist.
- Ball, Colin B., 104, Tottenhall Road, Wolverhampton, Assistant Works Manager.
- Beilensohn, Bernard, Heaton Cottage, 94, Bury Old Road, Higher Crumpsall, Manchester. Chemist.
- Brock, Raymond B., West Hill Cottage, Oxted, Surrey. Chemist.
- Connor, Dr. Robert J., The Woodlands, Crescent Road, Crumpsall, Manchester. Research Chemist.
- Dickson, John B., c/o A. G. Spalding & Bros., Chicopee, Mass., U.S.A. Director of Research.
- Freudenberg, Dr. Karl, Chem. Institut, Akademiestr. 5, Heidelberg, Germany. University Professor.
- Liang, C. L., Chemistry Department, Tsing Hua University, Peking, China. Lecturer.
- Lloyd, Dr. Dorothy J., The Lister Institute, Chelsea Gardens, London, S.W.1. Director of the British Leather Manufacturers' Research Association.
- Nave, Geo. M., 94, Park Road, Wallsend-on-Tyne. Analytical Chemist.
- Parry, John, The Laboratory, De Beers Consolidated Mines, Ltd., Kimberley, C.P., S. Africa. Analytical Chemist.
- Riding, Richard W., 17, Victoria Terrace, Ditton New Road, Widnes. Research Chemist.
- Robinson, Edwin B., 5, Wilfred Street, Moston, Manchester. Chemist.
- Simmons, William C., Geological Survey of Uganda, P.O. Box 9, Entebbe, Uganda, E. Africa. Petrologist and Chemist.
- Staley, Godfrey A., 74, Lansdowne Road, Tottenham, London, N.17. Chemist.
- Vickers, A. Eric J., 27, Lily Street, Wolstanton, Stoke-on-Trent. Chemist.
- Watts, Gordon E., "The Woodlands," Crescent Road, Crumpsall, Manchester. Chemist.

BRISTOL SECTION

At the meeting on November 3, a paper was given by Mr. H. R. S. Clotworthy on "The manufacture of viscose artificial silk."

Mr. Clotworthy first outlined the general principles of the manufacture of all types of artificial silk. Cellulose is treated by chemical means whereby it is brought into a homogeneous solution. This solution is then forced through fine orifices into a suitable liquid or heated air, in which the thin jets of liquid are coagulated, and the solid filaments thus formed are wound off continuously as produced.

The viscose process was then described in detail. The raw material generally used is woodpulp in the form of sheets. These sheets are immersed in a solution of caustic soda of mercerising strength, which causes the cellulose fibres to swell. The excess of caustic soda is pressed out, and the resulting solid mass of cellulose and caustic soda is disintegrated in specially-constructed machines until it is obtained in a fine flocculent form. The material, termed alkali-cellulose, is stored in bins at a constant temperature for several days to mature. In the maturing process the cellulose undergoes a change in molecular structure, and this change has an important

bearing on the viscosity of the cellulose solution ultimately obtained. After maturing, the alkali cellulose is treated with carbon bisulphide in revolving vessels. The carbon bisulphide re-acts with the alkali cellulose, forming cellulose xanthate, a solid dough-like substance of an orange colour, which is dissolved in a solution of caustic soda. The resulting solution, called viscose, is the material from which the silk is spun. Before spinning, however, this viscose is filtered very carefully and ripened at a constant temperature until it is ready for spinning.

In the spinning process the viscose solution is forced by pressure through jets containing 20 or more minute holes. These jets are immersed in a liquid which may contain a variety of substances, but the main components of which are sulphuric acid and sodium sulphate. The 20 or more fine streams of liquid issuing from the jet immediately solidify on coming in contact with the sulphuric acid, the solid filaments so formed are passed over a continuously-revolving drum and into a box rotating at high speed, thus being twisted together into a compact thread which is deposited on the inner surface of the rotating box, and gradually builds up on the inside of the box in the form of a cake.

The cakes of thread are removed at intervals, and the thread is wound off into hanks. These hanks are washed to free them from sulphuric acid, dried under tension, then treated with a solution of sodium sulphide to remove sulphur, and after bleaching are washed and dried. The hanks are then wound on to bobbins for hosiery manufacturers or on to pins for wearing.

Mr. Clotworthy dealt with the methods of ensuring uniformity of the yarn, and the problems to be faced in handling artificial silk due to its unique physical properties.

The lecture was illustrated by specimens showing the various stages of manufacture, kindly lent by the Western Viscose Silk Mills, of Bristol, and by lantern slides, many of which were supplied by Messrs. Dobson & Barlow Ltd., of Bolton.

GLASGOW SECTION

A meeting was held on November 9 at the Institution of Engineers and Shipbuilders, Glasgow, when a paper on "Research in the textile industry" was read by Mr. C. M. Keyworth, M.Sc. The chairman of the section, Mr. S. H. B. Langlands, presided.

The lecturer, introducing his subject, said that the best way of meeting the ever-increasing demands of an industry was to utilise the results obtained from research work. The textile industry was no exception, and textile technology had become an exact science. Attention was drawn to the fact that in the linen, woollen and worsted, and cotton and silk industries scientific investigation was now recognised as essential for the future welfare of these industries. With the financial assistance of the Department of Scientific and Industrial Research, associations had been formed in these industries.

Each association had its own technical officers, who were investigating the fundamental problems associated with the industry. Valuable academic information had been already obtained, and much of it had been put into actual practice.

A review of the work accomplished by these associa-

tions was given, and many interesting lantern slides were shown.

The chairman, who opened the discussion, paid a tribute to those who, by individual enterprise and experiment, had fostered the linen industry in Ireland.

Mr. Findlay, speaking more particularly on the problems associated with the cotton industry, referred to the detailed abstracts of the research work conducted in all countries. These abstracts were prepared by the officers of the respective associations, and were issued to all the members. He also mentioned the valuable work which had been done upon the composition of the wax constituents of the fibre. Utilising such information, it was possible to state from which country a particular sample had come. The composition of the wax differed according to the conditions under which the plant had been grown.

Mr. Nuttall referred to the difficulties with regard to specifications for cotton and to the occurrence of "dead" cotton in cloth.

Amongst the others who took part in the discussion were Messrs. MacCallum, Chapman, Jamieson, Gunn, and McArthur. On the motion of the Chairman, a vote of thanks was accorded to the lecturer.

SOUTH WALES SECTION

A meeting was held at the Technical College, Cardiff, on November 1, when Mr. T. Lewis, Ph.C., read a paper on "The care of the eyes in industry."

The lecturer treated the subject under three heads: (i) Hygiene, (ii) Accidents and preventive measures, (iii) Standards of vision and their effect on the efficiency of the worker. Under the first heading he dealt with types of lighting and the conditions which should be avoided. The best type of light was one which approached the yellow of the spectrum, whilst indirect lighting was better than direct from the point of view of the worker. Devices for the homogeneous distribution of light were discussed, and the lecturer suggested a minimum of 3 candle feet of light in the plane of the work for ordinary operations, and of 5 candle feet for fine work. He then dealt with the causes and prevention of nystagmus.

Under the second heading the lecturer defined the limits to which first aid should go in dealing with minor accidents to the eye. He then discussed the methods of rendering first aid, and dealt particularly with injury by acids, alkalis, and steam. Many eye accidents were avoidable by the use of proper goggles, but it was a common practice to fit flat, badly-annealed window glass to goggles, with the result that they were very trying to the eye; the necessity was emphasised for fitting proper meniscus lenses of no power. The prevalence of cataract amongst glass, iron and lead workers was then dealt with.

Under the third heading the necessity was emphasised for adopting a standard of vision for those who proposed to enter certain types of industry. At the present time little or no attention was paid to this important factor in industrial efficiency and safety. Many workers used only one eye, with consequent inability to appreciate depth of focus, others were colour blind. Workers with these defects were a potential source of danger in many industries.

The lecturer concluded by discussing the causes and prevention of blindness due to accidents in industry, and mentioned the peculiar properties of certain nitro-compounds in this connexion. Of all the blind persons in this country, including infants, no less than 7.5% was due to industrial accidents, and nearly all of these could probably have been avoided by the use of properly fitting goggles.

CALENDAR OF FORTHCOMING EVENTS

Nov. 18.—**Society of Chemical Industry, Chemical Engineering Group.** Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "Some modern methods of recovery of lubricating oils," by A. J. Broughall.

Nov. 18.—**Society of Chemical Industry, South Wales Section.** Jointly with the Institute of Chemistry, at Thomas's Cafe, High Street, Swansea, at 7.30 p.m. "The engineer-chemist and his influence in engineering economies," by G. E. Hider.

Nov. 18.—**Society of Chemical Industry, Liverpool Section.** Jointly with the Liverpool and North Western Section of the Institute of Chemistry. The University, Brownlow Street, Liverpool, at 6 p.m. "Modern improvements in petroleum refining," by A. E. Dunstan. A cinematograph film will be shown illustrating the petroleum industry in Persia.

Nov. 21.—**Chemical Industry Club, 2, Whitehall Court, London, S.W.1,** at 8 p.m. "A chemist's view of evolution," by Prof. J. C. Drummond.

Nov. 21.—**Royal Society of Arts, John Street, Adelphi, W.C.2,** at 8 p.m. *Cantor Lecture I.* "Alloy steels: their manufacture, properties and uses," by Prof. H. C. H. Carpenter. (Also on November 28.)

Nov. 22.—**Institution of the Rubber Industry, Scottish Section.** Caledonian Hotel, Edinburgh, at 7.30 p.m. "Relation between the cotton and rubber industries," by R. Truesdale.

Nov. 22.—**Armourers and Brasiers Company, Royal School of Mines, South Kensington, S.W.,** at 5.15 p.m. "X-rays and metals," by G. Shearer.

Nov. 23.—**Textile Institute, London Section, 38, Bloomsbury Square, W.C.1.** "Some laundry problems," by J. R. Peers.

Nov. 23.—**Royal Society of Arts, John Street, Adelphi, W.C.2,** at 8 p.m. "Malayan varnish resins," by T. H. Barry. (Lantern lecture.)

Nov. 23.—**Faraday Society.** Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 2.30 p.m. General discussion on "Cohesion and related problems."

Nov. 24.—**Chemical Society, Burlington House, Piccadilly, W.1,** at 8 p.m. "Gaseous combustion at high pressures," by Prof. W. A. Bone, F.R.S.

Nov. 24.—**Society of Chemical Industry, Birmingham and Midland Section.** The Chamber of Commerce Buildings, Birmingham, at 6.45 p.m. "Notes on the chemistry and physics of stone decay and preservation," by A. R. Warnes.

Nov. 24.—**Institution of the Rubber Industry, Manchester and District Section.** Bleachers' Association, Blackfriars Street, Manchester. "Artificial silk and its uses in the rubber trade and possible lines of development," by Major A. B. Shearer.

Nov. 24.—**Institute of Brewing, Midland Counties' Section.** White Horse Hotel, Congreve Street, Birmingham. "Science and practice in the malt house," by Prof. A. R. Ling.

Nov. 25.—**Society of Chemical Industry and Institute of Chemistry, Edinburgh and East of Scotland Sections.** Social evening. Party at the Palais de Danse, Edinburgh, at 8 p.m.

(See also p. 1089)

CORRESPONDENCE

COMFORT AND SUGAR

SIR,—Your interesting article on "Comfort and fertilisers" reminds me of a problem which has often puzzled me. How on earth did people manage without sugar, *i.e.*, cane sugar. Except honey, was there any other form available? May I hope this may be the subject of a future editorial?

Yours sincerely,

GEORGE J. WARD

"THERMS"

SIR,—Your correspondent's commentary on this subject might have gone a step further, to a practical conclusion, as the matter does not end with the comparative cost to the user of the various power media. The prices quoted presumably represent a considered average for a given district at the user's premises, apropos of which one might expect the electricity lines to be in existence, so that the cost of erection does not arise. One might also wonder why those fortunate people who can obtain coal at 3d. per therm and gas at 7d. per therm, cannot get electricity at less than 29d. per therm.

However, it will generally be conceded that electrical power is the most flexible and efficient form for use in the majority of works, and accordingly, whichever form of fuel is employed for the mechanical power generation, electricity will be the medium for the final power distribution.

Therefore, taking average efficiencies of coal-steam-electric, Diesel-electric, and gas-electric power generation on the average medium works scale at 7%, 33% and 28% respectively, the relative costs per therm, neglecting labour, maintenance, etc. charges, are:—Coal, 10.7d.; oil, 8.35d.; and gas, 25.35d.

The labour, maintenance, and overhead charges in the aggregate are proportionately much higher for small than for large stations, and one may reasonably assume that, if a large steam-electric power station with an overall thermal efficiency of 18–20% cannot generate and distribute electricity at less than 1d. per kw.-hr., a much smaller generating unit in the same locality cannot be expected to do any better, even when allowing for extra capital charges and distributing losses in the case of the former.

Summarily, it would appear that for the power requirements of the average medium-sized works, fuel oil, electricity, coal, and gas would be the probable order of ascending costs for "useful 'therm'" distribution on the basis of the figures quoted, the actual relative position of coal depending on the degree to which exhaust or "bled" steam from the power plant can be used.

In conclusion, is it too much to expect that finely-divided coal particles will replace fuel oil in a modified Diesel-type engine, with a similar thermal efficiency?

Yours faithfully,

E. W. WIGG

PERSONAL AND OTHER ITEMS

The Academy of Sciences at Stockholm has decided to divide the Nobel Physics Prize for 1927 between Prof. A. Compton, of Chicago, for his discovery of the Compton effect, and Prof. C. T. R. Wilson, of Cambridge, for his

method of investigating the movements of electrons. The Nobel Prize for Chemistry is not to be awarded until next year.

At the anniversary meeting of the Royal Society on November 30, the following were recommended by the President and Council for election to the Council:—*President*, Sir Ernest Rutherford; *Treasurer*, Sir David Prain; *Secretaries*, Mr. J. H. Jeans and Dr. H. H. Dale; *Foreign Secretary*, Sir Richard Glazebrook; *Other members of Council*, Dr. E. D. Adrian, Sir Hugh Anderson, Dr. F. W. Aston, Dr. F. A. Bather, Sir Archibald Garrod, Sir Thomas Heath, Prof. A. Lapworth, Prof. J. C. G. Ledingham, Prof. F. A. Lindemann, Mr. J. E. Littlewood, Mr. C. Tate Regan, Prof. A. C. Seward, Prof. G. Elliot Smith, Dr. T. E. Stanton, Sir Gilbert Walker, Sir James Walker.

The following Ph.D. degrees have been awarded by the University of London:—in physical chemistry to H. F. Gilbe, F. E. King, and F. K. V. Koch; in organic chemistry to S. R. Husain; in chemistry to C. H. Johnson; in biochemistry to L. P. McGuire; in agricultural chemistry to C. E. Marshall.

The late Alderman George Edward Wilson, J.P., a director of Albright & Wilson, Ltd., left £144,914, with net personalty £129,545.

The late Dr. W. H. Sodeau, M.I.Chem.E., left £6465, with net personalty £6423.

Rubber Industry Bill

The Government grant to the Research Association of British Rubber and Tire Manufacturers will come to an end in 1929, and the Rubber Industry Bill, introduced in Parliament this week, with the support of leading members of all the political parties, provides that thereafter funds shall be raised for the research work by collecting 1-25th of a penny on every pound of raw rubber that is retained for use in Great Britain. On an estimated consumption of 40,000 tons of rubber a year, this would bring in an annual sum of £15,000, and the principle of the scheme has the support of every trade association concerned and of 70 individual rubber manufacturers, representing a capital of £44,000,000 out of the estimated total capital of £50,000,000 in the industry.

Beet Sugar Subsidy in Parliament

In a written reply to Sir F. Wise, Mr. Guinness stated that, in accordance with the provisions of the British Sugar (Subsidy) Act, subsidy is paid to the manufacturers of home-grown beet sugar and molasses and not to beet growers. The total subsidy paid to manufacturers from April 1, 1927, to November 5, was £744,148 18s. 2d.

Advisory Committee on River Pollution

The Minister of Health and the Minister of Agriculture and Fisheries have appointed a Joint Advisory Committee to consider, and from time to time report on the position with regard to the pollution of rivers and streams, and on any legislative, administrative, or other measures which appear to be desirable for reducing such pollution. The membership of the Committee is as follows:—Sir Horace C. Monro, K.C.B. (chairman); A. R. Atkey, Esq., J.P.; Rear-Admiral T. Beamish,

C.B., R.N., M.P.; R. Beddington, Esq.; H. E. Brooks, Esq.; J. T. Conroy, Esq., D.Sc.; S. Easten, Esq.; C. N. Hooper, Esq.; F. E. W. Howell, Esq.; L. H. Lewis, Esq., M.I.C.E., M.I.M.E.; W. Prescott, Esq.; Lieut.-Col. D. Watts-Morgan, C.B.E., D.S.O., M.P.; and H. Maclean Wilson, Esq., M.D., B.Sc.

Safeguarding of Key Industries: Calcium biphosphate (Baking Powder quality)

The Board of Trade have received a complaint under Section 1 (5) of the Safeguarding of Industries Act, 1921, that calcium biphosphate (baking powder quality) has been improperly excluded from the list, H ii, of articles chargeable with duty under Part I of that Act, as amended by Section 10 of the Finance Act, 1926. The complaint will be referred for arbitration to a tribunal constituted under Section 10(4) of the Finance Act, 1926, and the date of the hearing will be announced shortly.

Any communications should be addressed without delay to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1.

Coal by-products in Germany

The Acting British Consul-General at Cologne informs the Department of Overseas Trade that the *Deutsche Bergwerks Zeitung* of November 4 states that the demand for raw tar is quite good, although lower prices are being offered and paid, in accordance with the general position of the tar market, which is showing a downward tendency. There is no doubt that the demand and sales in pitch are declining, partly owing to the fact that road-making has ceased, and especially owing to the decline in the manufacture of briquettes. Not only in Germany, but in all countries where coal is exploited and briquettes are produced, complaints are made about the shortage in briquettes sales. This is probably due in part to the price of briquettes, but also because a large proportion of fine coal is used for dust firing, which has been increasingly employed since the beginning of the year. The consumption of pitch has greatly decreased. As a result, prices of pit coal pitch have fallen and prices for pit coal-tar oil are also showing a downward tendency, in spite of a brisk demand.

The I. G. and Synthetic Rubber

It is reported in the German Press that the I. G. Farbenindustrie has developed a process for the manufacture of synthetic rubber, which has so far passed the experimental stage that large-scale production may be anticipated. A director, Herr von Weinberg, is stated to have said that the cost of production had been brought so low that synthetic rubber could compete with the natural product. Information from another source, however, seems to imply that the experimental stage has not yet been completed, and that commercial production is hardly probable at present.

World Output of Fixed Nitrogen

The report of the British Sulphate of Ammonia Federation for the year ended May 31, 1927, shows that the production of fixed nitrogen declined from 1,333,700 tons in 1925—26 to 1,237,500 t. in 1926—27, owing to a decrease in the output of Chile nitrate, though some compensation was afforded by the increases of other

nitrogen products, as will be seen from the following table (in which Japanese cyanamide is included under synthetic ammonium sulphate and industrial ammonia liquor is included under "other forms") :—

	1926-27	1925-26
	Tons	Tons
By-product ammonium sulphate	303,200	296,700
Synthetic ammonium sulphate	300,000	289,200
Cyanamide	180,000	150,000
Nitrate of lime	81,000	30,000
Other forms of synthetic nitrogen	133,400	120,700
Other forms of by-product nitrogen	40,300	47,700
Chile nitrate	199,600	309,400
Total	1,237,500	1,333,700

Consumption increased by just over 4% (compared with 10% in the previous 12 months), the total amounting to 1,312,700 t. pure nitrogen (1,258,500 t.).

Russian Potash Deposits

Operations are shortly to be commenced on the potash deposits at Ssolikamsk, the geological investigation having been completed. Further deposits have been found at Beresnjakowo, in the same district.

COMPANY NEWS

BORAX CONSOLIDATED, LTD.

An interim dividend of 6d. per share (2½%) has been declared, less tax at 4s., on the deferred ordinary shares in respect of the year ended September 30, 1927, compared with last year's interim of 3½% (9d. per share).

ALLEN-LIVERSIDGE AND CO., LTD.

A dividend has been declared at the rate of 6½% annum (less tax) for the six months ended October 31, 1927, on the preference shares.

BUELL COMBUSTION CO., LTD.

The directors announce that negotiations have now been completed for the sale of the foreign rights of the Buell patents, the purchase consideration being a substantial sum in cash, and the retention of practically a-half interest in any profits obtained in any of the countries covered by the various patents. An agreement has also been entered into with powerful shipping interests, whereby Buell patents will be immediately put into operation on marine boilers for use on ships.

Forthcoming Events—contd.

Nov. 23 and 24.—Institute of Fuel. Autumn Meeting Rooms of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. On Nov. 23, at 10.30 a.m., a general meeting will be held, followed by the Presidential Address by the Rt. Hon. Sir Alfred Mond, Bt. The following papers will be presented and discussed :—(1) "National electricity supply—better utilisation of our fuel resources," by Sir P. Dawson. (2) "Operating experience of steam production at 1300-lbs. pressure," by J. Anderson. At 2.30 p.m., papers will be read as follows :—(1) "Measurement of steam flow in works' practice," by T. Nordenson and H. C. Armstrong. (2) "Preheated air for boiler furnaces," by P. H. N. Ulander. On Nov. 24, the morning session will commence at 10 a.m. with papers as follows :—(1) "The British coking industry and some of its products," by R. Ray. (2) "Vertical intermittent chamber ovens," by N. J. Bowater. (3) "Chemical study of processes involving the carbonisation of coal by internal heating," by Prof. M. W. Travers. At 2.30 p.m., J. I. Graham and D. G. Skinner will give a paper on "Conversion of coal into oil by the Bergius process," and A. E. Dunstan and H. G. Shatwell will speak on "Liquid fuels, other than petroleum." The Annual Dinner will take place on the 23rd, at the Great Central Hotel, N.W.1.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned. Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £30 per ton; Powder, £32 per ton; Extra fine Powder, £34 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £9 10s.—£10 per ton. Good demand.
 Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carbolie.—Crystals.—7½d. 8d. per lb. Crude 60's, 2s. 3d.—2s. 5d. per gal.
 Acid Cresylic, 99/100. 2s. 11d.—3s. per gal. 97/99. 2s. 4½d.—2s. 8d. per gal. Pale, 95%, 2s. 3d.—2s. 6d. per gal. Dark, 95%, 2s. 1d.—2s. 3d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9½d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 6d. per gal., ex works in tank wagons.
 Toluole.—90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 6d.—2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.
 Creosote.—Cresylic 20/24%, 10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7½d. per gal. ex works. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.—10d. per gal. Solvent 95/160, 1s. 3d.—1s. 4d. per gal. Solvent 90/190, 9½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals, £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.
 Pitch, medium soft.—85s.—87s. 6d. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180.—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 6d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—8d. per lb., naked at works.
 Aniline Salts.—8d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb., 100%.
 Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—5½d. per lb.
 m-Cresol 98/100%.—2s. 7½d. per lb.
 p-Cresol 32/34° C.—2s. 8½d. per lb.
 Dichloraniline.—1s. 10d. per lb.
 Dimethylaniline.—1s. 11d. per lb.
 Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton.
 Dinitrochlorobenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—10d. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb.
 β-Naphthylamine.—3s. per lb.
 o-Nitraniline.—5s. 9d. per lb.
 m-Nitraniline.—3s. per lb. d/d.
 p-Nitraniline.—1s. 7d.—1s. 8d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb.
 R. Salt.—2s. 2d. per lb.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—7½d. per lb.
 p-Toluidine.—2s. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 4d.—2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. 36s.—37s. per cwt. Powder 40s.—41s. per cwt.; Extra Fine Powder, 42s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 7½d.—1s. 10d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 4d.—1s. 6d. per lb. Technical 11½d.—1s. per lb. Good demand.
 Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Amidol.—9s. per lb. d/d.
 Acetanilide.—1s. 11d. per lb. for quantity.
 Amidopyrin.—8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—9s. 6d. per oz.
 Barbitone.—5s. 9d.—6s. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—10s. 4d.—10s. 7d. per lb. Bismuth Citrate.—9s. 10d.—10s. 1d. per lb. Bismuth Salicylate.—9s. 10d.—10s. 1d. per lb. Bismuth Subnitrate.—8s. 4d.—8s. 7d. per lb. Bismuth Nitrate.—6s. 1d.—6s. 4d. per lb. Bismuth Oxide.—13s. 10d.—14s. 1d. per lb. Bismuth Subchloride.—13s. 10d.—14s. 1d. per lb. Bismuth Subgallate.—8s. 1d.—8s. 4d. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 30 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal 26s. per cwt. Powder 26s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 3d. per lb. Potassium.—

1s. 10½d. per lb. Sodium.—2s. 1d. per lb. Granulated ½d. per lb. less. All spot. Large quantities at lower rates.
 Calcium Lactate B.P.—1s. 4d.—1s. 5d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ethers: S.G. 730, 10½d.—1s. 1½d. drums. Other gravities at proportionate prices.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—4s. 9d.—5s. per lb.
 Hexamine.—2s. 3d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal. in carboys; Winchester, 2s. 11d. per gal.; 20 vols., 4s. 3d. per gal. in carboys; Winchester, 5s. per gal.
 Hydroquinone.—2s. 11d.—3s. 2d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—18s.—22s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol—A.B.R. recryst.. B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb.; Lovig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb.; Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb.; Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.
 Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonal.—8s. 9d.—9s. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb.
 Phenacetin.—2s. 6d.—2s. 9d. per lb.
 Phenazone.—4s.—4s. 3d. per lb.
 Phenolphthalein.—6s. 6d.—6s. 9d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2½%.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6d. per lb. spot.
 Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 11d.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 7½d.—1s. 9d. per lb. Crystal, 1s. 8½d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.
 Sulphonal.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.
 Anabepine (*ex Anethole*).—11s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 14s. per lb.—(*ex Shui Oil*) 9s. 9d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 17s. 6d. per lb.—(*ex Shui Oil*) 13s. 9d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 8d. per lb. Vanillin.—16s. 6d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb. Bergamot.—26s. per lb. Bourbon Geranium.—13s. 6d. per lb.
 Camphor.—9d. per lb. Cananga, Java, 15s. 9d. per lb. Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java, 1s. 10d. per lb., c.i.f. U.K. port, for shipment over 1928. Ceylon, Pure, 1s. 8d. per lb. Clove, pure 5s. 3d. per lb.
 Eucalyptus, Australian.—2s. 2d. per lb. Lavender.—Mont Blanc, 28/40%, 17s. per lb. Lemon.—7s. 3d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. per lb. Peppermint.—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—8s. per lb. Sandalwood—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Jan. 9th, 1928. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Nov. 24th. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

1.—Applications

Dunlop Rubber Co., Ltd., Murphy, and Twiss. Concentrating or drying liquids. 20,350. Nov. 3.
 Electroflo Meters Co., Ltd. (Republic Flow Meters Co.). Thermo-couples for pyrometers. 20,518. Nov. 4.

- Garland and Pickard. Edge filtration. 28,970. Oct. 31.
 Geldens. Kilns. 29,273. Nov. 2.
 Johnson (I.-G. Farbenind.). Carrying out photo-chemical gas reactions. 29,259—60. Nov. 2. Treating liquids with gases etc. 29,642. Nov. 5.
 Kingcome. Evaporators. 29,111. Nov. 1.
 Komers. Diffusion apparatus. 29,187. Nov. 1. (Czecho-Slovakia, 19.4.27.)
 Rispler. Extracting solids from fluids. 29,437. Nov. 3.
 Rosenheim, Schuster, and Tintometer, Ltd. Colour-estimating apparatus. 28,981. Oct. 31.
 Seligman. Heat-exchangers etc. 29,357. Nov. 3.
 Soc. Anon. des Charbons Actifs E. Urbain. Separation of mixtures of liquids etc. 29,167. Nov. 1. (Fr., 8.1.27.)
 Zwicky. Filters. 29,565. Nov. 4.

I.—Complete Specifications

- 10,582 (1926) and 566 (1927). Leek, and Wigan Coal & Iron Co., Ltd. Separation of solids and liquids. (279,525.)
 18,732 (1926). Reavell. Separating solids or semi-solids from liquids. (279,544.)
 30,919 (1926). Dorr Co. Separating solids from liquids. (262,479.)
 31,106 (1926). Leek. Heat interchangers. (279,663.)
 15,725 (1927). Allis-Chalmers Manuf. Co., and Newhouse. Crushers. (279,742.)
 728,860 (1927). Laughlin Filter Corp. Centrifugal separators. (279,896.)

II.—Applications

- Bates. Hydrogenating coal. 29,039. Oct. 31. (U.S., 23.11.26.)
 Dowling and Mallagh. Manufacture of incandescence gas mantles. 29,395. Nov. 3.
 Duffield. Gas-producing and oil-recovery plant. 29,165. Nov. 1.
 Goldsbrough. Catalytic agent for generating gas from fuels. 29,390. Nov. 3.
 I.-G. Farbenind. Manufacture of motor fuels. 29,397. Nov. 3. (Ger., 26.11.26.)
 Imperial Chem. Industries, Ltd., and Slade. Production of briquetted fuel. 29,243. Nov. 2.
 Johnson (I.-G. Farbenind.). Treating exhaust gases from combustion motors. 29,640. Nov. 5. Low-temperature carbonisation. 29,641. Nov. 5.
 Lush, and Technical Research Works. 29,526. See III.
 Metallbank und Metallurgische Ges. Production of active carbon. 29,131. Nov. 1.
 Petrole Synthétique Soc. Anon., and Wittonek. Obtaining gaseous hydrocarbons etc. 29,423. Nov. 3. Catalytic treatment of gases etc. 29,674. Nov. 5. (Fr., 18.1.27.)
 Wolters. Regenerative coke-oven plant. 29,536. Nov. 4.

II.—Complete Specifications

- 18,955 (1926). Asiatic Petroleum Co., Ltd., and Egerton. Preventing pinking or knock in internal-combustion engines. (279,560.)
 24,497 (1926). Jubb (Pickering). Treatment of acid sludge or acid resin obtained from the refining of mineral oils. (279,613.)
 27,148 (1926). Alfa-Laval Co., Ltd. (Funk). Treatment of lubricating oils. (279,636.)
 29,762 (1926). Lundin. See VII.
 24,403 (1927). Wigan Coal & Iron Co., Ltd., and Leek. Treating coal etc. material. (279,766.)
 25,328 (1927). Brand and Laing. Utilisation of pulverulent or powdered carbonaceous materials. (279,767.)
 *4618 (1927). Allgem. Ges. f. Chem. Ind. Continuous treatment of hydrocarbons. (279,774.)
 *27,190 (1927). I.-G. Farbenind. Heating carbonaceous materials. (279,825.)
 *27,914 (1927). Chilowsky. Manufacture of gas from heavy oils. (279,834.)

III.—Application

- Lush, and Technical Research Works. Hydrogenation of naphthalene. 29,526. Nov. 4.

IV.—Applications

- *Carpmael (I.-G. Farbenind.). Manufacture of primary hydroaromatic bases. 29,661. Nov. 5.
 Cassella & Co. Anthanthrone dyestuffs. 29,303. Nov. 2. (Switz., 2.11.26.)
 Green. Manufacture of derivatives of acridine. 29,189. Nov. 2.
 Imray (I.-G. Farbenind.). Manufacture of dyestuffs. 29,009—10. Oct. 31.

IV.—Complete Specifications

- 27,013 (1926). I.-G. Farbenind. Manufacture of alkyl-naphthalenes. (260,604.)
 27,224 (1926). Soc. Chem. Ind. in Basle. Manufacture of intermediate products for the dyestuff industry. (260,623.)
 29,841 (1926). I.-G. Farbenind. Manufacture of 1-diazo-anthraquinone-2-carboxylic acids. (262,119.)
 32,107 (1926). Chem. Works (Sandoz). Production of substantive dyestuffs of the stilbene series fast to alkali. (263,192.)
 19,985 (1927). I.-G. Farbenind. Manufacture of triaryl-methane-dyestuffs. (275,609.)

V.—Applications

- Brandwood. Treatment of artificial silk etc. 29,338—9. Nov. 3.
 British Celanese, Ltd., and Ellis. Treatment of materials containing cellulose derivatives. 29,246. Nov. 2.
 British Celanese, Ltd., and Dickie. Manufacture of textile products. 29,247. Nov. 2.
 Courtaulds, Ltd., and Stokes. Production of artificial threads etc. 29,643. Nov. 5.
 Ellis (Soc. Fabr. Soie Rhodiaseta). Treatment of threads etc. containing artificial silk. 29,026. Oct. 31. Treatment of cellulose acetate threads etc. 29,548. Nov. 4.
 Harrison. Manufacture of artificial filaments from viscose. 29,061. Nov. 1.
 Internat. Sugar & Alcohol Co. (Soc. Ind. de la Cellulose). Treatment of cellulose-containing materials with mineral acids. 29,288. Nov. 2.
 Robertson. Treatment of jute etc. fabrics. 29,337. Nov. 3.

V. Complete Specifications

- 10,978 (1926). I.-G. Farbenind. Manufacture of nitro-cellulose solutions and plastics. (251,303.)
 11,652 (1926). Duhamel, and Comp. Gén. des Ind. Textiles. Washing or cleaning wool. (251,609.)
 20,855 (1926). British Dyestuffs Corp., Hollins, and Chapman. Retting of flax and other fibres. (279,583.)
 26,564, 28,444 (1927). I.-G. Farbenind. Manufacture of cellulose acetate solutions and plastics. (278,735 and 279,771.)
 *20,178 (1927). Hölkenside Ges. Treatment of artificial silk. (279,791.)
 *21,007 (1927). I.-G. Farbenind. Manufacture of cellulose esters of inorganic acids. (279,796.)
 *15,544 (1927). Chem. Fabr. vorm. Sandoz. See VI.
 *24,215 (1927). I.-G. Farbenind. Manufacture of amino-cellulose derivatives. (279,801.)
 *28,761 (1927). I.-G. Farbenind. Spinning artificial silk. (279,888.)

VI.—Application

- Carpmael (I.-G. Farbenind.). Dyeing etc. wool and silk. 29,570. Nov. 4.

VI.—Complete Specifications

- 18,730 (1926). Etabl. Petitdidier. Colour printing on fabrics. (256,238.)

*15,544 (1927). Chem. Fabr. vorm. Sandoz. Treating material and artificial cellulose fibres with alkali. (279,784.)
 *28,481 (1927). I.-G. Farbenind. Printing with vat-dye stuffs. (279,864.)

VII.—Applications

Dicker (Philips' Gloeilampenfabr.). Precipitating rhodium, iridium, etc. 29,057. Oct. 31.

Pauling. Production of ammonia-air mixtures. 29,055. Oct. 31.

VII.—Complete Specifications

29,762 (1926). Lundin. Production of carbonic acid gas. (269,478.)

16,141 (1926). Johnson (I.-G. Farbenind.). Manufacture of hydrocyanic acid. (279,530.)

2202 (1927). Rütgerswerke-A.-G. Working-up fluorides containing silicic acid. (271,816.)

9891 (1927). Mond (I.-G. Farbenind.). Separating phosphorus from gases. (279,710.)

17,569 (1927). Hebler. Delaying ignition of hydrogen phosphide resulting from the action of water on calcium or other phosphide. (279,751.)

*25,889 (1927). Caro and Frank. Production of high per cent. calcium cyanamide or magnesium cyanamide. (279,811.)

*25,893 (1927). Caro and Frank. Production of the cyanamides of the alkaline earth metals and of magnesium. (279,812.)

*28,519 (1927). Metallbank und Metallurgische Ges. Production of alumina. (279,870.)

VIII.—Applications

Patent-Treuhand-Ges. f. Elektrische Glühlampen. Ceramic product. 29,447. Nov. 3. (Ger., 26.11.26.)

Vollkommer. Melting enamels etc. 29,297. Nov. 2. (Ger., 22.11.26.)

VIII.—Complete Specification

5607 (1927). Parker, and Dartmoor China Clay Co., Ltd. Bleaching on decolorising of clay etc. (279,694.)

IX.—Applications

Powell. Manufacture of bricks etc. 29,100. Nov. 1.

Rostock. Impregnating and coating concrete etc. 29,042. Oct. 31. (Austria, 24.11.26.)

X.—Applications

Bradbury and Hall. Aluminium alloy. 29,632. Nov. 5.

Cartwright. Annealing-furnace. 29,341. Nov. 3.

Gratze. Electroplating. 28,964. Oct. 31.

I.-G. Farbenind. Purifying magnesium etc. 29,176. Nov. 1. (Ger., 13.11.26.)

Kelly. Alloys. 29,380. Nov. 3.

Rhenania-Kunheim Verein Chem. Fabr. Dissociating zirconium ores. 29,255. Nov. 2. (Ger., 13.12.26.)

Woodward. Heat treatment of steel etc. 29,123. Nov. 1.

X.—Complete Specifications

18,770 (1926). Smith and Garnett. Magnetic alloys. (279,549.)

25,154 (1926). Newey and Jerred. Electroplating apparatus. (279,616.)

32,535 (1926). Kohlsch Jernverks Akt. Manufacture of steel. (263,811.)

4530 (1927). Williams. Apparatus refining of lead bullion etc. (267,105.)

5560 (1927). Mond (Metallbank und Metallurgische Ges.). Sintering, desulphurising, or removing volatile constituents from ores etc. (279,693.)

6618 (1927). Comp. des Métaux Overpelt-Lommel. Reduction of zinc ores etc. (279,697.)

14,372 (1927). Internat. Copperclad Co. Apparatus for electrodeposition. (276,306.)

*17,630 (1927). Titan Co. Akt. Reduction of solutions containing titanium, iron, and other compounds. (279,786.)

XI.—Applications

Bayes and Bentley. Electrolytic cells. 29,166. Nov. 1.

Cook. Electric accumulators. 29,505. Nov. 4.

Gratze. 28,964. See X.

Johnstone. Electrolytic cells. 29,545. Nov. 4.

Monnot. Alkaline storage batteries. 29,580. Nov. 4.

XI.—Complete Specification

25,154 (1926). Newey and Jerred. See X.

13,708 (1927). Electric Furnace Co., Ltd. (Northrup). Electric induction furnaces. (279,733.)

14,372 (1927). Internat. Copperclad Co. See X.

*26,784 (1927). George. Electric furnaces. (279,818.)

XII.—Application

*Anc. Etabl. Savy, Jeanjean, et Cie., Goodenough, and Baker Perkins, Ltd. 29,015. See XIX.

XII.—Complete Specification

19,556 (1926). Komatzki. Producing soaps, medical preparations, etc. containing succinic acid. (279,575.)

XIII.—Application

Kunstharzfabr. Pollak. Manufacture of phenol formaldehyde condensation products. 29,440. Nov. 3. (Austria, 21.5.27.)

XIII.—Complete Specification

10,978 (1926). I.-G. Farbenind. See V.

XIV.—Application

Buxendale. Treating indiarubber etc. 28,949. Oct. 31.

XIV.—Complete Specifications

16,143 (1926). Bateman. Manufacture or utilisation of indiarubber. (279,531.)

*26,328 (1927). Naugatuck Chem. Co. Vulcanising rubber. (275,815.)

XV.—Complete Specifications

18,703 (1926). Standard Development Co. Leather oil. (255,908.)

*28,480 (1927). I.-G. Farbenind. Manufacture of hardened casein products. (279,863.)

XVI.—Applications

Bauer, and Eisler & Szold. Production of manure. 29,392. Nov. 3. (Austria, 5.11.26.)

Nijdam. 29,383. See XIX.

Union Agricole de Jodoigne. Manure. 29,543. Nov. 4. (Belg., 4.11.26.)

XVI.—Complete Specification

10,625 (1926). Wendler. Increasing the yield of the soil. (251,285.)

XIX.—Applications

Anc. Etabl. Savy, Jeanjean, et Cie., Goodenough, and Baker Perkins, Ltd. Extraction of cocoa butter from cocoa etc. 29,015. Oct. 31.

Fischer-Hollinshed Co., Inc., and Grönningssalter. Transferring vitamins. 29,280. Nov. 2. (U.S., 2.11.26.)

Hoffmann. Treatment of milk etc. 29,018. Oct. 31. (Austria, 30.10.26.)

Legendre. Preservation of grain, flour, etc. 29,647. Nov. 5.

Nijdam. Treating seeds. 29,383. Nov. 3.

XIX.—Complete Specification

29,018 (1927). Hoffmann. Treatment of milk etc. with rays. (279,902.)

XX.—Applications

Boehringer, and Boehringer Sohn. Preparing tetrazoles. 29,170. Nov. 1. (Ger., 10.11.26.)

Gill (Chem. Fabr. Delta). Obtaining alkaloids. 29,537. Nov. 4.

Johnson (I.-G. Farbenind.). Manufacture of acetaldehyde etc. (29,261.) Nov. 2.

XX.—Complete Specifications

19,556 (1926). Kornatzki. *See* XII.

31,732 (1926). Naef and Firmenich. Preparation of mono-cyclic ketones having more than nine ring members, and of their alkyl derivatives. (263,153.)

16,191 (1927). Stephens (Wulff). Manufacture of primary-propyl-ester of 2-phenylquinoline-4-carboxylic acid. (279,745.)

18,932 (1927). Port. Removing nicotine from tobacco products. (279,757.)

*18,422 (1927). Silesia Verein Chem. Fabr. Oxidation of alkyl-aryl-substituted dithiocarbamic acids to the corresponding disulphides. (279,790.)

*28,388 (1927). Chem. Fabr. vorm. Schering. Manufacture of alkylisopropyl-phenols and their hydrogenation products. (279,855.)

*28,389 (1927). Chem. Fabr. vorm. Schering. Manufacture of condensation products from cresols and ketones. (279,856.)

*28,390 (1927). Chem. Fabr. vorm. Schering. Process for the manufacture of decomposition compounds from condensation products of *m*- and *p*-cresol with ketones. (279,857.)

*28,616 (1927). I.-G. Farbenind. Manufacture of stable solid solutions of salts of aromatic sulphonic acids. (279,877.)

*28,674 (1927). Chem. Fabr. vorm. Schering. Manufacture of higher alkylated guanidine derivatives. (279,884.)

XXI.—Applications

I.-G. Farbenind. Photographic developers. 29,011. Oct. 31. (Ger., 13,11,26.)

Kent. Photographic transfer processes. 29,582. Nov. 4.

XXI.—Complete Specifications

31,549 (1926). I. G. Farbenind. Manufacture of bodies of photographic desensitising action. (262,816.)

*28,644 (1927). Witte. Photographic production of coloured pictures. (279,882.)

XXII.—Complete Specification

16,034 (1926). Hezlet and Highfield. Explosives. (279,529.)

XXIII.—Applications

Muhka. Water-purifying apparatus. 29,017. Oct. 31. (Austria, 28,9,27.)

Overstræten. Purifying water etc. 29,634. Nov. 5.

XXIII.—Complete Specification

*17,895 (1927). Högans-Billesholms Akt., and Nordiske Natrolth Akt. Softening and purifying water. (279,788.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*Austria*: Indiarubber articles (393); *Belgium*: Industrial chemicals (394); *British India*: Cement, paper (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1); *Canada*: Metal specialties, asbestos roof tiles, cork coverings, and other building materials (389); *Colombia*: Leather (406); *Egypt*: Steel reservoirs (A.X. 5462); *Germany*: Shellac, gum traganth, gum olibanum, copal, turpentine oil, Japan wax (397); *Greece*: Sugar, tin, tinplate (399); *New Zealand*: Glassware (391); nine centrifugal sewage pumping plants (A.X. 5457); *Norway*: Rubber shoes, leather (102); *South Africa*: Copper wire (A.X. 5468); anti-friction grease (B.X. 3969); *Uruguay*: Twenty-two cranes (A.X. 5478).

Patent Acts and the Irish Free State

An Order in Council, dated November 3, 1927, applies to the Irish Free State the provisions of Section 91 (subsection 5) of the Patents and Designs Acts, 1907 and 1919, relating to the registration of patents, designs, and trade marks. The Order is to be cited as the Patents, Designs, and Trade Marks (Irish Free State) Order, 1927, and takes effect as from October 1, 1927.

News from Advertisements

Applications are invited for the post of senior lecturer in the Department of Pure and Applied Science of Loughborough College (p. vi).

A technical assistant is required for secretarial work by chemical and gas engineer (p. vi).

A junior partnership is required by chemist (p. vi).

A meeting of the Chemical Society Research Fund Committee is announced (p. vi).

Sets of the JOURNAL are offered (p. vi).

There are now 127 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

REPORT OF THE BRITISH PHOTOGRAPHIC RESEARCH ASSOCIATION FOR THE YEAR 1926—27. Pp. 15. London: British Photographic Research Association, 1927.

ANNUAL REPORT ON THE ONE HUNDRED AND THIRTY-FIRST SESSION OF THE ROYAL TECHNICAL COLLEGE, GLASGOW. Adopted at the Annual Meeting of Governors held on the 18th October, 1927. Pp. 74. Glasgow: Robert Anderson, 142, West Nile Street. 1927.

THE SEMI-CENTENNIAL OF THE HOKKAIDO IMPERIAL UNIVERSITY, JAPAN. 1876—1926. Pp. 210. Sapporo, Japan: The Hokkaido Imperial University, 1927.

DER GEGENWÄRTIGE STAND DER SPANNUNGSTHEORIE. By W. Hückel. Fortschritte der Chemie Physik und physikalischen Chemie. Edited by Prof. A. Eucken. Serie A. Band 19, Heft 4. Pp. 101. Berlin: Gebrüder Borntraeger, 1927. 7.60 m.

Einheitliche Untersuchungsmethoden für die Fettindustrie. Part I. Edited and produced by the Wissenschaftlichen Zentralstelle für Öl und Fettforschung E. V. Berlin. Pp. xvi + 105. Stuttgart: Wissenschaftliche Verlagsgesellschaft m.b.H., 1927. 5 rm.

CHEMICAL PATENTS INDEX. By E. C. Worden, First, Ph.C., B.S., M.A., F.C.S., F.I.S. Vol. I. Index of Names A—Z; Index of Subjects A—B. Pp. 904. New York: Chemical Catalog Co., Inc., 1927. \$25.00.

THE PROFESSION OF CHEMISTRY. By R. B. Pilcher, O.B.E. Revised edition, with an introduction by Prof. A. Smithells, C.M.G., D.Sc., F.R.S. Pp. x + 94. London: Institute of Chemistry, 1927.

THE ELECTRONIC THEORY OF VALENCY. By N. V. Sidgwick, M.A., Sc.D., D.Sc., F.R.S. Pp. xi + 310. Oxford: The Clarendon Press, 1927. 15s.

REPORT OF H.M. ELECTRICAL INSPECTOR OF MINES FOR THE YEAR 1926. Mines Department. Pp. 29. H.M. Stationery Office, 1927. 4d.

THE I.G. FARBEN-INDUSTRIE ARTEN-GESELLSCHAFT. Pp. 69. Berlin: Schwarz, Goldschmidt & Co., 1927.

DIE METHODIK DER FERMENTE. UNTER MITARBEIT VON FACHGENOSSEN. Edited by Carl Oppenheimer and L. Pincussen. Lieferung I. Pp. x + 320. Leipzig: G. Thieme, 1927. 28m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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SERIES

LONDON, NOVEMBER 25, 1927

No. 47

EDITORIAL

Sugar

WE are always pleased when a reader invites us to write an editorial on some particular subject; we cannot, however, always comply with such a request. In the case of sugar we find ourselves in a difficulty because we know very little of the subject and do not even know where to turn for our information. A sugar cane of some sort was native in India and was in early days cultivated in that country, in Persia and China. A variety of the sugar cane seems also to be a native of some of the Polynesian Islands and possibly some of the East Indies, but these have had but little effect on the use of this substance in the Middle Ages in Western Europe. Sugar was known, but we gather not well known, to the ancient Greeks and Romans, and it seems that the Arabs introduced the cultivation of sugar canes into Sicily, Spain and Morocco; the cane was planted in Madeira in 1420 and in San Domingo in 1494, and soon spread in the West Indies and parts of America. The early history of sugar, if preserved at all, is probably to be found in Arabic, Persian, Indian and Chinese writings. We are wholly unacquainted with these; perhaps Mr. Holmyard can help us; he knows some of this literature well. If we have amongst our readers, and we surely must have, some who are acquainted with the Sacred Vedas, we appeal for a reference to the sugar cane said to occur in the Atharva-Veda. Sugar was known in England at the time of the earliest books written in English. It was known here in the thirteenth century, and is mentioned towards the end of the fourteenth century by Langland in *The Vision of Piers Plowman*, by Chaucer in the *Squire's Tale*, and by Usk in the *Testament of Love*. In the *Paston Letters*, in the middle of the fifteenth century, one of the correspondents begs "I pray you that ye woll vouchesaff to send me an other sugor loff." There are plenty of references to sugar in the Elizabethan dramatists. We do not know exactly how they managed without an abundant supply of sugar in the early Middle Ages, but they had less need of it than we have now. They had

no tea or coffee at breakfast and hardly anything worth calling breakfast at all; a glass of beer often sufficed for this meal. In the *Compleat Angler* you may read: — "*Pisc.* What will you have to your breakfast, or what will you drink this morning? *Viat.* For breakfast, I never eat any, and for drink am very indifferent; but if you please to call for a glass of ale, I'm for you; and let it be quickly, if you please, for I long to see the little fishing-house you spoke of, and to be at my lesson. *Pisc.* Well, sir, you see the ale is come without calling; for though I do not know yours, my people know my diet, which is always one glass so soon as I am drest, and no more till dinner: and so my servants have served you." And does not Milton tell us of the guest who "rises, is saluted, and after the malmsey or some well spic'd bruage, and better breakfasted than he whose morning appetite would have gladly fed on green figs," and so on? In very much earlier days when sugar was a rare substance, almost a drug, the pastry cooks probably managed pretty well with honey; they had their sweetmeats made of flowers, as we do to this day, and fancy sweets in the shape of birds and lizards. One of the classical poets speaks of "the dainty cakes that women fashion in the kneading-tray, mingling blossoms manifold with the white wheaten flower, all that is wrought of honey sweet, and in soft olive oil, all cakes fashioned in the semblance of things that fly, and of things that creep." We are sorry we have such meagre information; if our correspondent has access to De Candolle, Marco Polo, and Dioscorides, he might glean something, we do not possess these books and cannot conveniently borrow them. We suppose that in Norman times the inhabitants of this country lived mainly on bread, meat, fish and vegetables; no doubt they had fruits in the summer; honey and salt were plentiful; mead, metheglin, beer, wine and milk sufficed for drinks; sugar was more a curiosity than an item of food. If our readers can tell us why the sugar cane produces so much sugar and most other grasses so little, we shall be glad.

SOME MODERN METHODS OF RECOVERY OF LUBRICATING OIL*

By A. J. BROUGHALL, M.I.Chem.E.

The recovery of used lubricating oil is a matter of considerable importance, not only as a question of economy to the user, but on the general consideration of supply.

During recent years the consumption of oil has very much increased, and attention has been directed to the effect of this increased consumption on the visible supply. The Hoover Committee, U.S.A., stated that the visible supply of lubricating oil in the United States would be consumed in 10 years at the present rate of consumption. The latest figures obtainable for the United Kingdom show that in 1926 91,810,250 gals. of lubricating oils of a value of £1,670,386, was imported. Of this, 2,529,459 gals., to a value of £203,893, was re-exported. During the first nine months of this year the importation has been 72,197,712 gals., valued at £3,715,992. It naturally follows that if the increased consumption affects the supply the prices will tend to rise. Some authorities consider that 70-80% of the total consumption of lubricating oil is recoverable. This figure would appear to be rather high, possibly 50% would be more correct.

The following figures are given by the Diesel Engine Users' Association, taking the average of 44 large stations, for the cost per unit of current generated in Diesel-engined stations in 1924-25:—

Fuel	0.393
Lubricating oil	0.078
Water	0.007
Stores	0.011
Wages for the whole of the running staff	0.148
Repairs, including maintenance, labour and material	0.141
Total	0.778

This shows that 10% of the cost is represented by lubricating oil.

Owing to the possible economy which can be effected by the installation of a suitable plant, it is most desirable that those in charge of machinery and plant using considerable quantities of oil for lubrication should pay particular attention to the possibility of recovery and the re-use of the reclaimed oil for its original purpose, or, if this is not possible, for other uses. Attention was particularly directed to this problem during the war, when it was of the utmost importance to conserve the supply of oil, and, owing to the particular attention directed during this period, advances were made in the design of apparatus suitable for oil recovery.

For many years oil has been recovered in a rough and ready way by means of stand filters, in which the oil was allowed to settle and various filtering media

were used to purify the oil. This method was slow and the efficiency not to be compared with specially designed plant of modern design. Owing to the lack of suitable apparatus, large quantities of oil have been undoubtedly thrown away to waste, and to-day it is quite common to find works and garages with a difficulty of getting rid of accumulated stocks of used oil.

The object of this paper is to set out the result of investigations into this problem by the author during recent years on the plants described. The oils chiefly investigated were cylinder oil, crank-case oil (high-speed engines), dynamo oil, transformer oil, and, to a small extent, oil from the crank-case of internal-combustion engines.

On going into the matter of oil recovery, opposition will possibly be raised by those responsible for using recovered oil, and the question at once arises: Is it possible to purify and recover used oil to make it available for use again, especially for its original purpose? It may be taken that the general considered opinion of those who have made careful investigation is that oil does not necessarily lose its lubricating property by use, and if the impurities present can be removed, there is no reason why a large proportion cannot be made available for its original purpose. In many instances tests have shown that the recovered oil is better than the original; this point is confirmed by the investigation made. In this connexion it is of interest to note that, from reports issued on oil recovery with the Air Service, U.S.A., during the war period, it was found that of the total oil issued 40-50% was returned for reclaiming, and of this amount 70-80% was recovered and used again. An interesting test was also made with a quantity of used lubricating oil, which was purified and returned for use and circulated eight times before any new oil was added. At the end of this period the viscosity was slightly higher than at the start.

The nature of the impurities found in the used oil vary considerably in accordance with the purpose for which the oil has been used, but they may be generally classified as follows:—(1) Water. (2) Metallic particles formed by the abrasion of the working parts. (3) Particles of carbon resulting from the effect of high temperature on the oil. (4) Particles of grit. These impurities are suspended in the lubricant, and as a rule can be easily removed by simple means.

With oil used in the internal combustion engine, other factors enter, such as the dilution of the oil by the heavy ends of the fuel. In some instances the impurities are met with in the form of colloid suspensions which are very difficult to break down.

A number of well-designed plants are now available for oil recovery, and work either on the principle of settling tanks, the centrifuge, or a special type of filter. During the investigation made the following methods were tested:—The settling-tank process, by Industrial Waste Eliminators, Ltd.; the Sharples centrifuge,

* Read at a meeting of the Chemical Engineering Group on Nov. 18, 1927.

made by Super-Centrifugal Engineers, Ltd.; a centrifuge, made by the Alfa-Laval Co., Ltd.; and the stream-line filter, made by the Stream-Line Filter Co., Ltd.

Several other systems are on the market, but these plants are fairly representative of the various methods adopted, and excellent results have been obtained from each of them, the effect of which has been that an organized system has been developed at the works concerned for collecting, purifying and returning the reclaimed oil to the various departments. It may also be stated that considerable economies were effected by reclaiming oil and grease etc. from rags and wipers and afterwards washing them. A brief description of the installations is given below.

SETTLING TANKS (INDUSTRIAL WASTE ELIMINATORS, LTD.)

These (Figs. 1, 2 and 3) are tanks of 80 gal. capacity fitted with steam-heated coils and a draw-off arrangement for the reclaimed oil, water and impurities. A

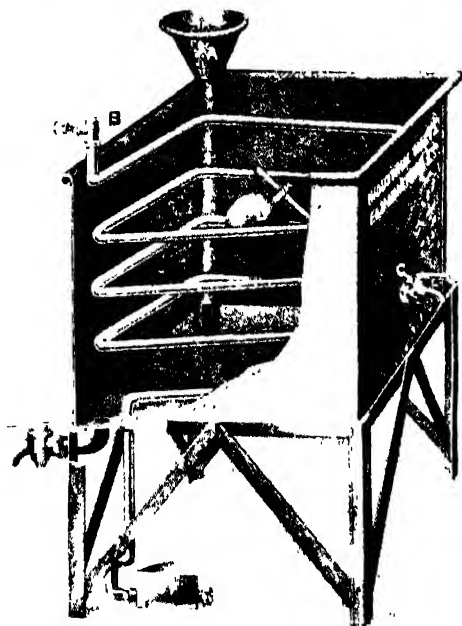


Fig. 1
Oil settling and purifying tank

special ball valve is provided which is adjusted to close the outlet for clean oil in order to prevent water and impure oil passing through. The general method of operation is to put the dirty oil in the tank in quantity sufficient just to cover the top coil.

Some test should be made in order to find out the nature of the impurities present and the general state of the oil. With heavy oil containing fine particles of grit and carbon in suspension, it has been found an advantage to add a solution of brine; and if acidity is present to any extent it is usual to add soda ash. The oil is heated to boiling point and kept at this temperature for 15 to 20 min. The heat is then regulated to keep the temperature at approximately 170–180° F. and the oil allowed to settle for two weeks. When

reclaiming lighter oils the period of settling is one week and the temperature is regulated to 150° F.

To draw off the recovered oil the pure oil pipe is regulated by a float just to skim the surface of the oil, which is run out into the receiving vessel through fine flannel.

A special design of turbine centrifugal extractor (Fig. 2) is made by the same firm for the recovery of oil from

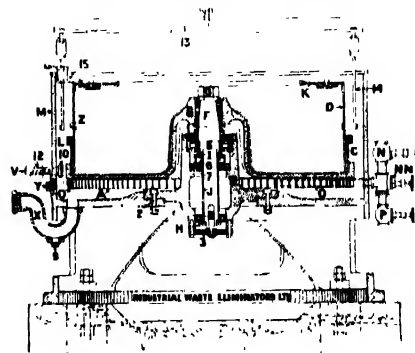


Fig. 2
Cross-section of steam turbine centrifugal oil extractor.
Industrial Waste Eliminators, Ltd.

rags and sponge cloths. The steam used for driving is allowed to pass through the machine and the materials impregnated with the oil are heated and oil and water are released by centrifugal force.

SHARPLES SUPER-CENTRIFUGE (SUPER-CENTRIFUGAL ENGINEERS, LTD.)

The Sharples Super-Centrifuge (Figs. 4 and 5) is designed to run at very high speeds, 15,000 to 17,000

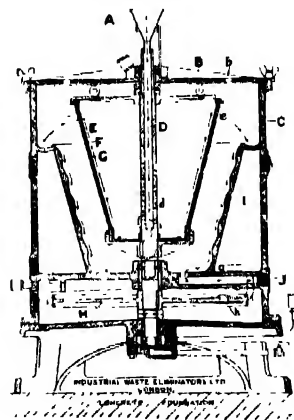


Fig. 3
Cross-section of steam turbine centrifugal oil filler. Industrial
Waste Eliminators, Ltd.

r.p.m., and is of rather an unusual type. It is claimed that the centrifugal force developed is equal to approximately 17,000 times that of gravity. It consists of a special form of casing in which is housed the cylinder or bowl, which is in the form of an elongated hollow cylinder 30 in. long, 4½ in. in diameter. This bowl is of light construction, made from high tensile steel machined all

over to ensure accurate balance, and is suspended by a flexible joint from a driving spindle fitted with special ball bearings, and at the foot it is fitted with a special spigot rotating within a guide bushing which limits the lateral movement. The method of construction is such that the bowl is easily removed for cleaning.

The dirty oil is fed in at the bottom of the bowl, and under the action of centrifugal force three layers of material are formed, the pure oil in the centre or

At the upper end of the bowl special discs are fitted with provision for the outlet of the pure oil and water. These are of an interchangeable type, and can be varied according to the class of oil treated. This centrifuge is designed to be driven by electric motor, belt, steam, or compressed air.

The oil to be treated should be heated to a temperature of 150° F. to facilitate separation. When dealing with oil containing considerable amounts of impurities or

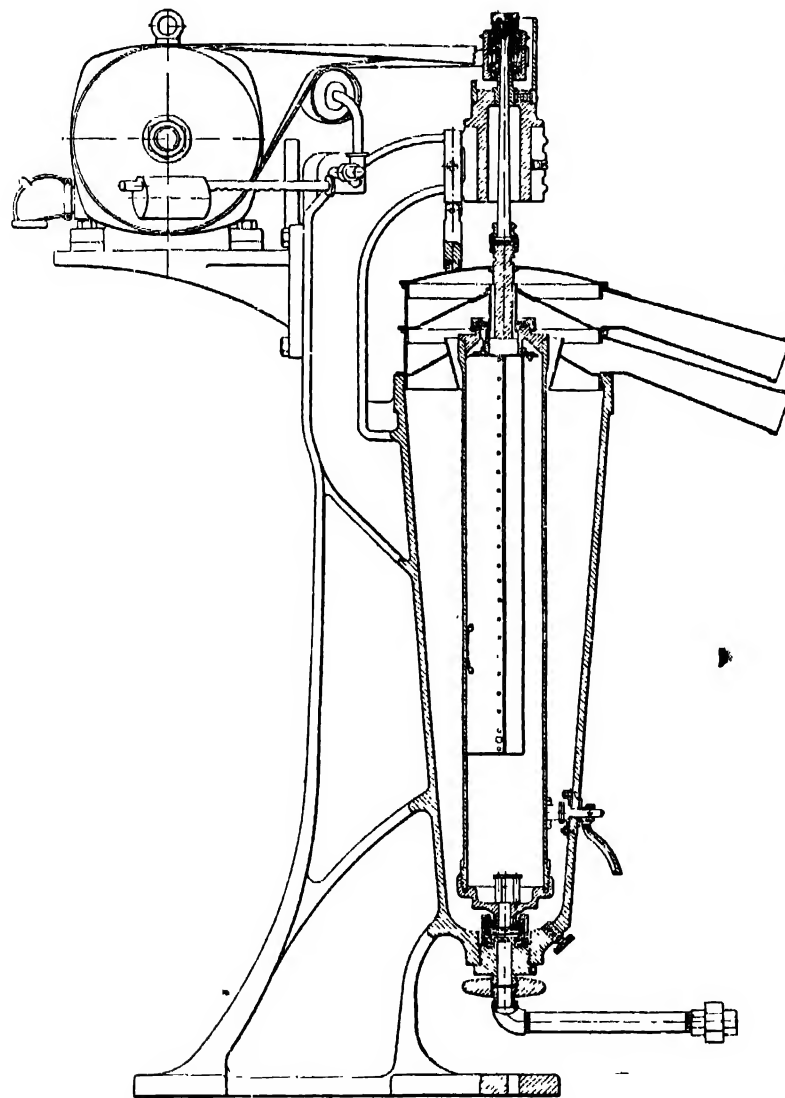


FIG. 4

Sharples centrifuge. Cross-section of machine

inner layer, water in the intermediate layer, and the solid matter in the outer layer. The liquid under treatment is maintained at the same speed of rotation as the bowl by a one-piece three-wing attached to the upper portion of the bowl. A good feature of this design is that the liquid flow is at right angles to the direction of centrifugal force, and the distance traversed between the inlet and outlet is approximately 25 times the thickness of the liquid layer.

presenting unusual features, special methods of treatment are adopted, and it is usual to provide receiving tanks in which the oil can be treated preparatory to centrifuging. A solution of sodium hydroxide is recommended to neutralise acidity and as a means of flocculating the fine particles of carbon.

A noteworthy feature of this machine, considering its high speed, is its remarkable freedom from vibration. It is also very accessible, the various adjustments and

cleaning operations being accomplished quite easily. When considerable impurity is present in the material their striking uniform and many of the delegates being in academic dress. The meeting was held in the presence

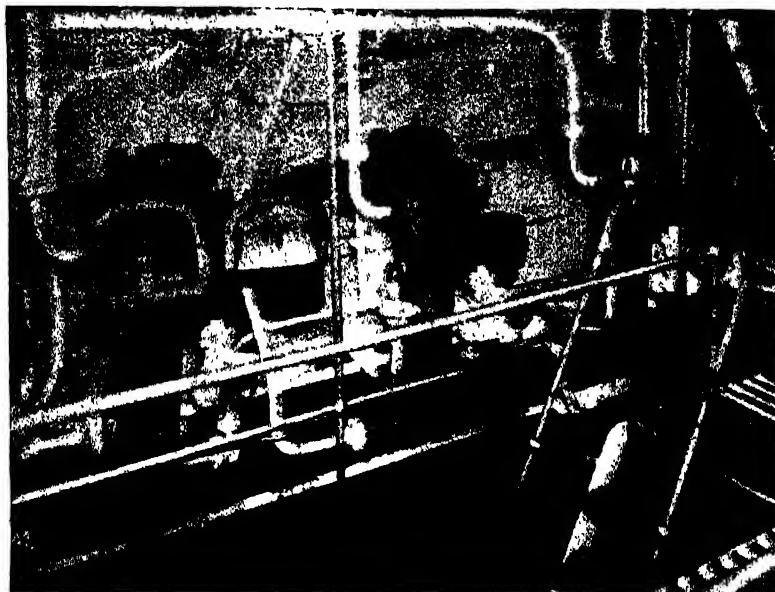


FIG. 5

Sharples centrifuge. Typical installation

to be treated, it is usual to supply a spare bowl for use while the other bowl is being cleaned.

A special form of casing for these machines is fitted where it is necessary to conform to the Board of Trade requirements on board ship, and provides for the total enclosure of the upper portion of the machine to prevent the escape of fumes.

(To be continued)

THE CENTENARY OF MARCELLIN BERTHELOT

By A DELEGATE

About 1800 "delegates," representing all nations, attended the meeting. The first event was a brilliant "crush" at the Sorbonne on Sunday evening, October 23, where we met many old friends. On the Monday, after inspecting various Berthelot relics at the Faculté de Pharmacie (Berthelot began his career in 1859 as Professor of Organic Chemistry at the École Supérieure de Pharmacie), a large body of chemists assembled in the courtyard of the Collège de France, where he became Professor of Organic Chemistry in 1865. Prof. Schlenk, President of the German Chemical Society, and Prof. Bogert here spoke on behalf of the delegates. The laboratories in which Berthelot worked, now occupied by M. Moureu, were inspected with great interest by many. Afterwards a tablet attached to his early residence, 113, Rue St. Martin, was unveiled. In the afternoon a crowded reception was held at the Hôtel de Ville. After several speeches, one of them by Prof. Nasini on behalf of the delegates, came music and dancing by experts from the Opera. In the evening a brilliant company assembled in the Great Amphitheatre of the Sorbonne, the members of the Academy wearing

of the President of the Republic, M. Painlevé, President of the Berthelot Committee, taking the chair. Music was provided by the celebrated band of the Garde Républicaine. Proceedings were opened by M. Moureu delivering an éloge upon Berthelot. After the overture of Ramuntcho had been most beautifully played by the band, laudatory speeches were made by M. Lecomte, Director of the French Academy; by M. Lacroix, Perpetual Secretary of the Academy of Sciences; by M. Gley, President of the Academy of Medicine; by M. Wéry, President of the Academy of Agriculture; finally, after another musical interval, by M. Hodza, Minister of Public Instruction of Czechoslovakia. Then we were regaled with over half an hour of comic opera, during which congratulatory addresses were presented by all and sundry in best "stage attire." Finally, M. Painlevé addressed the meeting.

The Hall of the Sorbonne is a magnificent amphitheatre seating about 4000 people, without a trace of echo. The President of the Academy of Medicine made it clear that it was possible for a practised speaker, gifted with a sonorous voice, to be generally heard; other speakers were but partially audible. Strangely enough, on this, as on almost every other occasion, the speeches were read, so that the oratorical charm which usually characterises French speaking was lacking.

The first ceremony on Tuesday was a very impressive commemorative meeting at the Pantheon, where Berthelot and his wife are buried. Delegates were then conveyed by motor car to Versailles and the huge party was entertained at lunch in the celebrated long gallery. The lunch was served with remarkable perfection and in the greatest comfort. Two speeches were delivered, Prof. Pictet representing the delegates. The

party then inspected the treasures of the Palace. At night there was a gala performance at the Opera—the first act of Massenet's *Hérodiade* and two ballets.

On Wednesday the first act was the laying of the foundation stone of the *Maison de la Chimie* by M. Herriot, Minister of Public Instruction. At twelve, delegates left by motor car for Chantilly, the country house of the Institute of France. Here the lunch was a scramble but visitors found satisfaction in the autumnal beauty of the grounds and the art treasures in the mansion. In the evening the President of the Republic received delegates at the Palace of the Elysée. The very perfect entertainment provided included not only music and dancing but also a philosophic dialogue by Paul Claudel, in homage to the memory of Berthelot, in which his ideas were reproduced. Even our Cambridge representative was overcome by the highbrow character of the discourse.

The final event of interest was a luncheon given by the President of the Chemical Society of France, M. Urbain and French colleagues at their club. At least seventy chemists were present, including the aged Prof. Konovalow; also Profs. Willstätter, Haber, Schlenk, Stock and Bodenstein. That we survived the ordeal of so many gatherings is remarkable, but the French always charm ever so wisely that it is impossible to resist their allurements. All will thank them for the gift of a *Souvenir du Centenaire*, containing a brief notice of Berthelot's life history and many portraits of himself and his co-workers.

The meeting has been full of lessons. Nominally, the celebration of the centenary of Berthelot, the chemist, in reality it has been far more. It was obviously calculated also to serve propagandist ends, in particular to bless the inauguration of a *Maison internationale de la Chimie*, the intention being to make this a meeting place for chemists of all nations, in Paris, whilst using it mainly for purposes of international documentation of chemical literature. The bizarre programme provided was the expression of the attempt to meet these two ends. Delegates were presented with a ponderous tome of 373 pages, containing lists of committees "pour l'édification de la *Maison de la Chimie*," established all over the world, including Panama—a striking proof of the energy displayed in organising the enterprise. Nearly 16 million francs have been subscribed, about half in France.

At the Commemoration in the Great Hall of the Sorbonne the addresses delivered by M. Moureu and his colleagues of the Institute of France were all in perfect taste and in keeping with the object of honouring Berthelot's memory. A false note was struck, however, by the delivery of a long address by the Czechoslovakian Minister of Public Instruction. Still less happy was the presentation of a multitude of official congratulatory addresses from here, there and everywhere, beginning with Abyssinia and Afghanistan and ending with Tchecoslovaquie. Such padded and potted appreciation is worthless. The mistake was in issuing invitations to all and sundry. Very wisely, at the various meetings, the speaking was confined to a few, usually one Frenchman and one foreign delegate. The delegates chosen, in not a few cases, in no way represented science—the

choice made may have been good as *réclame* but was not dignified. A strong opinion prevailed that not only French chemists but chemists generally were put into a false position. We may hope that the outworn practice of presenting formal addresses from learned and other bodies on such occasions received its death blow at the meeting; it cannot well be continued much longer with dignity. Some simpler and more direct means of offering congratulations must be devised.

The feeling among representative chemists present at the meeting was clear. All were anxious to have the work of Berthelot fully recognised and his memory honoured; few, however, seemed to favour an over-ambitious international scheme. Each of the chief countries prefers to do its own work of documentation; indeed several already have highly organised machinery for the purpose. The hope prevailed that the scheme will



LES VEINARDS.

(Après le centenaire de Villemain et celui de Berthelot, élu de Fresnel.)

— Vous en avez de la veine, vous autres, les savants... Qu'est-ce qu'on vous fait comme belles fêtes... après votre mort !...

Lucky Beggars.—After the centenaries of Villemain, Fresnel and Berthelot

Lucky chaps, you scientific men. Look what fine entertainments they provide for you . . . after you're dead ! . . .

be revised, so as to meet the wants of French chemists in particular. We, in England, know full well how great is our need of a meeting house, where all our interests may be worthily centralised. A similar home for French chemistry would doubtless be of great value in France. If a laboratory of the Davy-Faraday-Dewar Royal Institution type could be associated with it, so much the better.

The fact is, scientific workers are becoming rather tired of these international organisations. The meetings they entail are very pleasant up to a point but whilst the value of social intercourse cannot be over-rated, attendance at them is a very costly and time-wasting business. In most cases such gatherings have no broad scientific outcome. The meetings are too frequent and it is impossible to secure the attendance of representative delegates. Scientific joy-riding at public cost is fast being developed into a fine art, almost a profession by

the few. Chemists have had warning by the failure hitherto of the International Union of Pure and Applied Chemistry to do work of a character which in any way serves to justify its great cost, both to subscribing bodies and to individuals attending the meetings.

Unless the Union can be organised upon a basis very different from that which has prevailed, it must shortly come to an end. Chemists view with grave mistrust and apprehension the obvious attempt that is being made to "bureaucratise" the interests of chemistry, fearing another Geneva and another Albert Thomas. Subscriptions to the building will not alone be demanded. The maintenance of an international enterprise such as that contemplated will be very costly. Governments will be asked to contribute and work in the several countries will suffer by the diminution of their home grants. Let us hope that our French colleagues will recognise that true charity begins at home. We shall all profit if they set the example.

COMPANY NEWS

VICKERS LTD., AND SIR W. G. ARMSTRONG WHITWORTH AND CO.

A provisional agreement has been signed between Vickers Ltd., and Sir W. G. Armstrong Whitworth & Co. for the amalgamation of certain of their important works and businesses now engaged principally in naval shipbuilding, and in the manufacture of heavy and special steel and armaments. The agreement provides for the formation of a new company called Vickers-Armstrongs, with an initial capital not exceeding £21,000,000, to take over the amalgamated businesses from January 1, 1928, and the whole matter will be submitted at an early date for the approval of the debenture holders and shareholders concerned in both companies. The first directors will be General Sir Herbert A. Lawrence (chairman), General Sir Noel Birch, Sir George Buckham, Commander C. W. Craven, Sir A. Trevor Dawson, Sir Mark W. Jenkinson, Mr. G. R. T. Taylor, Sir George Hadcock, Sir Otto Niemeyer, Mr. E. R. Peacock, and Mr. J. Frater Taylor.

DORMAN LONG AND CO., LTD.

A dividend has been declared on the 6% cumulative preference shares for the half-year ended September 30, 1927.

PAN DE AZUCAR NITRATE CO., LTD.

The net profit for the year ended June 30, 1927, was £10,326, plus £17,267 brought in compared with a net profit of £22,011 for the previous year. A final dividend has been recommended of 10% less tax, making 15% carrying forward £14,393. No nitrate was manufactured at the company's oficina during the period under review, the profit shown being derived from the sale of nitrate stocks brought forward from the previous year. Extensive alterations and additions to the plant and machinery are being carried out with a view to reducing the cost of production, which will delay the reopening of the oficina.

ZINC CORPORATION, LTD.

A dividend has been declared of 2s. per share on the preference shares, being the last half of the fixed preferential dividend for 1927, and also an interim participating dividend of 1s. 6d. per share on both preference and ordinary shares, less tax.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

COAL CLEANING CONFERENCE

A reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, is now ready.

The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

EDINBURGH SECTION

The second joint meeting for the present session of the Edinburgh and East of Scotland Sections of the Institute of Chemistry and the Society of Chemical Industry was held in the hall of the Pharmaceutical Society on November 17, Major Bruce presiding.

A paper entitled "Chemical formulae of long ago" was read by Prof. R. M. Caven, of Glasgow. The lecturer traced the gradual development of the use of chemical symbols and formulae from the time when picture writing and Egyptian hieroglyphics were first used to designate substances used in chemical operations. In the middle ages, when alchemy was at its height, the earlier and simpler symbols were augmented by allegorical representations of reactions which gave less accurate conceptions of the truth, and tended to throw a veil of mystery over comparatively simple experiments. A great step was made in 1792 by the introduction of Bergmann's symbols. Unfortunately, this chemist had some difficulty in reconciling his symbols with the phlogiston theory, which detracted from their clarity. They gave, however, a wonderfully accurate picture of a reaction, even suggesting ionisation in solution—at that time not yet discovered. During the great age of chemical discovery, symbols were abandoned by all the great chemists except Lavoisier, owing to their complexity. His symbols, as modified by Hassenfratz and Adet, represented a great advance on any system yet invented. They were even capable of indicating what physical state the reacting materials were in, and they were comparatively simple. The last exponent of the symbol method of notation was Dalton. After him, however, his method gave place to the modern system introduced by Berzelius, in which letters take the place of symbols.

The meeting concluded with a hearty vote of thanks to the lecturer, proposed by Mr. J. Adam Watson, chairman of the Local Section of the Institute of Chemistry. Messrs. Rutherford, Hill, and Kermack also voiced the appreciation of the meeting.

NOTTINGHAM SECTION

The second meeting of the session was held jointly with the Midlands Section of the Society of Dyers and Colourists on November 9, at University College, Nottingham, Mr. Harcastle in the chair. Two papers were given:—(1) "The action of chlorine and hypochlorous acid on wool"; (2) "The action of formaldehyde on wool," by S. R. Trotman, M.A., and E. R. Trotman, Ph.D.

Dr. Trotman said that in previous investigations they had shown that the action of hypochlorous acid on wool is quite different from that of chlorine. Further experiments had shown that chloramines are produced when chlorine acts on wool, but none are produced by the action of hypochlorous acid. This led the authors to look for groups which might react with hypochlorous acid. Carbonyl groups are, of course, present in large quantities in the keratin molecule, and a possibility would be some kind of reaction between these and the hypochlorous acid. Direct combination would give $\text{--NH}\cdot\text{C}(\text{OH})(\text{OCl})$. This compound, however, would tend to become unstable, and might either (i) give back the carbonyl group and hypochlorous acid, or (ii) decompose thus: $\text{--NH}\cdot\text{C}(\text{OH})(\text{OCl}) \rightarrow \text{N}:\text{COCl} + \text{H}_2\text{O}$. The experiments seem to show that the latter reaction is more probable, since there is strong evidence that some portion, though not all, of the ketone groups is modified by hypochlorous acid. It is possible, however, that

$$\text{OH}$$

the group $\text{>C} \begin{smallmatrix} \text{OH} \\ \diagup \\ \text{OCl} \end{smallmatrix}$ is stable in the wool protein

molecule. Dr. Trotman described experiments on the effect of condensation with semicarbazide, and showed that the results indicated that hypochlorous acid reacts with the carbonyl groups of the wool protein whilst chlorine does not.

The presence of hydrochloric acid has a profound influence in modifying the course of the reaction between chlorine and the wool substance. The divergence between the two reactions lies in the observations that both in the absence and presence of sulphuric acid the action of chlorine on the wool substance is to cause a scission of the amino nitrogen, whilst in the presence of hydrochloric acid the reaction seems to consist almost entirely of dissolution of the wool substance as a whole. The scission of amino nitrogen takes place to only a very limited extent, viz., 0.03%. This action at once explains the cause of the lower nitrogen values obtained for wool chlorinated in presence of hydrochloric acid and then with semicarbazide. With hypochlorous acid, a slight dissolution of the wool substance as a whole probably takes place.

Dr. Trotman next gave a short account of the action of formaldehyde on wool. The moisture content of air dried paraformaldehyde wool was found to be considerably lower than that of untreated wool. No change occurs in the nitrogen content during treatment with formaldehyde or paraformaldehyde.

The resistance of formaldehyde wool to the action of alkalis appears to be superior to that of paraformaldehyde wool. Formaldehyde wool has a somewhat lower shrinkage than the untreated wool when subjected to normal washing, but when milled, no difference in either shrinkage or felting can be detected. Untreated fabrics and fabrics treated with formaldehyde showed no difference in the percentage of damaged fibres or in weight lost during chlorination. In the action of dyestuffs, formaldehyde has practically no affinity for neutral dyeing and dyestuffs. When dyed in presence of acetic acid, the affinity for the dyestuff develops slowly, with sulphuric acid the affinity develops quickly, and the formaldehyde-treated wool becomes as deeply dyed

as the untreated wool. It is evident that the affinity for acid dyestuffs is due to hydrolysis of the formaldehyde compound. The protection against bacterial action is very marked. Dr. Trotman also gave a theoretical explanation of the results.

YORKSHIRE SECTION

The "Chemists' Dinner" will be held on December 2, at the Great Northern Hotel, Leeds. This year it will be regarded as a local celebration of the Jubilee of the Institute of Chemistry, but it is open to all chemists in the area to participate. The President of the Society (Mr. F. H. Carr, C.B.E.) will be in the chair. Tickets (6s. 6d. each) may be obtained from Mr. H. J. Hodsman, The University, Leeds.

CALENDAR OF FORTHCOMING EVENTS

Nov. 25.—Society of Chemical Industry and Institute of Chemistry, *Edinburgh and East of Scotland Sections*. Social evening. Party at the Palais de Danse, Edinburgh, at 8 p.m.

Nov. 30.—Royal Society of Arts, John Street, Adelphi, W.C.2, at 8 p.m. "Marcellin Berthelot and synthetic chemistry," by Prof. H. E. Armstrong. His Excellency the French Ambassador will preside.

Dec. 1.—Society of Chemical Industry, *Bristol Section*. Joint meeting with the Fuel Section. The University, Woodland Road, Bristol, at 7.30 p.m. "Low-temperature carbonisation," by Dr. C. H. Lander.

Dec. 1.—Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. *Ordinary Scientific Meeting*. "Action of Beckmann's chromic acid mixture on some monocyclic terpenes," by T. A. Henry and H. Paget; "The condensation of glyoxalines with formaldehyde," by R. Grindley and F. L. Pyman; "Glyoxalins-4(5)-formaldehyde," by W. Hubball and F. L. Pyman; "Studies of dynamic isomerism. Part XXVI. Consecutive changes in the mutarotation of galactose," by G. F. Smith and T. M. Lowry; "Triazole compounds. Part II. Methylation of some 1-hydroxy-1:2:3-benzotriazoles," by O. L. Brady and C. V. Reynolds; "The reaction between diaryloxy-isopropyl alcohols and phosphorus oxychloride in the presence of pyridine," by D. R. Boyd and D. E. Ladham.

Dec. 2.—Institute of Chemistry, *Leeds Area Section*. "Chemists' Dinner" at the Great Northern Hotel, Leeds. Tickets (6s. 6d. each) may be obtained from Mr. H. J. Hodsman, The University, Leeds.

Dec. 2.—Society of Chemical Industry, *Manchester Section*. Joint meeting with the Fuel Section, Engineers' Club, 17, Albert Square, Manchester. "Coal and co-partnership," by J. A. Bowie.

Dec. 5.—Biochemical Society, Imperial College of Science and Technology, South Kensington, S.W.7.

Dec. 5.—Society of Chemical Industry, *London Section*. Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "Automatic analysis of liquids and its application to control of water-softening plants," by Dr. H. S. Hatfield.

Dec. 6.—Society of Chemical Industry and Institute of Chemistry, *Edinburgh and East of Scotland Sections*. The Pharmaceutical Hall, 36, York Place, Edinburgh, at 7.30 p.m. "Electro-synthesis," by Prof. Sir James Walker.

Dec. 7.—Society of Chemical Industry, *Nottingham Section*. "The indole group of the alkaloids," by Prof. R. Robinson.

CHEMICAL SOCIETY

At a meeting on November 17 the President, Prof. H. Brereton Baker, C.B.E., F.R.S., reminded Fellows that applications for research grants must be received by December 1, and that the meeting arranged for December 15 had been abandoned in view of the Jubilee Dinner of the Institute of Chemistry being held on that evening.

Mr. B. Cavanagh read the following papers:—

Differential Potentiometric Titration. Parts I and II.

I.—THE end-point of a titration is determined from two or three measurements of the potential, corresponding with one or two large additions of reagent. In its simple form the method depends on the assumption that the added reagent reacts completely, which implies that the end-point is not reached, and this sets a limit to the absolute precision attainable, which can be improved to a limited extent by the method of Part II.

If m c.c. of reagent added to V_0 c.c. of solution alter the potential by ϵ m.v., then the further amount (M c.c.) required to reach the end-point is given by $M = m \cdot f(\epsilon_m)$, where $\epsilon_m = \epsilon - \epsilon_v + \epsilon_\gamma$. The "corrections" ϵ_v and ϵ_γ for change of volume and activity coefficient respectively are defined by $V_0/m = f(\epsilon_v)$; $\gamma_0/(\gamma - \gamma_0) = f(\epsilon_\gamma)$, the function being of the form $f(\epsilon) = \frac{1}{2} [\coth (E/2RT) \epsilon - 1]$. ϵ_γ and the temperature correction are negligible, but ϵ_v is often very large.

II.—Based on thermodynamic relations only, the exact equation $(Mn \sqrt{\gamma\gamma' \theta \theta'})/2s(V_0 - M) = \sinh [F(E - E_0)/RT + \frac{1}{2} \log \gamma\gamma'/\gamma\gamma' + \frac{1}{2} \log \theta\theta'/\theta\theta']$ (where θ, θ' are the adsorption factors, E the measured potential, suffix e the end-point values, n the normality of the reagent, and s the activity product of the precipitate) for titrations typified by the silver-chloride titration, has been obtained. An equation is derived from which, by means of a family of curves, the value of M can be determined from a single potential change. This extends the method of Part I to the end-point region, and the conditions for maximum precision are seen from the curves. Another equation immediately permits the exact determination of the result of the titration from two successive potential changes, and yields probably the most precise possible method of analysis.

Dr. J. F. Spencer said that the method appeared to be no more rapid than the usual one, and involved the use of curves which must be prepared by the experimenter himself. In the example quoted the accuracy attained was far below that obtained by the ordinary method.

Dr. J. J. Fox remarked that for dilute solutions the only satisfactory methods had hitherto been weight-volumetric and nephelometric processes.

Mr. Cavanagh maintained that the accuracy is greater than that usually obtained, and that precision is dependent on concentration, and pointed out that the complex mathematics does not actually enter into the calculations. In reply to Dr. S. Sugden, he said that variations in solubility with fineness of division of the silver chloride do not, in practice, introduce error.

The President said that the method would be useful in certain atomic weight determinations.

Dr. F. M. Hamer described:

A General Method for the Preparation of Carbocyanine Dyes.

THE various types of carbocyanines and the methods hitherto used in preparing them are summarised. The method consisting in condensation of ethyl orthoformate with quaternary salts containing reactive methyl groups is converted by the introduction of pyridine as solvent into an excellent practical and general process for preparing carbocyanine dyes. The preparation of three 2:2'-carbocyanines by the pyridine method is described, the yields varying from 70—79% as against 21% by the best method hitherto known; the method is also applied to dicyanines, to three 4:4'-carbocyanines, to three thiocarbocyanines, to two so-called oxacarbocyanines, and to two so-called indocarbocyanines. Certain new dyes are described. Where this has not previously been done, the photographic properties of the dyes are recorded; it is found that the oxacarbocyanines and indocarbocyanines, like other cyanine dyes, are photographic sensitisers.

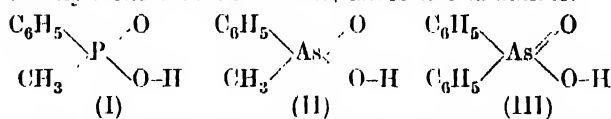
Mr. B. V. Storr expressed the hope that studies of the sensitisation of silver bromide would eventually lead to an understanding of the effect of light on silver bromide itself.

Mr. O. F. Bloch remarked that by supplying the dye in a form suitable for absorption by the silver halide, the range of compounds available as sensitisers had been increased. The colour of the dye-silver halide complex differs from that when other carriers are used, and bleaching is more rapid. The author's work opened up important problems relating to adsorption.

Prof. C. S. Gibson discussed:—

A Comparison of Analogous Organic Compounds of Phosphorus and Arsenic. [With J. D. A. Johnson.]

THE phosphinic acid grouping in phenylmethylphosphinic acid (I) behaves like a carboxyl grouping since the acid readily forms an acid chloride, esters and an anilide.



The arsinic acid grouping in the corresponding arsinic acid (II) behaves differently. When thionyl chloride reacts under the usual conditions with compound (II) phenyldichloroarsine and probably methyl chloride are formed, since under the same conditions from compound (III) phenyldichloroarsine and chlorobenzene are obtained. The ethyl ester of compound (I) was not obtained when its silver salt was treated with ethyl iodide.

The mechanism of the action of thionyl chloride on secondary arsinic acids is discussed.

Prof. G. T. Morgan directed attention to differences in the purely inorganic behaviour of phosphorus and arsenic, where the "working force" must be the same as in the reactions described.

Mr. M. A. Phillips remarked on the distinction between the silver salts of primary and secondary arsinic acids in regard to the formation of alkyl esters. The arsinous acids readily form esters by this method.

Dr. E. E. Turner said that the authors' observations exhibited analogy to the fact that arsenic, but not phosphoric, acid is a strong oxidising agent. In the reduction of an arsinic acid by hydrochloric and sulphurous acids, an oxychloride appears to be formed. Some arsinic acids, particularly benzyl-derivatives, are decomposed even by cold hydrochloric acid, and phenylbenzylarsinic acid even gives benzyl chloride when warmed with phenyldichloroarsine.

Dr. J. D. A. Johnson said that the amphoteric nature of the secondary arsinic acids makes it difficult to say whether in phenarsazinic acid hydrochloride the hydrogen chloride is associated with the nitrogen or with the arsenic atom. Dissolution of phenylarsinic acid in concentrated hydrochloric acid is more probably due to the formation of an oxychloride than to that of a simple hydrochloride.

Dr. J. L. Simonsen described

Derivatives of Methyl 2:2-dimethylcyclopentan-3-one-1-carboxylate. [With C. S. Gibson and K. V. Hariharan.]

The authors describe an improved method for the preparation of 2:2-dimethylcyclopentan-3-one-1-carboxylic acid. On bromination the methyl ester yields methyl 2:2-dimethyl-4,4-dibromocyclopentan-3-one-1-carboxylate. This ester on treatment with barium hydroxide yields 2:2-dimethyl-4-hydroxy- Δ^5 -cyclopentan-3-one-1-carboxylic acid.

CORRESPONDENCE

REMUNERATION OF THE CHEMIST

SIR, Some weeks ago there appeared in this JOURNAL a copy of an unusual letter, setting out in detail the terms of engagement of a chemist for a particular post. To the majority of your readers it would be a surprise to learn that a qualified chemist should be expected to put in 12 hours a day for 7 days a week and to receive remuneration at the rate of 1s. 2d. per hour.

This letter was succeeded by another asking for a disclosure of the name of the firm in question, but the present writer thinks it should be made known that such terms are not imaginary and are not limited to an individual company; they appear to be the general rule for an industry in this country; moreover, one that is much talked of and heavily subsidised by the Government: I refer to the beet sugar industry.

The various factories have an intensive campaign during the winter and engage chemists temporarily, and the writer knows in the case of at least half a dozen (and, personally, has had the offer of such a post by two of them) that the chemical staff is engaged on the terms quoted, namely, 12 hours a day, 7 days a week (this includes an 18 hour shift at the "turn over") for about four months, at the attractive salary of £20 per month.

This seems to be a standard rate, and no additional recompense was offered to a chemist with ten years' factory experience as compared with one newly graduated. This new industry has published in the press this week its profits for last season's working, and it is anything but encouraging to the profession to think that the scientific control of the chemical processes (which has its due proportion of the making of these profits) should be obtained so cheaply.

The unfortunate fact is that the companies know that at the commencement of the campaign there is a sufficient number of trained chemists unemployed who are so near to the point of desperation as to accept positions on the terms mentioned: these at the end of so many months are once more out of place, most probably much the worse for the long duties and absence of a resting day, but have the satisfaction of having managed to keep alive during the winter by pocketing the huge sum of £80 to £100. The following season a fresh staff is advertised for—and so the industry succeeds and makes its profits.

An appeal has been made that a larger proportion of the Government grant should go to the farmers, but surely the chemical staffs, as another unit of the trade, have also a just claim to a fair share of it in the form of reasonable terms of service.

I am, Sir, etc.

"CHEMIST"

PERSONAL AND OTHER ITEMS

Sir Max and Lady Muspratt have sailed from England in the *Cheshire*, on a visit to Ceylon.

At the last associate membership examination of the Institution of Chemical Engineers, held in June and July of this year, the following candidates satisfied the examiners: Harold Hunter, Edward Wallis, and Edward William Wigg.

The late Prof. H. R. Procter, for 22 years head of the Leather Industries Department of the Yorkshire College and the University of Leeds, left £17,502. All his scientific and technical books and instruments are left to the Procter Research Laboratory in Leeds University.

An International Chemical Review

A special chemical number will be issued with the ordinary number of "The Times Trade and Engineering Supplement" of November 26. It will contain a number of important articles dealing with the chemical production of the world, and can be obtained for the inclusive price of 3d.

Nitre Deposit in N. Australia.

According to Sir Douglas Mawson, a large deposit of potassium nitrate has been found 120 miles east of Alice Springs, in Northern Australia.

Institution of Chemical Engineers

An important series of meetings will be held on December 7, 8 and 9 at the Chemical Society's Rooms, Burlington House, W.1.

On December 7 there will be one session only, at 5 p.m., when the President, Sir Alexander Gibb, will take the Chair, and Mr. Norman Swindin will read a paper on "Submerged flame combustion."

The two sessions on December 8 will be devoted to a discussion on refrigeration, under the chairmanship of Mr. J. Arthur Reavell, Vice-President. Three papers will be read at 5 p.m., as follows:—(a) "The design of refrigerating plants," by Mr. G. W. Daniels; (b) "The practical aspect of refrigeration as applied to the chemical industry," by Mr. Leung Chew; and (c) "Electrical automatic refrigerators for domestic use," by Mr. Raymond Mitchell. After an adjournment for dinner at 6.45 p.m., the discussion on these papers will open at 8 p.m.

On December 9, at 5 p.m., with Mr. W. A. S. Calder, Vice-President, in the chair, Mr. W. J. Jones will read a paper entitled "The problem of industrial lighting with some reference to the chemical industry." At 8 p.m. on the same evening, Mr. William Macnab presiding, two papers will be read:—(a) "Continuous weighing of the contents of vessels: the weighmeter," by Messrs. R. G. Parker, D. N. Jackman and J. N. Vowler, and (b) "The properties of silica and fireclay refractories in relation to their industrial usage," by Mr. A. T. Green.

The President and Council of the Institution will be pleased to welcome all who may be interested in any of the above subjects. Application for admission to any particular session should be made to the Hon. Secretary of the Institution on or before December 2. Advance proofs of the papers will shortly be available, and may be obtained on application to the Hon. Secretary, The Institution of Chemical Engineers, Abbey House, Westminster, London, S.W.1.

Smoke Abatement

The Minister of Health proposes to make an Order extending the list of noxious and offensive gases, and also the list of works mentioned in the Act. A public enquiry into the proposed Order will be held on December 14 at the Ministry of Health, Whitehall. A full notice will be found on p. vi.

Research on Mine Rescue Apparatus

The Secretary for Mines has appointed the following to be a Committee to report to the Safety in Mines Research Board from time to time what research is required for the improvement of mine rescue apparatus and equipment, and how such work should be carried out, and as a Committee of the Board, to co-ordinate research on this subject that the Board may undertake to carry out by its own investigators:—Mr. Robert Clive (chairman), Mr. James R. L. Allott, Mr. G. L. Brown, Dr. J. S. Haldane, F.R.S., Mr. W. E. T. Hartley, Mr. P. S. Hay, Prof. J. A. S. Ritson, Mr. J. H. Thorne, Dr. R. V. Wheeler, and a representative of the Chemical Warfare Research Department.

Low Temperature Carbonisation

A circular has been issued by the Low Temperature Carbonisation Co., Ltd., setting forth the present position of its process. The process of low temperature carbonisation produces from each ton of coal distilled the following:—14 cwt. of smokeless fuel called "Coalite," 20-22 gallons of oil and 6000 cb. ft. of gas having a thermal value of about 700 B.Th.U. The company's works are at Barugh, near Barnsley, where there are five batteries of retorts, the first of which was started up in July. The process is working night and day, seven days a week. The normal weekly output of the main products is 1020 tons of "Coalite" smokeless fuel, 28,320 gals. of oil, and 7,000,000 cb. ft. of gas.

German Chemical Fusion

The Chemische Fabrik auf Aktien (vorm. E. Schering) and the Kahlbaum concern have amalgamated to form a single company, the Schering-Kahlbaum A.-G.

Coal Research in Czechoslovakia

An institute for research on coal has been formed in Prague with the help of the State and all the coal producers in Czechoslovakia.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial.—Cryst., £30 per ton; Powder, £32 per ton; Extra fine Powder, £34 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60d. per ton, 168° Tw., Arsenical, £5 10s. per ton, 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P. Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate.—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
Arsenic Sulphide, Yellow.—1s. 9d. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 9d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep.—6s.—6s. 3d. per lb.

Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £10 5s. per ton. Good demand.
 Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.

Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.

Red Liquor.—9d.—10d.

Wood Creosote.—1s. 9d. per gal., unrefined.

Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.

Wood Tar.—£4—£5 per ton.

Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—7½d.—8d. per lb. Crude 60's, 2s. 4d.—2s. 5d. per gal.

Acid Cresylic, 99/100.—2s. 11d.—3s. per gal. 97/99.—2s. 4d.—2s. 5½d. per gal. Pale, 95%, 2s. 3d.—2s. 4d. per gal. Dark, 95%, 2s. 1d.—2s. 2d. per gal.

Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.

Benzole.—Crude 65's, 9½d.—9¾d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 6d. per gal., ex works in tank wagons.

Toluole.—90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 6d.—2s. per gal.

Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.

Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7¾d. per gal. ex works. Salty, 7d. per gal., less 1½%.

Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.—10d. per gal. Solvent 95/160, 1s. 3d.—1s. 4d. per gal. Solvent 90/190, 9½d.—1s. 3d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.

Naphthalene.—Crystals. £11 10s.—£13 10s. per ton. Flaked, £12 10s.—£13 per ton.

Pitch, medium soft.—85s.—87s. 6d. per ton, f.o.b. according to district. Market firm.

Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180—4s. 6d.—5s. per gal. Heavy.—4s.—4s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 6d. per lb.

Acid Amidonaphthol disulpho (1.8.2.4.) 10s. 9d. per lb.

Acid H.—3s. per lb.

Acid Naphthionic.—1s. 6d. per

Acid Neville and Winther.—4s. 9d. per lb.

Acid Sulphanilic.—8½d. per lb.

Aniline Oil.—8d. per lb., naked at works.

Anthranilic Acid.—8d. per lb., naked at works.

Benzaldehyde.—1s. 2d.—1s. 4d. per lb., 100%.

—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—5½d. per lb.

m-Cresol 98/100%.—2s. 7½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—1s. 10d. per lb.

Dimethylaniline.—1s. 11d. per lb.

Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton.

Dinitrochlorobenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

α-Naphthol.—2s. per lb. d/d.

β-Naphthol.—10d. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb.

β-Naphthylamine.—3s. per lb.

o-Nitraniline.—5s. 9d. per lb.

m-Nitraniline.—3s. per lb. d/d.

p-Nitraniline.—1s. 7d.—1s. 8d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb.

R. Salt.—2s. 2d. per lb.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—7½d. per lb.

p-Toluidine.—2s. per lb., ex works, naked.

m-Xyldine Acetate.—2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 4d.—2s. 5d. per lb.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Soley ex Gum.—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—Cryst. 36s.—37s. per cwt. Powder 40s.—41s. per cwt.; Extra Fine Powder, 42s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 7d.—1s. 8d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 4d.—1s. 6d. per lb. Technical 11½d.—1s. per lb. Good demand.

Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Acetanilide.—1s. 6d.—1s. 9d. per lb. for quantity.

Amidol.—7s. 6d.—9s. per lb. d/d.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton, Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—9s. per oz.

Barbitone.—5s. 9d.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—10s. 4d.—10s. 7d. per lb. Bismuth

Citrate.—9s. 10d.—10s. 1d. per lb. Bismuth Salicylate.—

9s. 10d.—10s. 1d. per lb. Bismuth Subnitrate.—8s. 4d.—

8s. 7d. per lb. Bismuth Nitrate.—6s. 1d.—6s. 4d. per lb.

Bismuth Oxide.—13s. 10d.—14s. 1d. per lb. Bismuth Sub-

chloride.—13s. 10d.—14s. 1d. per lb. Bismuth Subgallate.—

8s. 1d.—8s. 4d. per lb. Extra and reduced prices for

smaller and larger quantities respectively; Liquor

Bismuthi et Ammon. Cit. B.P. in W. Qts.—1s. 1d. per lb.;

12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal 25s. per cwt. Powder 26s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d. per lb. Potassium.—

Anthranilic
Benzaldehyde

1s. 10½d. per lb. Sodium.—2s. 1d. per lb. Granulated ½d. per lb. less. All spot. Large quantities at lower rates.
 Calcium Lactate B.P.—1s. 4d.—1s. 5d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ethers: S.G. 730, 10½d.—1s. 1½d. drums. Other gravities at proportionate prices.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—4s. 9d.—5s. per lb.
 Hexamine.—2s. 3d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal. in carboys; Winchesters, 2s. 11d. per gal.; 20 vols., 4s. 3d. per gal. in carboys; Winchesters, 5s. per gal.
 Hydroquinone.—3s. 3d.—3s. 6d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate—B.P.—2s. 2d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—18s.—20s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol—A.B.R. recryst., B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots Red oxide, 7s. 6d.—7s. 7d. per lb.; Lévig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.
 Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonal.—8s. 9d.—9s. per lb.
 Metol.—9s. 11s. 6d. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb. less in quantity
 Phenacetin.—2s. 6d.—2s. 9d. per lb.
 Phenazone.—4s.—4s. 3d. per lb.
 Phenolphthalein.—6s. 6d.—6s. 9d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 98s. per cwt., less 2½%.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferrieyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6½d. per lb. spot.
 Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 11d.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb. carr. paid.
 Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 7d.—1s. 8d. per lb. Crystal, 1s. 8d.—1s. 9d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.
 Sulphonal.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.
 Aubepine (ex Anethole).—11s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(ex Bois de Rose) 14s. per lb.—(ex Shui Oil) 9s. 9d. per lb. Linalyl Acetate.—(ex Bois de Rose) 17s. 6d. per lb.—(ex Shui Oil) 13s. 9d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 8d. per lb. Vanillin.—10s. 6d. per lb.

ESSENTIAL OILS

Almond. Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb. Bergamot.—26s. per lb. Bourbon Geranium.—13s. 6d. per lb.
 Camphor.—9d. per lb. Cananga, Java, 15s. 9d. per lb. Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java, 1s. 10d. per lb., c.i.f. U.K. port, for shipment over 1928. Ceylon, Pure, 1s. 8d. per lb. Clove, pure 5s. 3d. per lb.
 Eucalyptus, Australian—2s. 2d. per lb. Lavender.—Mont Blanc, 28/40%, 17s. per lb. Lemon.—7s. 3d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. per lb. Peppermint—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Potitgrain.—8s. per lb. Sundalwood—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST.

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Jan. 16th, 1928. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Dec. 1st, 1927. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

British Dyestuffs Corp., Ltd., Saunders, and Williams. Thermal decomposition of substances. 29,757. Nov. 7.
 Buss. Apparatus, for making extracts and infusions. 30,064. Nov. 9.

Calico Printers' Association, Ltd., and Watson. Drying-cylinders. 30,302. Nov. 11.

Carborundum Co., Ltd. Furnaces. 30,086. Nov. 9. (U.S. 27,12,26.)

Carborundum Co., Ltd. (Carborundum Co.). Kilns. 30,448. Nov. 12.

Chem. Engineering & Wilton's Patent Furnace Co., Wilton, and Wilton. Apparatus for treating gases with liquids. 29,926. Nov. 8.

Comp. des Mines de Bruay. Furnace. 29,778. Nov. 7. (Fr. 27.7.27.)

Crénond. Filters. 29,950. Nov. 8.

Electroflo Meters Co., Ltd. Recording pyrometers. 29,861. Nov. 8.

Empson. Centrifugal separators. 29,888. Nov. 8.

Excelsior Feuerlöschgeräte A.-G. and Treichel. Extinguishing fires. 29,809. Nov. 7. (Ger. 15.11.26.)

Fells and Firth. Manufacture of adsorbents. 29,895. Nov. 8.

Fusion Corp., Ltd., and Hollins. Extraction of dust or solid particles from gases. 30,363. Nov. 11.

Harding. Filtering-apparatus. 30,115. Nov. 10.

Hump. Crushing etc. mills. 30,183. Nov. 10.

Laughlin Filter Corp. Centrifugal separators. 29,967. Nov. 8. (U.S. 20,1.27.)

Loewe. Obtaining high vacuum. 30,103. Nov. 10. (Ger. 11.11.26.)

Scott. Prevention of caking of crystals etc. 30,374. Nov. 11.

Snow. Emulsifiers, mixers, etc. 30,238. Nov. 10.

Steele, Steele, and Sutton. Dry separation. 30,191. Nov. 10.

Studienges. f. Gas-Ind. Producing compressed gases. 30,201. Nov. 10. (Ger. 10.11.26.) Conveying and consuming liquid air. 30,202. Nov. 10. (Ger. 10.11.26.) Accumulating, conveying, etc. liquefied gases. 30,155. Nov. 12. (Ger. 13.11.26.)

Wilderman. Filter presses. 30,143. Nov. 10.

Zeiss. Colorimeters. 30,020. Nov. 9. (Hungary. 10.11.26.)

I.—Complete Specifications

19,040 (1926). Andrews. Classification of powdered materials by elutriation. (279,932.)

19,199 (1926). Ges. f. Lande's Eismaschinen. Transmission of heat from one gas to another. (256,271.)

19,322 (1926). Carpmacel (I.-G. Farbenind.). Extracting and drying inorganic jellies. (279,941.)

24,987 (1926). I.-G. Farbenind. Treating liquids containing tasty and aromatic substances. (259,598.)

30,654 (1926). Woodall Duckham (1920), Ltd., and Duckham. Tunnel kilns. (280,044.)

32,640 (1926). Robinson and Parkes. Resolution of emulsions or suspensions containing tar or oil. (280,059.)

18,077 (1927). Siemens & Halske A.-G. Pyrometers. (274,096.)

*21,039 (1927). Filtration Engineers, Inc. Filter-cake treating-devices. (280,170.)

*29,182 (1927). Sandor. Producing foam. (280,208.)

II.—Applications

Bowater and Lynn. Intermittent carbonising plants. 29,825. Nov. 7.

Drake, and Drakes, Ltd. Producer etc. furnaces. 29,995. Nov. 9.

Flawn. Fuel for cooking, heating, etc. 29,686. Nov. 7.

Johnson (I.-G. Farbenind.). Recovery of oxidation products of solid hydrocarbons. 29,711. Nov. 7.

Lander and Shaw. Low-temperature carbonisation of bituminous coals etc. 30,365. Nov. 11. Vertical retorts etc. 30,366. Nov. 11.

Martin and Thame. Extraction of oil from shale etc. 30,193. Nov. 10.

Montgomerie. 30,283. See IX.

Moore and Moore. Apparatus for manufacture of combustible gas. 30,104. Nov. 10.

Ramsay. Distillation of carbonaceous material. 30,275. Nov. 11.

Regenerative Coal Gasification System, and Travers. Apparatus for enriching gas. 30,353. Nov. 11.

Sharples Specialty Co. Refining petroleum. 30,087. Nov. 9. (U.S. 9.11.26.)

Smith. 29,913. See VII.

Smith. Apparatus for extracting tar from gases etc. 30,324. Nov. 11.

II.—Complete Specifications

19,578 (1926). Elhs (Foundation Oven Corp.). Coke ovens. (279,955.)

28,922 (1926). Collins. Apparatus for refining or cracking of hydrocarbons. (280,039.)

32,640 (1926). Robinson and Parkes. See I.

32,714 (1926). Ammonia. Purifying gas. (263,830.)

28,540 (1926). Collins. Refining or cracking of hydrocarbons. (280,034.)

6298 (1927). Kohlenveredlung A. G. Working of gas retorts. (267,153.)

6299 (1927). Dicker (Nederlandsche Bims-Cement- en Asphaltd.). See IX.

12,404 (1927). I.-G. Farbenind. Extraction of carbon dioxide from gaseous mixtures. (271,852.)

*18,724 (1927). Koppers Co. Purification of fuel and other gases. (280,165.)

III.—Complete Specification

32,640 (1926). Robinson and Parkes. See I.

IV.—Applications

Cassella & Co. Manufacture of anthranthrene dyestuffs. 30,241. Nov. 10.

Comp. Nat. de Mat. Colorantes. Manufacture of halogenated organic compounds. 30,354. Nov. 11. (Fr. 23.7.27.)

Crood (Pyridium Corp.). Preparing water-soluble azo dyes. 30,170. Nov. 10.

Hellriegel and Traube. Producing N-monoalkyl derivatives of the aminophenols. 30,025. Nov. 9. (Ger. 15.11.26.)

Imperial Chemical Industries, Ltd. and Alchem. Dyes. 29,756. Nov. 7.

Selden Co. 30,327. See XX.

IV.—Complete Specification

*29,303 (1927). Cassella & Co. Manufacture of dyestuffs of the anthranthrene series. (280,217.)

V. Applications

British Celanese, Ltd., Ellis, and Olpin. Treatment of cellulose derivatives. 29,738. Nov. 7.

Brown, Godsaver, and Hall. Manufacture of cellulose products. 30,457. Nov. 12.

Courtaulds, Ltd., Huxley, and Morton. Production of artificial threads etc. 29,727. Nov. 7.

Dreaper. Manufacture of artificial silk etc. 30,287. Nov. 11.

Gough. Drying raw wool. 30,069. Nov. 9.

Happer. Manufacture of paper. 30,411. Nov. 12.

Imperial Chemical Industries, Ltd., Jenkins, Payman, and Swann. Cellulose ester solutions. 29,938. Nov. 8.

Imperial Chemical Industries, Ltd., and Jenkins. Nitro-cellulose products. 30,206. Nov. 10.

Nederlandsche Kunstzijdefabr. Preparing artificial silk. 30,296 and 30,314. Nov. 11. (Holland, 27.12.26 and 25.2.27.)

Toda. Treating viscose filaments. 29,724. Nov. 7.

V.—Complete Specifications

- 13,730 (1926). I.-G. Farbenind. Treating articles with soaps. (253,105.)
 19,403 (1926). Lapierre. Treatment of hemp etc. (279,946.)
 5618 (1927). Jackson (Bennett, Inc.). Production of waterproof paper or paperboard. (280,083.)
 8784 (1927). Clavel. Treatment of artificial silks. (280,094.)
 28,580 (1927). British Celanese, Ltd. Products from organic derivatives of cellulose. (280,195.)

VI. Applications

- Brandwood. Dyeing artificial silk threads etc. 30,002. Nov. 9.
 Crompton. Dyeing cloth. 30,442. Nov. 12.
 Haddan (Soc. des Textiles Roannais). Hydrophilising textile fibres. 30,188. Nov. 10.
 Hunt, and Hunt & Moscrop, Ltd. Bleaching kiers. 29,982. Nov. 9.
 Silver Springs Bleaching & Dyeing Co., and Hall. Production and colouring of textile yarns etc. 29,872. Nov. 8.

VI.—Complete Specifications

- 19,325 (1926). British Dyestuffs Corp., Horsfall, and Lawrie. Colouring furs and other materials. (279,942.)
 19,482 (1926). Etabl. Petrididier. Colour printing on fabrics. (258,562.)
 23,161 (1926). British Dyestuffs Corp., Baddley, and Chapman. Manufacture of wetting-out agents etc. (279,990.)

VII. Applications

- Deutsche Gold- & Silber-Scheideanstalt. Oxygen-evolving preparations for respiratory apparatus etc. 30,040. Nov. 9. (Ger., 10.11.26.)
 Johnson (I.-G. Farbenind.). Production of anhydrous metallic chlorides. 29,739. Nov. 7.
 Kisscock. Production of molybdates. 29,790. Nov. 7. (U.S., 6.11.26.)
 Messer, and Messer & Co. Ges. Separation of air into oxygen and nitrogen. 29,815 and 30,339. Nov. 7 and 11. (Ger., 15.11.26.)
 National Processes, Ltd., and Robson. Roasting pyrites etc. 29,881. Nov. 8.
 Scott. 30,371. *See* I.
 Smith. Recovery of ammonia from coal gas etc. 29,913. Nov. 8. Manufacture of lead carbonate. 30,060. Nov. 9.
 Stuhenges f. Gas Ind. 30,202. *See* I.

VII.—Complete Specifications

- 19,322 (1926). Carpmuel (I. G. Farbenind.) Extracting and drying inorganic jellies. (279,941.)
 *29,790 (1927). Kisscock. Producing molybdates. (280,240.)

VIII. Application

- Setterberg. Manufacture of porous refractory bricks etc. 29,855. Nov. 8. (Sweden, 26.11.26.)

IX.—Applications

- Baxter. Hydraulic cement etc. 30,207. Nov. 10.
 Carpenter. Manufacture of cement. 30,107. Nov. 10.
 Grote, and Musag Ges. 30,036. *See* X.
 Lindman. Manufacture of porous clinker-like materials. 30,190. Nov. 10. (Sweden, 10.11.26.)
 Montgomerie. Bituminous emulsions. 30,283. Nov. 11.

IX.—Complete Specifications

- 6299 (1927). Dicker (Nederlandsche Buis-Cement- en Asphaltind.). Preparing an artificial asphalt material. (280,085.)

X.—Applications

- Anthoine. Treatment of low-grade ores. 29,777. Nov. 7.
 British Thomson-Houston Co., Ltd. Alloys. 29,731. Nov. 7. (U.S., 9.11.26.)

Carpmuel (I.-G. Farbenind.). Decomposition of chromium ore etc. 30,242. Nov. 10.

Cheeseman and Cheeseman. Solder for aluminium etc. 29,072. Nov. 9.

Coles. Preparation of iron surfaces for painting. 30,274. Nov. 11.

Goodyear Tire & Rubber Co. Preventing dissolution of metals in pickling-baths. 30,232. Nov. 10. (U.S., 21.10.27.)

Grote, and Musag Ges. Transformation of slag into slag sand. 30,036. Nov. 9. (Ger., 20.11.26.)

Gustafsson. Producing metals from their sulphides. 29,751. Nov. 7. (Sweden, 11.11.26.)

Hadfield. Heat treatment of steel. 29,916. Nov. 8.

Johnson (I.-G. Farbenind.). Recovery of metals etc. soluble in ammoniacal liquors. 29,743. Nov. 7.

Smith. Treatment of metalliferous materials. 30,059. Nov. 9.

Sundberg. Manufacture of iron etc. articles. 29,963. Nov. 8.

Zohrab. Reduction of iron ores. 29,920. Nov. 8.

X.—Complete Specifications

- 19,057 (1926). Jessup. Electrolytic production of metals. (256,610.)
 3468 (1927). Joseph and Schnorr. Silver alloys. (280,073.)
 10,208 (1927). Rutsche. Removing deposits, scale, or incrustations from metal. (280,099.)
 11,490 (1927). Tainton. Electrodeposition of zinc. (280,103.)
 14,725 (1927). Cholewinski. Bearing-metals. (272,889.)
 15,154 (1927). Aluminium-Ind. A.-G. Electrolytic extraction of pure aluminium from crude aluminium alloys etc. (272,246.)

XI. Applications

- Almeida Accumulators, Ltd., and Levy. Electric cells. 30,205. Nov. 10.
 Everett. Storage batteries. 30,371. Nov. 11. (U.S., 3.9.27.)
 Marchini (Passatti). Production of insulating-material. 29,871. Nov. 8.
 Oldham & Son, Ltd., and Wilde. Galvanic batteries etc. 30,194. Nov. 10.

XI.—Complete Specifications

- 17,179 (1926). Edison Swan Electro Co., Ltd., and Webster. Preparation of electric accumulator plates. (279,926.)
 19,057 (1926). Jessup. *See* X.
 19,234 (1926). Smith and McLachlan. Photo-electric cells. (279,937.)
 11,684 (1927). Thinton. *See* X.
 15,154 (1927). Aluminium Ind. A.-G. *See* X.
 21,219 (1927). Stewart. Metallic filaments for electric incandescent lamps. (277,634.)
 *26,977 (1927). I.-G. Farbenind. Electrically insulating composition. (280,178.)
 *28,325 (1927). British Thomson-Houston Co., Ltd. Flexible insulating-material. (280,189.)
 *28,745 (1927). Kugel. Electrolyte for lead accumulators. (280,197.)

XII.—Complete Specifications

- 13,099 (1927). I.-G. Farbenind. Soap preparations. (280,110.)
 *28,471 (1927). Vidal. Production of fatty bodies soluble in water. (280,193.)

XIII.—Applications

- British Dyestuffs Corp., Ltd., Stafford, and Walker. Manufacture of phenolic resins. 30,225. Nov. 10.
 Canadian Electro Products Co. Manufacture of synthetic gum or resin. 29,843. Nov. 8. (U.S., 8.11.26.)
 I.-G. Farbenind. 29,764. *See* XX.

Imperial Chemical Industries, Ltd., Hill, and Walker. Manufacture of artificial resins. 30,349. Nov. 11.

Pollopas, Ltd., Baly, and Baly. Manufacture of aldehyde condensation products. 30,259-60. Nov. 11.

XIII.—Complete Specifications

*20,509 (1926). British Dyestuffs Corp., Hollins, and Chapman. Manufacture of inks. (279,968.)

30,314 (1926). Torrance, and Torrance & Sons, Ltd. Plant for manufacture of paints, enamels, inks, etc. (280,041.)

32,857 (1926). Quittner. Manufacture of elastic and waterproof coatings. (263,849.)

10,210 (1927). Chem. Fabr. vorm. Schering. Printers' ink. (270,671.)

*29,843 (1927). Canadian Electro Products Co., Ltd. Manufacture of synthetic gum or resin. (280,246.)

XIV.—Application

L.-G. Farbenind. Preservation and treatment of latex. 30,433. Nov. 12. (Ger., 11.11.26.)

XIV.—Complete Specifications

25,561 (1926). Tomlinsons (Rochdale), Ltd., and Smith. Drying rubber. (280,016.)

25,968 (1926). Soc. Italiana Pirelli. Protection of rubber articles against ageing. (260,001.)

509 (1927). Roessler & Hasslacher Chemical Co. Vulcanisation of rubber. (265,169.)

XV.—Applications

Arnot. Hydrolysis of casein etc. 30,452. Nov. 12.

Jalowez and Stiasny. Tanning hides etc. 29,795. Nov. 7.

XVI.—Complete Specifications

*29,392 (1927). Bauer and Szold. Production of manure from molasses waste. (280,219.)

*29,543 (1927). Soc. Anon. Union Agricole de Jodoigne. Complete dissolved manure. (280,226.)

XVII.—Application

Anc. Etabl. Navy, Jeanjean, et Cie., Baker, Perkins, Ltd., and Hulme. Crystallisation of gums etc. 29,786. Nov. 7.

XVII.—Complete Specifications

*30,159 (1926). Raffinerie Tirmontoise. Refining massecuite etc. (280,152.)

*29,392 (1927). Bauer and Szold. See XVI.

*29,764 (1927). L.-G. Farbenind. See XX.

XVIII.—Application

Johnson (L.-G. Farbenind.). Cultivation of micro-organisms etc. 29,742. Nov. 7.

XIX.—Applications

Arnot. 30,452. See XV.

Büning. Increasing percentage of fat in milk. 29,753. Nov. 7.

Donner. Preservation of liquid eggs etc. 30,138. Nov. 10.

Serafian. Concentrating fruit juices etc. 29,854. Nov. 8.

XIX.—Complete Specifications

19,743 (1926). Marks (Industrial Appliance Co.). Curing flour. (279,958.)

22,476 (1926). Fujii. Preparation of flavouring, nourishing, and similar substances. (279,985.)

24,987 (1926). L.-G. Farbenind. See I.

*20,280 (1927). Grönningaer, and Fischer-Hollinshead Co., Inc. Transferring vitamins. (280,212.)

XX.—Applications

Chem. Works Sandoz. Manufacture of chemotherapeutical compositions. 29,927. Nov. 8. (Switz., 15.1.27.)

Preparation of bile acid salts of cinchona alkaloids. 29,928. Nov. 8. (Switz., 17.12.26.)

Firth and Towson. Chlorinating organic materials. 30,258. Nov. 11.

L.-G. Farbenind. Manufacture of condensation products from urea. 29,764. Nov. 7. (Ger., 6.11.26.)

Manufacture of hydrogenated naphthostyryls. 30,058. Nov. 9. (Ger., 25.11.26.)

Johnson (L.-G. Farbenind.). 29,741. See II. Production of thiourea. 30,046. Nov. 9.

Laboratorium Tasch. Recovery of organic substances from liquors. 30,167. Nov. 10. (Ger., 28.2.27.)

Merck, Merck, Merck, Merck, and Merck. Manufacture of arylaminoalkyl carbinols. 30,229. Nov. 10. (Ger., 10.11.26.)

Pollopas, Ltd., and others. 30,259-60. See XIII.

Selden Co. Catalytic oxidation of organic compounds. 30,327. Nov. 11. (U.S., 3.6.27.)

XX.—Complete Specifications

13,813 (1926). Dreyfus. Manufacture of aliphatic acid anhydrides. (279,916.)

*19,868 (1927). Calcott, Parmelee, and Lorrman. Producing tetra-ethyl lead. (280,169.)

*28,220 (1927). Holzverkohlungs-Ind. A.-G. Production of acetone. (280,184.)

*29,764 (1927). L.-G. Farbenind. Manufacture of condensation products from urea and an alcohol or a ketone. (280,238.)

XXI.—Applications

Howard and Robertson. Obtaining photographic prints 30,171. Nov. 10.

Johnson (L.-G. Farbenind.). Preparation of photographic emulsions. 29,744. Nov. 7.

Martinez. Colour-responsive photographic surfaces. 29,720. Nov. 7.

XXI.—Complete Specification

13,274 (1927). L.-G. Farbenind. Photographic emulsions. (271,475.)

XXII.—Applications

Imperial Chemical Industries, Ltd., and Jenkins. 30,206. See V.

Schaub. Production of nitrocellulose. 30,437. Nov. 12.

Scott. Explosives. 30,375. Nov. 11.

XXIII.—Applications

Dallyn. Purifying sewage etc. 30,302. Nov. 11.

Deutsche Gold- und Silber-Scheideanstalt. 30,040. See VII.

Dickinson and Groombridge. Manufacture of insecticides. 30,215. Nov. 10.

Sim. Deaerating feed water for boilers. 30,105. Nov. 12.

PUBLICATIONS RECEIVED

CLAYS, THEIR OCCURRENCE, PROPERTIES AND USES, WITH ESPECIAL REFERENCE TO THOSE OF THE UNITED STATES AND CANADA. By H. Ries, Ph.D. Third edition, revised and enlarged. Pp. vii+613. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. 35s.

A GUIDE TO THE LITERATURE OF CHEMISTRY. By E. J. Crane and A. M. Patterson. Pp. 438. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. 25s.

DIE VISKOSITÄTSMESSUNGS-APPARATE IHRER MASCHINEN UND APPARATE. By E. Wurtz. Part 5. Monographien zur Chemischen Apparatur, enlarged by Dr. A. J. Kieser, edited by B. Block. Pp. 110. Leipzig: Otto Spamer, 1927. Paper, 6 rm.; bound, 8 rm.

PHYSIKALISCH-CHEMISCHE GRUNDLAGEN DER CHEMISCHEN TECHNOLOGIE. By Dr. G.-M. Schwab. Chemische Technologie in Einzeldarstellungen, edited by Prof. A. Binz. Allgemeine Chemische Technologie. Pp. viii+130. Leipzig: Otto Spamer, 1927. Paper, 10 rm.; bound, 12.50 rm.

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JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, DECEMBER 2, 1927

No. 48

EDITORIAL

Research

IMPERIAL CHEMICAL INDUSTRIES, LTD., have appointed a research council which will be presided over by Sir Alfred Mond, and will include Dr. G. C. Clayton, M.P., Col. G. P. Pollitt, Mr. J. Rogers, Major F. A. Froeth, F.R.S., Dr. E. F. Armstrong, F.R.S., Dr. R. E. Slade, Mr. H. A. Humphrey, Sir Frederick Keeble, F.R.S., and the following academic representatives: Professors F. G. Donnan, F.R.S., R. Robinson, F.R.S., W. A. Bone, F.R.S., F. A. Lindemann, F.R.S., and Dr. E. K. Rideal. Major A. E. Hodgkin will act as secretary. We are quite sure that a council containing so many men of vision and experience will organise the research they are concerned in so as to produce the greatest result from the funds at their disposal. The problem of research in general, when looked at from the point of view of the chemist, is not a simple one. There is a great mass of research being conducted at the present time by students, industrial companies, universities and the Government, and it is perhaps worth spending a few minutes in considering these separately. Most of the research conducted by students is valuable as a training for them, but is not of great value to anyone else, even if it contribute a few new facts to the immense mass already known. Without having real knowledge of the problem, it has appeared to us, in recent years, that there are more highly-trained chemists now available than good posts for them: the supply is greater than the demand: we could more easily find competent chemists at two or three pounds a week than mechanics skilled in some special trade, at five pounds a week. Why more of the younger generation do not think of this important fact, we are unable to state. If a few thousand men and women were to train as skilled professional pianists every year, the majority of them would be glad to receive three pounds a week, and they would not receive a much higher salary, even if the standard of training were raised. We think the supply of trained chemists exceeds the demand, and the amount of research conducted by chemical students is in excess of what is economically justified. So far as research by industrial companies is concerned, including so vast and important

an organisation as Imperial Chemical Industries, we think each individual company or firm must decide for itself how much money should be spent on research and on what sorts of research: the same is true of research organisations designed for particular trades: the conditions vary so much that each case must be considered on its own merits. Subject to what we have already stated about students, we have the highest opinion of the research carried on by the universities. Lastly, we come to the research conducted by the Government: so far as chemistry and associated sciences and industries are concerned, we think the Government is unduly lavish with its money, having regard to the state of our finances, industry and taxation. We admit, however, that we have no really reliable data to go upon: we have this opinion quite strongly, but it may possibly be an instance that when the judgment is weak, the prejudice is strong.

Retirement of Prof. E. C. Williams

Prof. E. C. Williams, who has been Professor of Chemical Engineering at University College, has been remarkably successful, almost too great a success. He has proved to University College that chemical engineering can and should be properly taught there and that the benefits which the present students receive from their training should be extended and enlarged by the provision of more building and equipment. He has proved to the oil industry that his abilities will be useful to them, and we understand that he will soon be engaged in organising research in oil problems in California. It is a pity that he cannot stay to put the department in the order which University College desires, but we ought to be thankful that his zeal and efficiency have inspired the college authorities to the considerable development they have in mind. It is rumoured that a strong committee has been formed to raise funds and to organise a chemical engineering department, not only worthy of that branch of engineering, and of University College, but also worthy to be a testimony to the skill and enthusiasm shown by Prof. Williams. It is stated that Sir Alfred Mond will be the chairman of the committee.

and that it will include Sir R. Waley Cohen, Sir David Milne Watson, and Sir Frank Heath. Prof. Williams is particularly good as a teacher, an investigator and an administrator; his academic career has been distinguished. He would have been certain to attain to greater heights as a teacher had he not impressed the industrial world with the belief that he possessed good sense as well as marked ability. This error may be a fatal obstacle to his academic progress. The committee appointed to deal with the situation is a strong one; whether strong enough to find a successor equal to Prof. Williams we do not know. We wish him good fortune in California; we feel sure that he carries with him the respect of his colleagues and his students; he leaves behind him a little constructive work for the committee to do; the members whose names we have given all like work, and take every opportunity of filling up their spare time; if they are fairly representative of the committee useful work will speedily be done.

The Times Chemical Supplement

The International Chemical and Allied Industries number of *The Times Trade and Engineering Supplement* is a handsome journal of 36 pages, and it gives a more complete account of the chemical industry of the world than any other publication we remember. It is worth buying and worth keeping, and those portions we have read are worth reading. The chemical industry has now become a very large and important one, and it will in the course of time not only grow in size and importance, but will permeate more and more into other industries. Prof. E. C. Williams writes the first article in this number, one on "The chemical engineer," and he considers, among other matters, the necessity for vision and foresight and the possibility of these qualities being possessed by financiers and chemists. In his view "there can be no far-seeing to one who is not raised above the level, and to see far in chemical industry it is upon a structure of chemistry and engineering that he must be raised." The chemist alone is, according to Prof. Williams, probably more near-sighted than the financier alone. We wonder if chemists will admit this statement; probably not. Even if it is true, the explanation is possibly that the profession of chemistry is so overcrowded that the pay of the majority is inadequate and they must work so long hours to make an income that they have neither time nor energy left for other pursuits. There are many other articles worth reading: one on "Cyanides," by Kenneth M. Chance; on "Explosives," by W. Macnab; on "British fine chemicals," by C. A. Hill; on "Non-ferrous ores," by W. G. Wagner; on "Modern steel," by Sir Robert Hadfield; on "The metallurgy of zinc," by H. M. Ridge; and on "Chemical societies and institutions," by R. B. Pilcher, and others by many well-known men. The illustrations and tables of statistics are abundant, and we think that if the chemists and the managers and directors of the chemical industry would find the time to read this publication it would be a good thing. No one could make a habit of reading supplements of so broad a nature and remain near-sighted. The first page of the number is alone worth more than the 3d. which is the price of the whole 36 pages.

SOME MODERN METHODS OF RECOVERY OF LUBRICATING OIL

By A. J. BROUGHALL, M.I.Chem.E.

(Concluded)

CENTRIFUGE (ALFA-LAVAL CO., LTD.)

This centrifuge (Figs. 6, 7, 8 and 9) is of a neat compact design similar to this firm's well-known cream separator, and consists of a casing in which is housed the mechanism for driving the cylindrical bowl. This bowl, which has a conical top, is of a special floating construction and self balanced. It revolves at 6000 to 9000 r.p.m., according to size, and the special feature is the fitting of a number of conical discs, each of which have a certain number of holes.

The bowl is designed to act either as a purifier or a clarifier. When used to purify oil which contains water and solid impurities, a special fitting is supplied for the upper portion of the bowl, and by fitting various sized discs adjustments can be made for the difference in specific gravity. The fitting has outlets for the pure oil and for water, the solid impurities being retained in the bowl.

Before putting oil into the machine, water is fed in to form a seal. The oil to be purified is fed in the central cavity at the top of the bowl and passes down a tube to the bottom, where it is subjected to the action of centrifugal force, which causes the heavier particles to travel at right angles to the axis of rotation.

The dirty oil on reaching the bottom of the bowl is

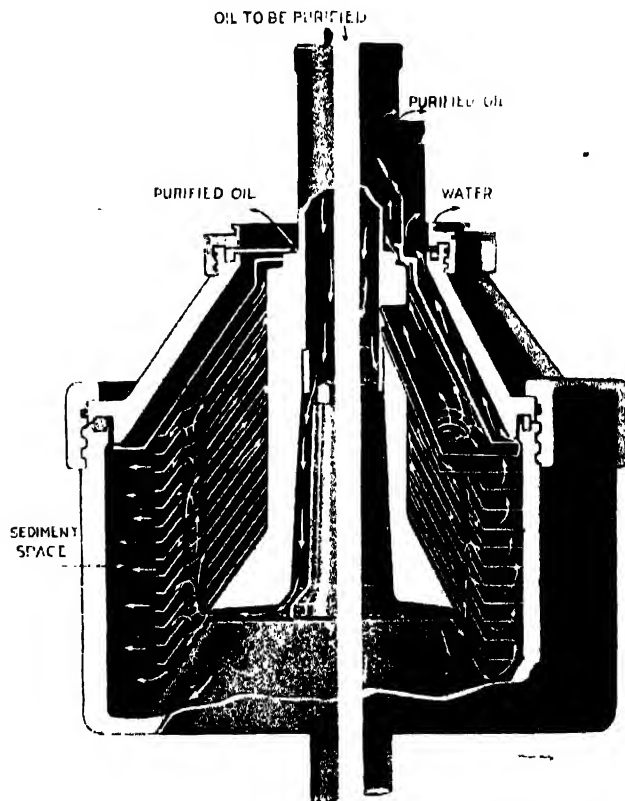


FIG. 6.—Alfa-Laval centrifuge. Section through bowl

distributed between the discs in thin films through a series of holes. Whilst in this finely divided state purification is effected; the solid particles strike the underside of the conical disc, move outwards and are deposited on

the bowl and the liquid is discharged through a special outlet.

This firm supplies special washing and settling tanks for treating the oil previous to it going through the centrifuge. Trisodium phosphate is recommended to neutralise

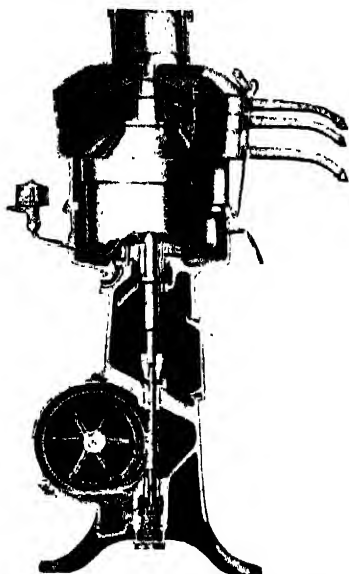


FIG. 7.—Alfa-Laval centrifuge. Cross-section of machine.

the periphery of the bowl. The water passes outwards on the underside of the discs and forms the intermediate layer, passing out through the water discharge pipe at the top, the pure oil passing along the upper side

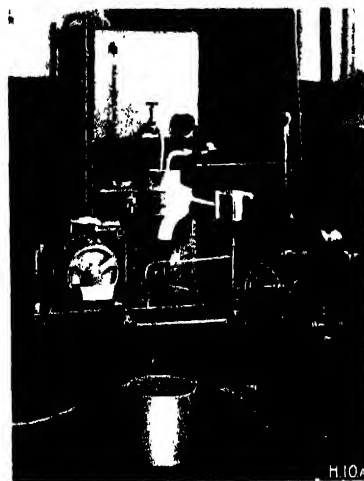


FIG. 8.—Alfa-Laval centrifuge. Installation.

acidity, and, in certain cases, a solution of sodium silicate. Water is added to the oil and the mixture is heated to a temperature of 190° F. before passing it through the centrifuge.

A good feature of this machine is accessibility, the bowl being easily removed for cleaning purposes.



FIG. 9.—Alfa-Laval centrifuge. Installation, with tanks.

of the discs towards the centre, and being discharged through the pure oil pipe.

When using the machine for clarifying, another fitting is supplied by means of which the solids are retained in

For dealing with the oil from the crank case of internal-combustion engines, where it is generally found that the viscosity of the oil has been lowered owing to dilution by the heavy ends of the fuel, a special plant is provided

by means of which the diluent can be removed and the oil restored to its original viscosity.

STREAM-LINE FILTER (STREAM-LINE FILTER CO., LTD.)

This is a special type of filter which has given very good results on oil recovery. It was described by Prof. H. S. Halc-Shaw in June, 1923, before the London Section of the Society. The basic feature is that when a liquid containing solid particles is brought against the edges of a pile of suitably prepared impervious papers, the solids are arrested at the edge and only the clear liquid goes *between*, not through the leaves. This provides a filtering medium, the degree of fineness of which can be regulated as desired, as with increasing pressure on the pile of papers constituting the filter, particles of diminishing size can be filtered out until, at a pressure of 40–50 lb. per sq. in. on the column of papers, even the fine colloidal carbon held in suspension in used lubricating oil can be completely removed.

Two experiments will be made to illustrate this point. In the first, a sample of used lubricating oil will be passed through an ordinary high-grade gravimetric

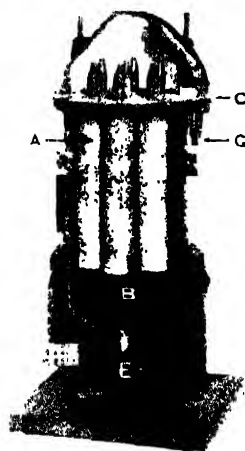


FIG. 10

Stream-line filter. Section through machine

filter paper, when it will be seen that the oil passing through is still discoloured and contains colloidal carbon in suspension. A similar sample of oil will be passed through the filter, and an examination of it will show that the whole of the colloidal carbon has been filtered out.

The second experiment, which demonstrates the extreme fineness of filtration, shows the complete removal of one of the finest artificially-prepared precipitates that can be obtained, namely, a cold precipitated barium sulphate, which passes freely through the gravimetric filter paper, but is completely arrested by the stream-line filter having a pressure of 20 lb. per sq. in. on the filter pack and 2 to 3 lb. on the liquid. It is of interest to notice the relative rates of filtration through these two media. In view of the fact that the particles of solid which have to be removed from a used oil are in a general way much smaller than the thickness of the paper, it is of particular importance that these shall be prevented from entering between the fibres, which would cause the thickening of the edges. The characteristics

which have made this filter so valuable commercially for the recovery of used oil depend upon the impervious nature of the paper, which has made it possible to devise the extremely simple cleaning operation.

In its commercial form (Figs. 10 and 11) the stream-line filter consists of a series of columns A of specially-prepared paper which are fitted between a grid end plate B and a top plate C in a cast-iron or mild steel casing,

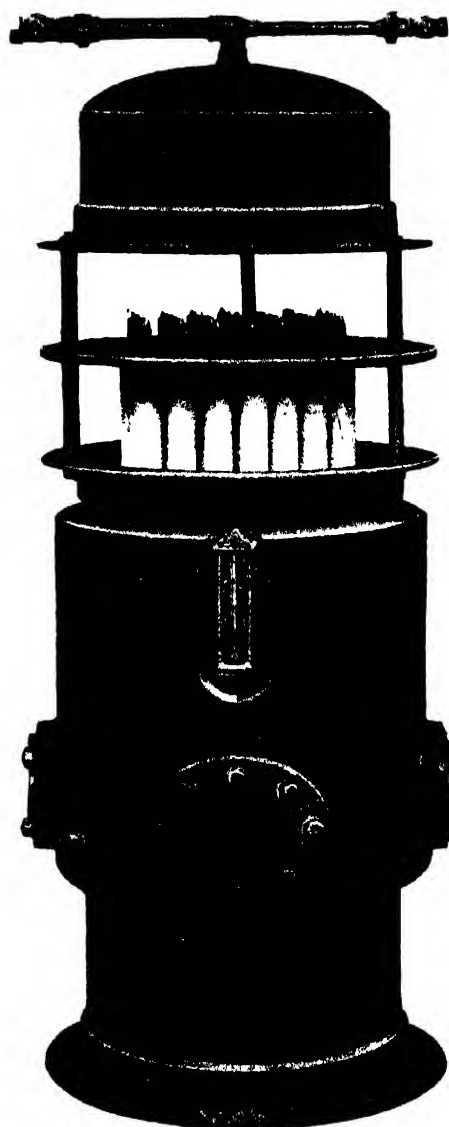


FIG. 11

Stream-line filter. Unit before closing

the columns being held together under pressure by springs G carrying the grid. The used oil is caused to flow between the sheets by a difference of pressure between the two sides of the columns, produced either by a pressure pump or a small vacuum pump. The solid residue remains on the outside of the columns, and only the clean oil goes *between*, but not through the papers, into the centre holes which communicate with the outlet.

It will be noted, on referring to the tables giving analyses of used oils, that they contain not only carbon and asphaltenes, but usually water from the products of combustion of the fuel, and petroleum products, either from the fuel itself or from the breakdown of this fuel as

fractions of fuel oil and the water are evaporated and discharged with the air from the exhaust of the vacuum pump. The division of the supply of oil into extremely thin layers, in its passage between the papers, brings it into an ideal condition for the complete removal of these products.

Tests made with this apparatus on used oils show that clean oil is obtained equal to its original quality, and that water and solid particles are completely removed.

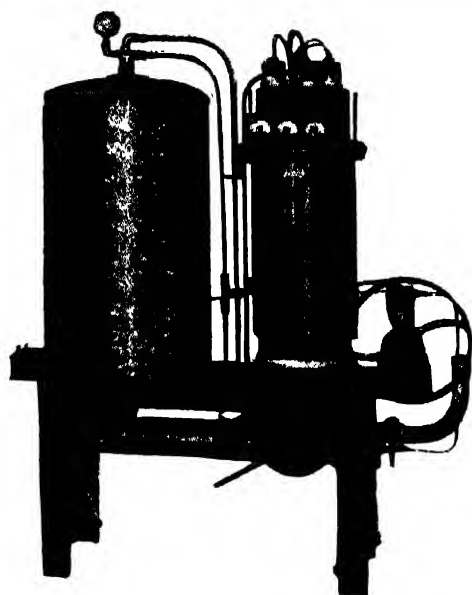


FIG. 12

Stream-line filter. Self-contained electrically-heated plant

in the Diesel engine. It is essential that these as well as the carbon should be removed if the oil is to be restored to its original condition.

To do this the plant (Fig. 12) has been arranged to operate by means of vacuum and at a temperature of

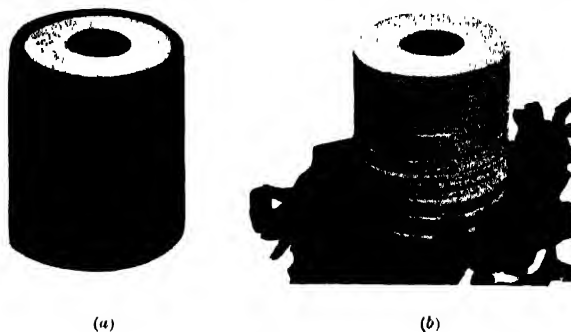


FIG. 13

Stream-line filter. Showing—(a) collection of solid residue on surface; (b) completeness of removal by compressed air

The illustration of an incandescence lamp (Fig. 14) immersed in the recovered oil is of interest in showing the purity of the recovered oil. In view of the principle upon which this filter works the question of keeping the filtering surfaces clean is of importance. This cleaning is effected by simple reversal with compressed air (Fig. 13), and experiment shows the completeness and simplicity of this operation. In the commercial plant the small vacuum pump is used for this purpose, as by the moving of a lever from the position marked "Filter"

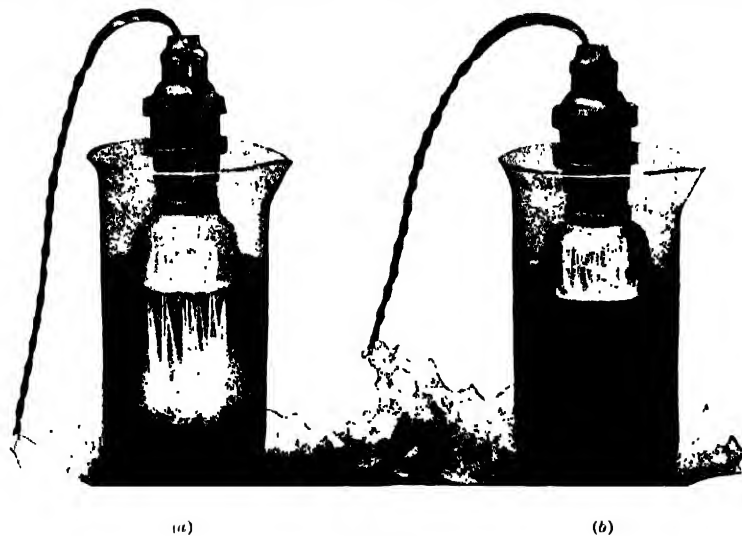


FIG. 14

Stream-line filter. Incandescence lamp immersed in—(a) recovered oil; (b) used oil

150–170° F. The small vacuum pump driven by a motor of from $\frac{1}{8}$ to $\frac{1}{2}$ h.p., according to the size of the plant, gives a vacuum of from 28½ to 29 in. of mercury, and under this pressure and at 150–170° F. the light

to "Drain," the oil then in the filter is allowed to drain out, but can be returned to the plant later. This movement also converts the vacuum pump into an air compressor. In each size of filter plant the drain cock

and the compressed air bottle are so designed that while the filter is draining (3 to 4 minutes) a charge of compressed air at 50 lb. per sq. in. is collected in the air bottle, which is fitted with a safety valve adjusted to blow off at this pressure. The movement of the control cock from "Drain" to "Clean" releases the compressed air in reverse through the unit and blows out the collected sludge from the orifice at the bottom of the filter.

The "Stream-line Renovator" has been applied successfully to the continuous purification of lubricating oil in steam turbines, Diesel and gas engines, and also motor cars.

An interesting series of samples of oil taken from the crank-case of a Swift 14 h.p. car is available showing the condition of the oil at 60, 90, etc. miles up to 23,000 miles. It is most interesting to compare the last sample with one of oil taken from the crank-case after a run from Coventry to London without the filter attached.

In fairness to other makers of oil recovery plants, the methods described are not put forward in the sense that they are the best or the most suitable, but because they have been personally investigated by the author. The results obtained have proved that with a well-designed plant and a properly organised system it is possible to recover oil so that it is not only equal to its original quality, but in some instances is improved, and that considerable economies can be effected by the saving in the cost of lubrication and greater efficiency attained by prevention of wear on the bearings and moving parts of engines and plant supplied by clean oil.

Much useful information can be obtained by the study of the methods used in the United States, where probably the question has been given more attention than in this country. The reports of the Air Service already referred to are of great interest; 50% of the engineers stated they preferred the reclaimed oil, and the other 50% agreed it was as good as the original.

A number of analyses are given showing the results of tests on recovered oil:—

Nos. (1) and (2).—Industrial Waste Eliminators, Ltd.

Nos. (3) and (4).—Alfa-Laval Co., Ltd.

Nos. (5), (6), (7) and (8).—Stream-Line Filter Co., Ltd.

Analyses of recovered oil compared with original oil

Description	(1) Dynamo oil			(2) Dynamo oil			(3) Cylinder oil			(4) Cylinder oil		
	Original	Used	Recovered	Original	Used	Recovered	Original	Used	Recovered	Original	Used	Recovered
Specific gravity	0.910		0.908	0.918		0.911	0.892		0.891	0.893		0.901
Flash point	188° C.		180° C.	---		---	286° C.		292° C.	287° C.		295° C.
Viscosity	134 s		150.4	110.0		142.0	300*		414*	420*		440*
Loss on heating	15.6%		13.3%	7.1		4.9	0.2		0.5	0.2		0.5
Acidity	0.23		0.3	0.3		0.5	0.04		0.15	0.4		0.07
Ash	Slight trace		Trace	Slight trace		Slight trace	Nil		Trace	Nil		Trace
* At 150° F.												
Description	(5) Gas engine lubricating oil			(6) Turbine oil			(7) Diesel engine lubricating oil			(8) Motor car crank-case oil		
	Original	Used	Recovered	Original	Used	Recovered	Original	Used	Recovered	Original	Used	Recovered
Specific gravity	0.908	0.9184	0.911	0.887	0.912	0.892	0.8873	0.8982	0.8885	0.920	0.942	0.926
Flash point	303° F.	378° F.	391° F.	385° F.	380° F.	382° F.	389.4° F.	368.3° F.	391.2° F.	377° F.	273° F.	381° F.
Viscosity—At 60°	---	---	---	284	372	291	993	1152	1070	---	---	---
At 70°	048	732	662	---	---	---	---	---	---	1507	1731	1612
At 140°	96	104	101	08	88	71	102.4	110.3	103.2	148	162	151
At 200°	47	52	49	---	---	---	---	---	---	53	69	55
Solids	Nil	1.31†	Nil	Nil	0.80%	Nil	Nil	2.14%†	Nil	Nil	2.87%†	Nil
Water	Nil	2.13	Nil	Nil	21.53%	0.13%	Nil	1.37%	Nil	Nil	3.63%	Nil
Colour	Bright	Black	Bright	Bright	Opaque	Bright	Light	Black	Dark Red	Bright Red	Black	Red. No
	Light Red	Opaque	Medium Red	Orange	Chocolate	Orange Red	Red Clear	Opaque	Clear	(Green	Opaque	Fluor-escence
Percentage recovery = 93.87%												
Percentage recovery of available oil = 97%												
† Carbons and asphaltenes												
Percentage recovery = 73.3%												
Percentage recovery of available oil = 94.8%												
Percentage recovery = 94.1%												
Percentage recovery of available oil = 97.8%												
† Carbons and asphaltenes												
Percentage recovery = 87.1%												
Percentage recovery of available oil = 95.4%												
Fuel fractions = 3.46%												
† Carbons, asphaltenes, road dust, etc.												

These indicate quite satisfactory results. No. 1 was a low quality oil, and the loss on heating figure is much too high. As a rule oils of good quality give much better results with oil recovery than those of lower grade. Where large units are concerned and considerable quantities of oil are in circulation it is becoming a general practice to purify the oil on the continuous system. This is to be strongly recommended where possible, as it ensures that the oil is kept clean and in good condition.

On the merits of the different methods of treating oil for recovery and the type of plant used, opinions will naturally differ. Important factors to be considered are the initial cost, working cost, class of oil to be recovered, and the results obtained. Where oils such as cylinder oil and oil for crank-case internal-combustion engines have to be dealt with, it will be found that they present rather more difficult problems than others. Some of the solid matter, such as carbon, exists as very fine particles in a colloidal state, whilst emulsification will be found to some extent, so that with the ordinary method adopted for oil recovery it is not possible to make a satisfactory purification without some preliminary treatment in the wash tank; with motor oil it will inevitably be found that the viscosity has been lowered by dilution of the fuel. Some means must be provided for heating the oil and treating it so that the diluent is removed. Light body oils such as dynamo and transformer oils do not present the same difficulties, and are, in consequence, dealt with far more easily. Some means must be provided for heating the oil, and where the oil can be either spread or finely divided there is always a better chance of the purification being more complete.

It is very important that transformer oil should be quite free from moisture, although the results of tests published on this subject indicate that moisture itself is not so injurious as when impurities are present, a drop in the dielectric strength being caused where water and a small quantity of hygroscopic fibres are present. For use with transformers it is recommended that an oil-recovery plant of a portable nature should be employed, as purification can take place on the spot and there is no risk of contamination.

To obtain the best results from any system of oil recovery, it must be properly organised. In large works the various oils used should be classified and standard specifications drawn up showing the maximum and minimum variation allowed in the different tests, and an oil chart should also be prepared showing what grades of oils are to be used in different parts of the plant. By this means recovered oils which fail to pass the standard test for the original oil can be used in other places where it would be quite satisfactory. Suitable arrangements must be made for the collection of the used oil in receptacles correctly labelled, and for the delivery of the recovered oil in clean vessels.

It is advisable to make an examination of the oil before recovery in order to determine what treatment is necessary to get the best results, and when treated and purified, chemical analysis should be made and the results compared with the original specification. If found satisfactory, a certificate, together with details of analysis, should be furnished by the chemist to the engineer responsible.

There is no doubt that many engineers are reluctant to use recovered oil, and they should not be unduly blamed for taking care that the lubricants they use are suitable for their purpose; it is up to the chemist to treat them with the utmost confidence, and by working together get the most economical results from the recovered oil.

So far as costs are concerned, these will vary according to the nature of the oil recovered and the treatment necessary, but the maximum cost, even on the most difficult oil, should not exceed 6d. to 7d. per gal., and will vary in some instances from 1d. to 2d. per gal.

The author wishes to express his thanks to the Industrial Waste Eliminators, the Super-Centrifugal Engineers, Ltd., the Alfa-Laval Co., Ltd., and the Stream-Line Filter Co., Ltd., for illustrations and the loan of lantern slides; also to Mr. C. S. Garland for much useful information.

CANADIAN INDUSTRIAL NOTES

The financial statement of the Spanish River Pulp & Paper Mills, Ltd., for the fiscal year ending June 30, 1927, shows a gross profit of \$3,065,261, which compares with \$3,743,448 for the preceding year. After deducting interest on funded debt, taxes, etc., a net profit of \$1,715,112 was left, compared with \$2,195,902 the previous year. Dividends of 7% per annum were paid to preferred and common stockholders. The balance to profit and loss has been increased, and now stands at \$7,174,948; general reserve stands at \$1,834,848, and debenture reserve \$7,151,983. During the year the company acquired a holding in the St. Anne Paper Co., Ltd., at Beauport, Quebec.

The Maple Leaf Refining Co.'s plant at Coutts, Alberta, has commenced the production of gasoline and other petroleum products.

The Fraser Companies, Ltd., will enlarge the pulp and paper establishment at Edmonton, N.B., by the addition of plant for an increased daily output of 250 tons sulphite pulp, and increase paper and board output to a corresponding extent.

SCIENCE AND INDUSTRY*

By GEORGE GRAY, M.Sc., F.I.C., M.I.Chem.E.

Neither the scope of the chemist nor the application of scientific principles in industry is, as yet, fully appreciated. The chemist might be of considerably greater value in industry if he would realise that a knowledge of chemistry alone is not sufficient to equip him for the development of industry, wherein lies a mass of problems yet unsolved—problems which require for their solution the best brains the nation can produce. There is but a very fine dividing line between science and industry: The underlying principles of the one find ready application in the other, always provided such principles are viewed in the broadest possible sense.

Science may be defined as "systematised knowledge"; industry may be defined as "the steady application to any business or pursuit." I believe that in the future it is only the industry built on the more scientific foundation that will continue to prosper. Others will be swallowed up by the competition which their apathy is certain to attract.

Industry is full of opportunities for the use of analysis and synthesis. Like any concrete science it can only be based on measurement, whilst the powers of deduction inherent in the well-trained chemist find immeasurable scope in its midst.

Up to the present the chemist has shown too little appreciation of the value of his scientific training in formulating methods of control in industry. Matters have been left either in the hands of the accountant, who must necessarily base his scheme on accountancy methods, unless he is given the help and co-operation of the chemist, or else in the hands of cost experts who have not really possessed either scientific or accounting knowledge—but have attacked their problem in the light of producing every conceivable figure relative to the process. Such systems become mere mass-producing statistical machines. Frequently, so many facts and figures are produced that the executive striving to control his plant or his process is left spellbound with no certain knowledge as to what is really happening.

Measurements in industry must be made on lines indicated by the technical man for his most effective guidance. Too many chemists and works managers in the past have tended to regard this all-important duty as beyond their sphere. They have accepted the figures produced for them and tried to control their operations by secretly-made check tests.

I will refer more fully at a later stage to the problem of measurement in industry. For the present, I wish merely to stress its importance, to note its close relationship with scientific principles and, finally, to suggest that it should be followed up and studied by the chemist.

I very strongly maintain that the first duty of chemical science to the world at large is the basic development of pure chemistry. This great task is largely in the hands of our Universities. Just as legislation lags in the vanguard of social and political thought, so do the scientific developments of to-morrow lag in the van of the research work of to-day. The man with the capacity for pure research is rare, although it would appear that

* Chairman's address to the Bristol Section on March 3, 1927.

given the encouragement and the opportunity the supply of workers might exceed the demand. It is the duty of industry to associate itself more closely with pure research work, and whilst results cannot be expected to provide an immediate commercial return, they must undoubtedly provide an insurance for the future, yielding a high return to industry in years to come.

The average chemist appears to regard industry as the most likely market for his services. Undoubtedly industry requires a limited supply of trained chemists to carry on applied research and technical experimental work in connexion with the working up of new processes or the development and improvement of old ones.

There is, however, knocking at the door of industry an already great and an ever-increasing body of chemists awaiting absorption. Some pass through works laboratories into our factories and prove able to apply their scientific training in the control of plant and people; many fail in this application.

It is often asked whether industry requires men trained in our universities or whether the man trained in the environment of factory life is not more likely to succeed. I would say without hesitation that this question entirely depends, not only on how the university training is given, but much more so on how it is received.

What industry requires above all else is the man who can take the broad view, the man who has, and can express, the reasons for the opinions which he holds. The man who has the personality to support those he is working under, and the power to engender the respect of those working under him.

The chemist who is to find scope in industry is not necessarily the man with the highest degrees. His academic training should, above all, have taught him how to teach himself. It should have taught him the powers of investigation and deductive reasoning. Almost as important as his technical training, however, is the use he has made of his academic environment. He should have learned on the playing fields, before he enters industry, what it means to "play the game," and what it means to "play for his side." He should have been instrumental in furthering the social work of his university during the period of his residence.

It naturally must not be assumed that a man who has devoted his whole academic life to the social side is what industry requires, but there is a *Via media*. We learn at school to play a "straight bat," and to "push in the scrum." This teaching must be continued at the 'varsity, and its greater application in industry is bound to become of far-reaching importance in the future.

I do not for one moment suggest that all these attributes cannot be possessed by the factory-trained man. He may play his games as keenly for his club as for his 'varsity. He may gain his experience of organisation and debate by means of a multiplicity of societies and clubs. He may extend his technical knowledge by an excellent system of night classes and university extension lectures.

I think, however, the university man has this advantage. He comes into industry having acquired not only the power to teach himself, but with a fresh outlook, and should continue his factory training, deducing the

why and the wherefore of his various problems step by step. The factory-trained man may tend, though he by no means always does, to accept everything that he is taught without full analysis.

On balance I would say that a university training should be an advantage in industry. Many large firms of to-day are endeavouring to equip a limited number of their young employees with such a training, and are providing the means. It is to be hoped that it will be found possible to increase these numbers in the future.

It does not seem to me that there is any great need for alteration in the general university curriculum. It would appear, however, to be helpful if our professors would assist the student who has industry as his bent to derive the greatest possible benefit from the environment of his academic life.

On entering the factory, the chemist can only be fitted to take his place in industry by realising that progress depends upon "taking his coat off to it." This is the one and only way of appreciating the difficulties of plant and process. It is also the one way of gaining the confidence of management and workers alike.

As the chemist is proceeding with his factory training, his mind will be dwelling upon the problems of the industry with which he is associated. His immediate problem is that of manufacture, but the day has arrived when the chemist should turn, and is turning, his mind to a consideration of other industrial problems. Gone are the days when the chemist can afford to say that it is the sales department that is always wrong and the works that are always right. Gone are the days when the industrial chemist can afford to stand aloof from accountancy, from advertising, and from the multifarious problems of industry. The day has arrived when we look to the technical man to try and take into his reckoning these essential factors and give or take just a little, so that his works organisation and management may blend with the policy of the business as a whole.

There are times in every industry when the problem of manufacture is outstanding; times when some new product has been discovered or some new process evolved, creating a temporary monopoly. At such times the works must be strained to satisfy the demand created. It is more general, however, for the strain to be on the sales department, and the works manager is called upon to run his plant and his process below maximum output, yet at the same time at minimum cost. We may regard manufacture as the work done in converting raw materials into finished product. In the process certain losses must occur. The efficiency of the conversion depends upon its cost. It is the measurement of this cost and the sound appreciation of the results that make for progress.

We are all of us, I think, clear that it is useless to weigh a body having a large air displacement to limits beyond the weight of air displaced without making the necessary allowance. It is surprising how little this principle is ever applied in industry. It is surprising how little the "definition of the object" is ever considered when making a calculation of yield or cost in the factory. In the measurement of factory cost, "definition of the object" plays a most important part. There are too many cost systems in industry to-day which lack this

"definition" and which tend to produce a mass of statistics as equally unscientific as unsound.

We have all of us learned the wisdom in research of spending at the outset a considerable time in investigating our problem. All available literature must be studied, and a research plan must be drawn up before laboratory work is commenced. How similar are conditions in industry, whether we consider the problems of manufacture, selling, accounting, or advertising. Time spent in investigation is always amply repaid.

It is interesting to note the work which is being done by our sales and advertising experts to-day. Potential markets are being investigated in quite a scientific way. Methods of recording sales statistics are such as would fascinate the keenest research chemist as bases for the application of deductive reasoning. Salesmanship and advertising themselves are arts, yet we are becoming accustomed to the phrases "scientific salesmanship" and "scientific advertising." Their claim to be scientific, and I think it is a just claim, lies in the work of investigation, which is applied in deducing the facts upon which the methods employed are finally adopted. I feel sure that the chemist in industry would very greatly benefit by a study of how these problems have been approached by the commercial man. There is yet ample scope for development in this field of work, and I am convinced that the scientifically-trained man will be able to apply his training in considerably speeding up progress in this direction.

In a similar way "scientific management" is the application of the science of investigation to the art of management. There appears to me to be the same link between the science of investigation and the art of application as there is between the library and the laboratory. We may even go further and regard science as the investigation, and industry as the application. I would imply, therefore, that the chemist in industry must first of all determine by investigation his plan of campaign.

His first thought must necessarily turn towards the question of measuring his cost. He must analyse his problem and determine what component costs should be measured and within what limit of experimental error he is able to work. He should aim at the measurement of those costs only which will definitely enable him to control his process, and which will indicate lines of improvement. Unnecessary cost determinations are not only valueless but often misleading. In viewing the cost problem the chemist should eliminate constants and carefully define variables. It should be regarded as axiomatic that the simpler a cost system becomes the more efficient it is. Such a system, therefore, should be economical to operate.

One might enlarge at great lengths on the pros and cons of various methods of determining cost, but the object of these remarks is principally to establish the importance of cost determination in so far as the chemist in industry is concerned, and to stress the necessity for basing all determinations made on scientific and mathematical lines.

It will be obvious that the measurement of cost must be aligned to some standard. The generally accepted basis is to measure the cost per unit and compare this

with a previous performance. I am convinced that "cost reduction" can better be effected by building up "empirical standards." The compilation of such standards requires the most careful consideration. The scope provided for the analytical mind is immense. Deductive reasoning is called upon at every turn. It is readily possible to construct on paper the probable happenings in any process over any reasonable period of time, and justify every figure used in so depicting it. It is the investigation work leading up to the construction of this picture, which, in my opinion, is the true science of management.

Having carefully investigated his problem and depicted it in cost form, the executive is able closely to follow the subsequent results, and to see whether or not he is operating at the desired efficiency.

In my opinion, a cost system should be so simple and so economical to operate that weekly returns can be obtained, and with a cost week ending on a Saturday, the results should be available the following Wednesday, so that they may be used whilst the information they have produced is, so to speak, still "red hot." The cost system which produces results weeks after the event is, to my mind, more likely to do harm than good.

A careful investigation of his cost statistics will continually be turning the mind of the executive to a consideration of the type of organisation he has adopted. Organisation must be looked upon as a means of propulsion, and consequently each branch of such organisation becomes a driving force, and the resultant of these forces represents the efficiency of the organisation. Although these forces cannot be measured mathematically, they may be graphically depicted by means of an organisation chart showing graphically the complete working of the organisation.

It should be the duty of every executive to depict his organisation by means of such a chart, which may be regarded as little more than a family tree. The chart may be used to measure the departmental costs of an organisation, and to be of real value must essentially be complete.

Organisation is no exception to the axiom that the strength of a chain lies in the strength of its weakest link. It is only by the most careful consideration of an organisation chart that overlap in authority and control can be detected, and that the final disposition of responsibility can be laid down. It is a common fallacy to suppose that because each department of a business is efficiently operated the organisation as a whole is efficient. Upon investigation of any business one usually finds a weakness at the junctions of executive control, and the larger the organisation the more difficult it becomes to ensure a high efficiency of departments *inter alia*.

This problem, which is a very real one in every industry, should appeal to the scientifically-trained man, and its solution best lies with such a man who combines with this training the necessary personality to practice and apply the "golden rule," and thus engender in all around him a real desire to pull together.

The only way to eliminate inter-departmental inefficiency is to promote trust and to dispel fear. There has been, in the past I fear, too much thought given by

many in managerial positions as to how best they could protect their own skins rather than how best they could foster the development of the organisation as a whole. Conversely I say most emphatically that too many manufacturers have encouraged this stupid outlook. Let us hope the day is at hand when we shall be able to say definitely that the chemist in industry, at any rate, realises that it is the resultant force that counts, and that he is pushing his full weight in the scrum.

I have dealt with the control of the plant and the process by cost determination and the control of the organisation by means of a carefully-prepared organisation chart. There remains the control of the people. Generally speaking, the principles which apply in the case of the management apply equally in the case of the workers. We must promote trust. We must dispel fear. We must, above all, apply common sense, and give a "square deal." I always regard workers as capitalists in industry. Their greatest asset is their capacity to earn wages. The amount of their capital invested depends upon the effort which they put into their work, and it is on this effort that they should receive their dividends in the form of wages. The worker is always happiest when he is paid by results, provided the basis adopted is a fair one.

We have suffered considerably in the past by badly-set piece-rates being cut, or by the savings obtained by improved working being pocketed by the manufacturer. I maintain that the workers' holding in our industries should be a participating holding, and that they should receive in extra wages their fair share of economies effected. I would again refer to the work being done by our sales organisers. The successful men in this field have all realised and are putting into practice this very principle.

I would conclude with the enunciation of four principles which I have always found of real value. They are as follows:—

- (1) The authority to issue an order involves the responsibility to see that it is properly carried out.
- (2) A wise policy is of more avail than a large plant; good management than perfect equipment.
- (3) We have no right morally to decide as a matter of opinion that which can be determined as a matter of fact.
- (4) The be-all and end-all of good management is to have the right thing at the right place at the right time, and to know how it got there.

CANADIAN PULP AND PAPER

A United States paper manufacturing company has acquired control of the Kootenay Pulp & Paper Co., and proposes to erect a 200 ton mill near Nelson, B.C., to make bleached sulphite pulp, at an outlay of about \$3,000,000.

The third machine of the Canadian International Paper Company's Gatineau (East Templeton) newsprint mill is operating, and the mill is now daily producing over 450 tons paper. A fourth machine will soon be in operation.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

COAL CLEANING CONFERENCE

Copies of reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, are still obtainable.

The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

SUSPENSION OF ENTRANCE FEE

The Council has decided to continue the suspension of the Entrance Fee during the year 1928.

ABSTRACTS IN APPLIED CHEMISTRY

It has been arranged to supply members of the Society with reprints of the Abstracts of Applied Chemistry, printed on one side of the paper only, at the price of £1 for the year 1928.

Applications for these, accompanied by the appropriate remittance, should reach the General Secretary before the end of the present year.

CHEMICAL SOCIETY'S LIBRARY

Members of the Society of Chemical Industry are reminded that they are entitled to consult the Library of the Chemical Society, Burlington House, Piccadilly, W.1, and to borrow books therefrom.

The Library is open daily from 10 a.m. to 9 p.m. Saturdays from 10 a.m. to 5 p.m. The Library is closed on Bank Holidays, the day following, and on such other occasions as the Council may direct.

ROTHAMSTED LIBRARY

By the courtesy of the Lawes Agricultural Trust, any member of the Society of Chemical Industry, on presenting a card from the General Secretary, shall be allowed access to this Library. The rules of the Library preclude journals and periodicals from being sent out, and these are, therefore, always accessible.

A catalogue of the journals and periodicals is in the Society's Offices at Central House, and may be consulted there by members.

DEATHS

Bostock, George H. (elected 1922), c/o Chief Factory Manager, Department of Labour, Spadina Crescent, Toronto, Ont., Canada. Chemist. On August 1, 1927.

Hyams, Godfrey M. (elected 1897), 309, Sears Building, Boston, Mass., U.S.A. Mines Manager. On October 7, 1927.

Smith, Albert W. (elected 1905), The Case School of Applied Science, Cleveland, Ohio, U.S.A. Professor. On March 9, 1927.

AMERICAN SECTION

The November meeting of the American Section of the Society of Chemical Industry was held on November 4, 1927, in the Rumford Hall of the Chemists' Club as a joint meeting with the New York Sections of the American Chemical Society and American Electrochemical Society

and American section of the Société de Chimie Industrielle. Dr. L. V. Redman presided. About 125 members and guests attended a dinner in the club dining room preceding the meeting and about 250 attended the meeting.

The principal speaker of the evening was Mr. F. R. Wadleigh, former Fuel Administrator of the United States. Mr. Wadleigh's paper on "Preparation of bituminous coal: its scope and significance to the user" covered the subject from the mines to the point of use. The paper will be published in the *Journal of the Society* at an early date. Dr. H. J. Rose, a research chemist for the Koppers Company, outlined the "Importance of coal preparation in the manufacture of gas and coke" and illustrated his subject by slides of good and poor coke. This paper will also be published in the near future.

LIVERPOOL SECTION

A joint meeting of the Liverpool Section and the Liverpool and North Western Section of the Institute of Chemistry was held in Liverpool University, on November 18. Dr. Alfred Holt was in the chair, and the attendance numbered about 100. An address was delivered by Dr. A. E. Dunstan, entitled: "Modern improvements in petroleum refining."

The lecturer discussed briefly modern methods of fractional distillation, pointing out that in the early days of the industry the necessity for sharp cutting had not arisen, but with the advent of the motor car and the increasing demand for motor spirit, refiners had been compelled to extract the maximum gasoline possible from the crude oil. He described the modern equipment, consisting of a tubular heater from which the vaporised oil was flashed into a bubble tower. The overhead distillate from the column is gasoline, and from various decks down the tower kerosene, gas oil, wax distillate are drawn, and a residue of pitch runs away from the bottom. He drew attention to the importance of maintaining an adequate reflux ratio and presented diagrams indicating the entire absence of overlap in the fractions.

Modern cracking plant was briefly described, and the importance of cracking in the production of maximum gasoline yield was indicated. The refining of various cuts was gone into, attention being paid to those processes in which sulphuric acid is eliminated. Details were given of the hypochlorite method, the Edlebaum method and the Sharples method, bauxite and vapour-phase treatment by adsorption. Finally, the manufacture of lubricating oils was dealt with, and the methods of Steinschinder and Schultz were described.

A cinematograph film was shown of the methods in use in Persia for drilling, refining oil, transport and so on.

The meeting concluded with a cordial vote of thanks to the lecturer, proposed from the chair and seconded by Prof. T. P. Hilditch.

SOUTH WALES SECTION

At the joint meeting held with the Institute of Chemistry on November 18, an interesting paper was read by Mr. G. E. Hider, M.I.Mech.E., A.M.I.C.E., M.I.E.E., on "The engineer-chemist and his influence in engineering economics." The chair was occupied by Mr. C. M. W. Grieb, B.Sc.

Great stress was laid on the need for the economic analysis of engineering propositions, and the fact was emphasised that engineering divorced from economics was no longer engineering. There was, however, a tendency to overdo the questions of economics in engineering, and it was essential to realise the exact meaning as applied to engineering, lest the academic type of mind, influencing professional examinations, should deem it necessary to inflict a long course of useless study on the engineering graduate because of the acknowledged need of economic analysis.

Having stressed the point that the word "economics" should be correctly interpreted so far as the subject must be included in the training of an engineer, the lecturer proceeded to discuss the relation of the engineer and the chemist in industry. It was necessary carefully to dissect all the factors; also it was necessary to see that, whatever the skill or knowledge possessed of specific phases, no one person possessed that specialist knowledge of all the phases which went to build up a great enterprise. To locate and define the duties of the engineer and the chemist, the lecturer discussed the series of acts leading to industrial propositions, which were divided as follows: (1) Conception of the enterprise. (2) Investigations to determine the volume of service which may be required. (3) To obtain capital. (4) To design and prepare plans for any structures that are necessary. (5) To build the structure and machines. (6) To operate the structure and machines. (7) To sell the resulting productions.

The engineer and the chemist could now be placed in the enterprise. They need not be concerned in the conception of the enterprise—that may be the idea of a man who has no knowledge of engineering or chemistry. They must certainly take part in the investigation to determine the volume of business to be done, and they would assist in obtaining capital, because their estimates of capital expenditure, probable results, etc. were essential. They would take part in the building of the structures and machines, and the operations would be largely in their hands. They could take part in the final operations in the sequence of acts leading to the satisfaction of public wants, i.e., the selling of the productions.

In regard to this last act, as the chemist and the engineer took a greater part in this, so would there be a greater regard for accuracy in statements regarding probable results due to installations of the resultant productions of the series of acts outlined.

The lecturer commented on the uselessness of the works chemist contenting himself with the casual sampling and testing of boiler flue gases, and asked that it be realised that unless such an analysis was made with a full examination of all the concomitant factors, it was a useless operation. The works chemist should have a comprehensive knowledge of the thermal side of his subject, as this was intimately bound up with the success of the chemical processes which it was his duty to control. The endeavour to put flue gas analysis into correct perspective was intended to indicate to the works chemist that if his knowledge of boiler plants was limited to the analysis of flue gas, then he must depend on others.

for more vital data, and accordingly he could not contribute to the demand for cheap steam.

It was suggested that this lack of co-ordination and collaboration between specialists contributed to the tragic spectacle of Great Britain sending envoys all over the world to obtain information of progress in industries in which Wales was the pioneer, and stressed the point that in South Wales there were chemists, metallurgists and engineers possessing complete knowledge of the fundamentals of their own science, and yet, so complete was the lack of collaboration, that whilst South Wales stood still, foreign competitors forged ahead with revolutionary methods of manufacture.

There was much evidence in engineering history that prosperity spoiled perspective. The thermal cycle of the so-called Diesel engine was common knowledge in Great Britain at the time British engineers were making as much money as they liked in supplying steam engines and boilers to the mines in the Rand; they were too prosperous to spare time or money to investigate the possibilities of the "Diesel" cycle, and their prosperity so completely dimmed their vision that at the present time British manufacturers built only a very small percentage of the total crude-oil engine horse-power. They were overtaking the foreigner in this phase of engineering, and many beautiful designs were being built by British manufacturers, but had our manufacturers had the foresight to get qualified chemists and metallurgists to solve the early difficulties, we should have led the world in this phase of engineering, and thus have reduced the hardships and financial losses which a period of unparalleled depression in the engineering industry had created. It was vital to recognise that no balance sheet could represent the true position of affairs of an industrial organisation which did not take into account the obsolescence of prevailing processes and of the fundamental facts on which such processes were based.

Further instances were given of the British scientists, researches benefiting the foreigner because of the refusal of the British manufacturer to appreciate the results of fundamental research, and it was pointed out that vast volumes of business had left Britain because of two factors:—(1) The failure of manufacturers to regard the obsolescence of processes as a concrete liability, and (2) the failure to link up the results of fundamental research with that series of acts which lead to the economic accomplishment of any specific enterprise.

An interesting discussion followed, in which Messrs. George Madel, C. A. Seyler, Dr. MacNair, Prof. Coates, Dr. Ramsay, and the Chairman took part.

CALENDAR OF FORTHCOMING EVENTS

Dec. 2.—Oil and Colour Chemists' Association, Manchester Section. Milton Hall, Deansgate, Manchester, at 7.30 p.m. "Application of methods of dyestuff analysis to the examination of pigments and lakes," by Prof. A. G. Green. Annual Dinner on Dec. 3.

Dec. 2.—Society of Chemical Industry, Manchester Section. Engineers' Club, 17, Albert Square, Manchester, at 7 p.m. "A new diagnosis of the coal trouble," by J. A. Bowie.

Dec. 3.—Western Junior Gas Association. Visits to (a) Stapleton Road Works—Gas-drying plant. (b) Canons' Marsh Works—Automatic C.W.G. plant. (c) Barton

Street—Stove and meter workshops of the Bristol Gas Company. A short descriptive paper on each visit will be given.

Dec. 5.—Institution of the Rubber Industry, London Section. Engineers' Club, Coventry Street, W.1. "Efficiency methods in the rubber industry," by W. W. Hamill.

Dec. 5.—Society of Chemical Industry, London Section. Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. "Automatic analysis of liquids and its application to control of water-softening plants," by Dr. H. S. Hatfield.

Dec. 5.—Royal Society of Arts, John Street, Adelphi, W.C.2, at 8 p.m. "Alloy steels, their manufacture, properties and uses," by Prof. H. C. H. Carpenter.

Dec. 6.—Society of Chemical Industry and Institute of Chemistry, Edinburgh and East of Scotland Sections. The Pharmaceutical Hall, 36, York Place, Edinburgh, at 7.30 p.m. "Electro-synthesis," by Prof. Sir James Walker.

Dec. 7.—Society of Chemical Industry and Institute of Chemistry, Edinburgh and East of Scotland Sections. Joint meeting with the Glasgow Section, and with the Scottish Section of the Institution of the Rubber Industry. The Cadorna Restaurant, Union Street, Glasgow, at 7 p.m. "Some features of sulphur for rubber manufacture," by Dr. D. F. Twiss. "Naphthas and their uses," by C. Chapman.

Dec. 7.—Society of Chemical Industry.—Nottingham Section. "The indole group of the alkaloids," by Prof. R. Robinson.

Dec. 7.—Society of Public Analysts, Burlington House, Piccadilly, W.1, at 8 p.m. Ordinary Meeting. The following papers will be read:—Demonstration of apparatus:—(1) "Apparatus for determining benzoic acid in foods," by G. W. Momer-Williams. (2) "Sodium flame for polarimetric work," by T. McLachlan and A. W. Middleton. (3) "Oil bromide films and their use in determining the halogen absorption of oils," by H. Toms. (4) "Tests for impurities in ether," by G. Middleton. (5) "Arsenic in coated papers and boards," by H. J. Stern.

Dec. 7 to 9.—Institution of Chemical Engineers. Conference at the Chemical Society's Rooms, Burlington House, Piccadilly, W.1. (*Particulars of the Conference were given in Chem. & Ind., Nov. 25, 1927, p. 1104.*)

Dec. 8.—Society of Dyers and Colourists, Midlands Section. University College, Nottingham, at 7.30 p.m. "Effect of light on dyed cotton and artificial silk fabrics," by F. Scholefield.

Dec. 9.—Society of Dyers and Colourists, Manchester Section. Jointly with the Manchester Section of the Institution of the Rubber Industry, at 36, George Street, Manchester, at 7 p.m. "Colouring of cold-cured rubber," by W. E. Sanderson.

Dec. 9.—Biochemical Society. Royal School of Mines, South Kensington, S.W.7, at 4.45 p.m. (1) "On the presence of vitamin A and provitamin D in yeast fat," by H. Henderson Smith, M. Hume and J. S. MacLean. (2) "Dephosphorylated methylhexosides derived from hexosediphosphoric acid," by W. T. J. Morgan and R. Robison. (3) "Organic phosphates from rabbit's muscle," by J. Pryde and E. T. Waters. (4) "Chemical changes taking place in the proteins of muscular tissue when passing into rigor," by H. R. Hewer, H. Jarran, and S. B. Schryver. (5) "The basic hydrolysis products of certain plant proteins, and the method of separation," by H. J. Holman and S. B. Schryver. (6) "Relationship of pectin to hemicellulose," by E. J. Candlin and S. B. Schryver. (7) "Studies on the nutrition of pigeons," by E. C. Grey. (8) "Estimation of chlorides in biological fluids," by R. K. Christy and W. Robson. (*Date altered from December 5.*)

INSTITUTION OF CHEMICAL ENGINEERS

The following is an extract from the Report of the Board of Examiners on the Examination for Associate-Membership, June—July, 1927:—

The holding of the second public examination in chemical engineering in this country in June—July of this year, not unlike the first, has revealed features which call for comment.

In preparing the questions, no attempt was made to depart from the standard which was set in the examination of 1926. On the contrary, the questions were designed to test not only the knowledge of the candidates in the matter of fundamentals, but to ascertain their ability to attack some of the ordinary problems with which a chemical engineer is faced. While some of the questions concerned some special aspect of the technology of a particular industry, others invited a decision on aspects relating to the solution of typical chemical engineering problems and the application of fundamental chemical engineering knowledge and economics.

The work of some of the candidates reached a much higher level than in 1926, and ability has been shown in the application of physical-chemical and engineering principles to the solution of given problems.

There is still, however, a tendency to ignore the specific points in respect of which information is sought, and for the replies to be of a general or descriptive character, and unnecessarily diffuse.

In future examinations it is recommended that questions bearing on the "outline of training" should be confined to three written papers, and that the fourth should be assigned to the preparation of a simple working drawing.

The second examination has again revealed that most of the candidates are lacking in a knowledge of heat transfer.

CHEMICAL SOCIETY

Prof. W. A. Bone, F.R.S., delivered a lecture entitled "Gaseous combustion at high pressures," on November 24, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., occupying the chair.

The lecturer introduced his subject by referring to the new factors which must be considered in relation to high-pressure explosions. We must, he said, remember not to regard our terrestrial chemistry as more than a small fragment of the whole story; we must keep our minds open to the reception of knowledge accruing from a study of gaseous interactions under conditions which, until recently, would have been regarded as abnormal. After all, as Prof. Eddington has said, it is rather terrestrial conditions which should be considered abnormal seeing that, apart from the interstellar cloud which is at the moderate temperature of $15,000^{\circ}$, some nine-tenths of the matter of the universe is above $1,000,000^{\circ}$. Astrophysicists find that under "ordinary" conditions matter has rather simple properties, and chemists now realise that, had the pressure of our atmosphere been a few hundred times as great as it actually is, their own branch of knowledge would disclose a state of affairs differing in various ways from that to which they are accustomed.

Unexpected results had emerged from the experiments

on combustion under pressure; since the chief difference between conditions of high and low pressure lies in the absolute conditions of the interacting molecules, it might be anticipated that factors, the operations of which chiefly depend on such concentration, would become more dominant as the pressure rises. The value of the investigations lies in the accentuation of the operation of factors the influences of which are either masked or overlooked at the ordinary pressures; the increased density causes an increase in the rate of chemical change, involves a depression of cooling and dissociation effects, and may affect both the emission and the absorption of radiation during the explosion. With the remark that the more important experiments envisaged by the first section of the work, dealing with hydrogen-air, carbon monoxide-air, and methane-air mixtures, at initial pressures up to 200 atm., are now nearing completion, and that the next section would be concerned with initial pressures between 200 and 1,000 atm., Prof. Bone proceeded to describe typical experiments on the explosion of carbon monoxide-air mixtures, and to contrast the results with those obtained with hydrogen air mixtures in similar circumstances, paying tribute to the skill and devotion of the late Mr. W. A. Haward, and of Drs. D. M. Newitt and D. T. A. Townend, his chief collaborators.

Illustrating his descriptions with photographic and diagrammatic lantern-slides, the lecturer dealt first with the apparatus in use at the Imperial College of Science and Technology: the spherical bombs withstand pressures up to 2,000 atm., and a cylindrical bomb, which withstands pressures up to 1,200 atm., has been fitted with quartz windows and successfully used for spectrographic observations in experiments developing pressures up to 500 atm. The arrangement of the Petavel recording manometer and its optical accessories was also described. The behaviour of theoretical hydrogen air mixtures when exploded at 50 atm. is in striking contrast with that of carbon monoxide air mixtures; the pressure in the former case rises in about 0.005 sec. to its maximum (about 400 atm.) and almost immediately begins to fall and to assume the character of a cooling curve, whilst in the latter case the maximum pressure (about 410 atm.) is reached only after 0.18 sec., the pressure beginning to fall only after a considerable interval. Replacement by hydrogen of a very small percentage of the carbon monoxide in a theoretical carbon monoxide-air mixture greatly accelerates the pressure increase when the initial pressure is 50 atm.; this result is ascribed to the counter-acting effect of hydrogen on nitrogen "activation," and to the fact that hydrogen is a potent catalyst of carbon monoxide combustion.

The discovery of the new phenomenon of nitrogen "activation" in carbon monoxide-air explosions at high initial pressures was next mentioned, together with the abnormal effect of increasing the initial pressure in such explosions. The production of nitric oxide in presence of excess of oxygen is a pressure effect, consequent on the nitrogen "activation," occurring during the "cooling period." Finally, Prof. Bone said that the spectrographic evidence proved, *inter alia*, that (i) steam does not function chemically, but carbon monoxide reacts

directly with oxygen in carbon monoxide-air explosions, (ii) the radiation emitted in such direct interactions is strongly absorbed by either carbon monoxide or nitrogen, and (iii) in a carbon monoxide-excess-air explosion at 25 atm. initial pressure, no nitric oxide is formed during the actual explosion period, although more than 2.5 per cent. of nitrogen peroxide may be present in the cooled final explosion products.

Proposing a motion for a vote of thanks to the lecturer, Sir R. Robertson, K.B.E., F.R.S., said that the study of reactions under pressure was now assuming great industrial importance. In his investigation of these fundamental reactions, Prof. Bone had developed a new technique, and one not devoid of danger. The speaker referred to the effect of the density of loading of high explosives on the pressure changes involved, and remarked that progress depends on the recognition of abnormal results. The motion was seconded by the Treasurer, Prof. J. F. Thorpe, C.B.E., F.R.S., and carried with acclamation, the President also conveying the thanks of the meeting to Drs. Newitt and Townend. Prof. Bone made a brief acknowledgment.

INSTITUTE OF FUEL

A two-days' conference was held at the Institute of Electrical Engineers on November 23 and 24.

On November 23 the Presidential Address was delivered by Sir Alfred Mond, who, after referring to the amalgamation of the Institute of Fuel Technology and the Institute of Fuel Economy Engineers, said he regretted to announce that Sir William Larke, owing to the many duties involved in his position with the National Federation of Iron and Steel Manufacturers, had been compelled to resign the chairmanship of the council. A successor had been secured whom he was certain would be received with general acclamation, namely, Mr. Frank Hodges, who, of course, knew the fuel problem from every possible angle. Speaking of the Institute itself, Sir Alfred said the membership of the new body showed an increase over the combined membership of the two original bodies, but it was not desired to stand still, and therefore he urged that everyone should do his best to secure new members. A class of "collective members" had been established, and already some of the most progressive and largest firms in the country had joined this class. The object of increasing the "collective membership" class was to enable the subscription to be maintained at its present low level to the ordinary members. Every constituent firm of Imperial Chemical Industries, Ltd., was a "collective member" of the Institute.

Regulations were being drawn up governing the membership, which it was intended to maintain at as high a standard as possible. Monthly meetings had been arranged in London, and would be extended to the provinces, and at the present time it was intended to issue a quarterly journal to be followed later by a monthly journal, which would contain a bibliography of the fuel literature of the world. He hoped that the Institute would develop the advisory side of its work and become more or less authoritative for those who were endeavouring to obtain help in fuel problems, and who had not the technical assistance at hand which was

at the disposal of the larger companies and institutions. After giving a brief outline of the subjects to be discussed during the meeting, Sir Alfred Mond made a few remarks on the wider aspect of the fuel problem. Some little time ago he accepted the chairmanship of the National Fuel and Power Committee, which was set up by the Government to investigate the possibility of economies in fuel and power in this country. The committee had not issued a report, although he hoped that in a not too distant future one would be issued. He did not wish to forestall the conclusions of the committee, but there were a few things which had struck him personally in the investigation. One was that we still have a great deal to learn in handling coal, and although it would be unfair to say that our collieries are inadequately equipped, there were, nevertheless, many old-fashioned ones. Take anthracite coal, for instance, an expensive material which obtained a lower price the smaller the size, every endeavour seemed to be made in the handling of it to reduce it to powder, and to turn a product worth 40s. per ton into duff worth only 5s. per ton.

The methods of washing and screening coal generally in use to-day seemed to be extraordinarily crude. Having been brought up in the more delicate chemical industry, he was horrified to see the primitive methods adopted at so many collieries, but he was told that these were the only methods which could be adopted. Fortunately, many new ideas were being discussed and tried, and he had taken a little personal interest in a new washing process which, as far as it had gone on a semi-technical scale, had proved itself very remarkable as it enabled the ash to be reduced from a very high figure to about 2%. This process was about to be installed at one of the collieries he was interested in, and after it had been working for some time on a commercial scale more would be heard about it. There was nothing more terrible than to contemplate the amount of money spent in this country in carrying ash about in the coal from one part to another. It was obvious, too, that by a reduction in the ash content of the coal before it left the colliery it would be possible to produce qualities of metallurgical and other cokes which might have a very vital effect upon metallurgical practice.

Some evidence had also been given to the Committee as to the position of the coke industry in this country, and that evidence might be published one day. If that were done people would be rather surprised, because it was not satisfactory. There were in this country many small and antiquated coke ovens, and when these were compared with some of the bigger installations abroad it was realised that in this industry there was still a great deal to be done. When one compared the work done in Germany before the war, and continued ever since, with the work done in this country, it made one blush. In Germany they had a magnificently equipped central institution to deal with all the fuel problems of the various collieries, with a very large number of able men to deal with them. Here, however, we were still relatively backward. Attempts at co-operation were becoming more successful, but the amount of money that people in this country seemed to consider adequate to spend on research was absolutely fantastic. The Germans dealt

in what they called mass research work. If the Germans were endeavouring to obtain coal from oil they would put up not two pieces of apparatus, but one hundred, so that in studying the problem they could get one hundred variations right away. This obviously saved very much time, and eliminated their difficulties very much more quickly. These results were obtained in Germany not because the Germans were better people or more brilliant than we; it was due solely to their more systematic working and the extent to which they spent money on research. Dr. Bosch, the head of the I.G., had told him that he was satisfied if they invented something new every ten years, but in this country the position was usually that the wretched research man, badly equipped, was asked by the Board within a very few months whether he had not produced something of commercial value, and he was probably dismissed if some results were not shown on the profit and loss account. Unless the industries of this country took these problems seriously to heart they would find themselves in a very short time displaced in the industries of the world, simply because of the higher technical efficiency and better scientific work carried out in other countries. It was impossible to stop the march of progress of science and ideas, and there was no reason why we in this country should not do as well as any other country in developing scientific progress. We had in this country plenty of able scientific men, and it was up to those who were leading the industries of the country to take every possible advantage of the facilities offered for research work on a continuous and growing scale. In the coal industry, for instance, there was a very wide field for development on these lines. The Germans were actually using pulverised fuel in Diesel engines. If this was developed, it seemed likely that those who were obtaining oil from coal could retire into obscurity, because compared with the use of pulverised fuel in this way the production of oil from coal was a laborious and expensive method. In America, too, they were already beginning to think of transporting coal in the pulverised form for various purposes. All this demonstrated in what a state of flux was what might be thought one of the most stable industries of the world, and it held out great hope for the coal industry. Only by cheaper fuel, better utilisation of fuel, cheaper power and cheaper products generally would it be possible for the nation as a whole to increase its spending power and improve the prospects for the industries of the country.

The following papers were then read:—

"Operating experiences with 1300 lb. steam pressure," by J. Anderson.—This paper is a record of the actual operating experiences with a water-tube steam boiler of 240,000 lb. evaporation per hour installed at the Lakeside Power Station, Milwaukee, U.S.A., and generating steam at a pressure of 1300 lb. per sq. in. The period covered is eleven months, and the boiler was in service for 57% of this period, including one continuous run at full capacity for 50 days, which improved overall plant efficiency 4%. The author concludes from his experience that such a unit may be kept in service as long as desired, and states that an order for an additional 1300 lb. equipment will soon be placed. There have been

experienced, however, major troubles, and the paper describes them in detail and also the remedies. These troubles were confined almost wholly to tube failures from scale formation and tube corrosion troubles. No difficulties appear to have been experienced with pining, or mountings. For high-pressure service it is positively necessary to provide nearly scale-free make-up because: (1) 150° F. higher water temperature than in 300 lb. boilers exists. (2) Higher metal stresses equivalent to an additional 150° F. higher tube temperature. It is also necessary to maintain an appreciable caustic alkalinity, and reduction of oxygen in the feed water, to below 0.1 c.c. per litre to prevent corrosion in high-pressure boilers fed with evaporated make-up.

"Preheated air for boiler furnaces," by P. H. N. Ulander.—To-day the air preheater is being recognised as a necessary adjunct to the boiler. This change has largely been the result of economic pressure, for since the end of the war the tendency in most large boiler plants has been towards an increase in rating coupled with the use of higher steam pressures and temperatures. Higher steam pressures mean increased flue gas temperatures with consequently larger potential heat losses, and in addition the increase in the use of bled steam for feed heating has helped to make the task of the economiser more onerous. Owing to the relatively low price of the heating surface of the economiser when compared with that of the boiler, the installation of a small economiser is frequently advantageous, but for higher boiler efficiencies, in those cases where the load factor and cost of fuel merits it, the addition of an air preheater is desirable and frequently essential. It is suggested that the tendency of the future will be for an increasing number of air preheaters to be installed in connexion with economisers of decreasing size. Moreover, the trend of development will probably be towards an increase in the exit temperature of the flue gases from the boiler, and with the collateral rise in feed temperatures the installation of an air preheater of high thermal efficiency will be essential. The air preheater is also finding an increasing use for the aiding of the combustion of low-grade fuels, especially with those containing a large percentage of free moisture. Air preheaters are developing along two distinct lines, namely, the regenerative and recuperative types, and the relative merits of each of these types are now known. The prejudice against the use of highly preheated air is mainly due to lack of proper appreciation of some of the problems involved. If due and proper care be taken in design then no trouble need be expected with comparatively high air temperatures, as is proved by practical experience. The air preheater enables a reduction to be made in the capital cost of the complete steam generating unit and in the cost of generating the steam itself. Air preheating and the preheaters themselves have passed out of the experimental stage.

"The British coking industry and some of its products," by R. Ray, B.Sc., M.I.Chem.E.—The first section of the paper illustrates how American and Continental nations have been developing their coking industries, whereas Great Britain has been practically stationary since 1914. In discussing the means for the rehabilitation of the industry, stress is laid on the

necessity for a closer relationship between the coking industry, the gas industry, and the iron and steel trades. For the production of a suitable blast-furnace coke at a price which would leave a profit for the producer and, at the same time, permit the ironmaster to compete on fair terms with the Continent, amalgamations of coking interests in certain areas must be brought about. This would mean the production of coke in large centralised batteries of coke ovens of a minimum capacity of 1000 tons per diem, instead of in many small and uneconomical plants which are operating to-day. The essential conditions attached to the successful operation of centralised coking plants are as follows:—(1) Railway freights to-day prohibit the transport of coking slacks to a central plant: aerial ropeways provide the solution to this difficulty. (2) No central battery of ovens can be a practical proposition unless the bulk of the valuable high-calorific gas produced is disposed of at a satisfactory figure. Apart from the advantages of cheaper coke and vast supplies of high-calorific gas, the modernisation of the coking industry would mean the installation of plant to produce accurately graded coke. The necessity for this is recognised by all conversant with blast-furnace practice, whilst it is of almost equal importance if the domestic smokeless fuel market is to be successfully developed. To produce such a coke—one which will stand transport and rough usage—the study of coals and the results obtained by blending them must be given much more serious consideration. The importance of the grading of coke and the scientific blending of coals is recognised and practised abroad, but in Great Britain the former is carried out in a most haphazard manner in most cases, whilst the latter is practically unknown.

“National electricity supply,” by Sir Philip Dawson.

On the Continent of Europe and U.S.A. it is realised that modernisation of industry is synonymous with electrification, and this and the process of amalgamation and co-operation of similar productive interests has gone on far more rapidly than with us. Use of electricity is largely neglected in our coal mining and steel industry, although many individual examples of most efficiently equipped and operated works exist. In Germany 40% of the electricity is produced by cheap low-grade brown coal. In this country large reserves of coal remain unworked owing to poor quality: they could be utilised for producing power at the pit's mouth, and this would enable coal resources now lost to be utilised. Much of this coal could be used to produce oil, the residue being used for generating electricity. Our mining industry cannot be made successful except by linking up the modern methods of power production and fuel utilisation. In this country much coke-oven blast-furnace gas, owing to lack of co-operation and co-ordination, is still wasted. The co-ordination of coal mining, by-product plant, and generation of electricity would benefit the whole community. Hitherto such an arrangement has been difficult, as the electric supply is an essential part of the scheme: no organisation existed which would take the electricity produced and dispose of it. The creation of the Central Electricity Board has now solved this difficulty. By linking up as provided by the 1926 Act, spare plant will be reduced to 10%, in addition to which, owing to the better operating

conditions resulting from interworking, the cost of production will be materially reduced.

“The conversion of coal into oil by the Bergius method,” by J. Ivon Graham and D. G. Skinner.—By the Bergius process, at the present rate of consumption, the liquid fuel needs of this country could be met by the treatment of approximately 15 million t. of raw coal per annum, *i.e.*, about 6% of the total amount raised. Obviously, therefore, hydrogenation cannot be a panacea for the ills of the mining industry, even should the process be economically feasible. Since 1922 investigation of the process as applied to British coals has proceeded in the Mining Research Laboratory at the University of Birmingham. These experiments, since 1924, have been financed by the British Colliery Owners' Research Association, and have, in the main, confirmed Bergius's results. The aim of these experiments has been, and is, to ascertain with more exactitude than appears to have been the case with those carried out by the Bergin A.G., which type of coal and which constituent of the coal substance undergo hydrogenation most readily. It appears from the researches carried out in the Mining Research Laboratory that those coals falling into the parabituminous division of the Seyler classification, and having a carbon/hydrogen ratio between 15.5 and 16.5, give the highest oil yields. With coals of this class the process might possibly be worked with profit at the present time. There seems no doubt, however, that it is only by further research into the influence of constitution of coal upon ease of hydrogenation, and the nature of the products obtained, as well as in the engineering technique of high-pressure work, that the more general application of the process can be made a commercial success.

“Measurement of steam flow in works practice,” by H. C. Armstrong, A.M.I.C.E., and T. Nordenson, C.E.—The paper is divided into two parts, in the first of which the authors, having discussed the necessity of measuring the steam used in works of all kinds, indicate a practical method of so doing. The measurement of steam flow by means of a portable meter or a differential manometer and a special orifice fitting is advocated. Designed to work on the principle that the drop in pressure of a fluid flowing through an orifice inserted in a pipe, due to the constriction of the orifice, is proportional to the quantity flowing, a special diaphragm, which has been largely used by the authors, is described. Having fitted the arrangement, the differential pressure head is measured by means of a manometer described in the paper or with a steam meter of the ordinary type. The paper includes a series of charts from which it is possible to read off the correct size of orifice plate for any ^{at} in a pipe of given size, and also to convert the ^{one} ential pressure head into direct flow figures without ^{ce} intervention of elaborate calculations. These ^{ch} which have been translated into British units by ⁴ authors, are taken from the work of M. Backstrom, ^{is} well-known Swedish engineer, a translation of ^{val} paper on the subject forms the second part of the ^{auth} paper.

“Liquid fuels other than petroleum,” by A. E. D^{stan} and H. G. Shatwell.—Despite the continuous ^{on} coveries of new deposits of crude petroleum, the ^{alt}

increase in production and the recent heavy falls in prices, intensive searches for indigenous liquid fuels in coal-bearing countries have been in progress for some years, whilst important investigations have been conducted in which the conversion of solid into liquid fuels is the chief aim. These activities are influenced to only a small degree by economic considerations, but have their source almost entirely in political and strategic movements. The economic factor involved arises from the fact that solid fuels introduce handling costs of the first importance. For this reason coal might be increasingly gasified at the pit-head and the railroads utilised as means for laying pipe lines to the great towns, the gas being conveyed under high pressure to the existing low-pressure receivers. The carbonisation of coal at low temperatures gives smokeless solid fuel as the main product and primary tar as a by-product the latter being obtained in yields of about 16 gals. per ton of coal carbonised. Tar-acids cannot be employed as motor-spirit, though they have been used with some success in Diesel engines: their chief value lies in the possibility of converting them into benzol hydrocarbons. The oils remaining after removal of pitch and phenols resemble "cracked" rather than natural petroleum, and their refining must be modified accordingly. The authors have found that primary tar straight-run spirit possesses an anti-knock equivalent equal to that of benzol, whilst the spirit obtained by cracking the tars also has anti-knock properties. Hydrogenation of coal by the Bergius process gives an average yield of 140 gals. of liquid products per ton of coal. The economics of berginisation will depend largely upon the cost of hydrogen, and it is for this reason that Bergius has recently evolved an ingenious method for recovering hydrogen from the gases leaving the plant. The liquefaction of coal may also be effected by transforming the raw material, after a preliminary carbonisation, into water-gas, which is treated under different conditions to give a variety of products. Thus the Badische Co. and Patart manufacture synthetic methanol by passing water-gas at high pressure and at about 420° C. over certain catalysts from which iron must be rigorously excluded. Fischer, on the other hand, prepared synthol under similar conditions of temperature and pressure, but by the employment of iron coated with alkali. Both

methanol and synthol possess properties which militate against their value as motor-spirits, but they will readily find application in other directions. Finally, by passing purified water-gas over iron, nickel or cobalt at atmospheric pressure and at temperature of 150-270° C., by Fischer and Tropsch have succeeded in preparing a product which consists entirely of hydrocarbons, and is of all intents and purposes synthetic petroleum.

Vertical intermittent chamber ovens," by N. J. Lake, F.R.S., O.B.E., A.M.I.C.E.—The object of this paper is to give particulars of recent developments in Germany in the vertical intermittent chamber oven system of carbonisation, which is a rational development of the intermittent vertical retort. The results of carbonising a Durham coal in intermittent vertical chamber ovens

are given and tabulated in a similar way to the results given by Hardie (in a paper read before the Institute in December, 1926), and although too close a comparison

must not be made between these two tables of results, an examination does show that the intermittent system is able to achieve results as good as, if not better than, those achieved by systems generally employed in this country. A number of advantages of the intermittent chamber oven system is enumerated. A short description of a modern intermittent chamber oven plant is given. Attention is drawn to the reasons why the intermittent chamber oven system has been preferred on the Continent to the continuous systems so successfully developed in this country. Sufficient information has been given in the paper to demonstrate that their employment is not, as might be suggested from the intermittent nature of their operation, a retrograde step, and that they deserve the most serious consideration of those interested in the carbonisation of coal. Large plants of this type are now under construction in this country.

"The chemical study of processes involving the carbonisation of coal by internal heating," by Prof. M. W. Travers, F.R.S.—By drawing up a heat balance of the total heat entering and leaving the system in a process of complete gasification or of carbonisation of solid fuel it is frequently possible to determine whether a particular system can or cannot be carried out. If such a method were universally adopted, only a very small proportion of the processes for carbonisation and gasification of fuel which are patented would ever be put forward. Unfortunately, there is no agreement as regards the values of the important constants used in the compilation of thermal balance sheets. Assuming, however, the known data available, taking customary specific heats of gases and specific heat of coke calculated from the thermal capacities of graphitic carbon and silica, the thermal requirements for (1) low-temperature carbonisation of coal by producer gas, (2) low-temperature carbonisation of coal by superheated steam; and (3) manufacture of water-gas from coal, have been calculated. With respect to low-temperature carbonisation of coal by producer gas, in no single paper are the data for any particular experiment sufficient for complete analysis, but from a compilation of published data the quantities can be deduced which are required to effect the carbonisation of coal at 600° by producer gas or superheated steam. In the manufacture of water-gas from coal it is shown that the quantity of water-gas required to carbonise one ton of coal equals 63,500 cb. ft. An output of 70,000 cb. ft. per ton of coke probably represents the limit attainable with blue water-gas practice, and then only when 6-7% CO is permitted: 55,000 cb. ft. is probably a very good average for carburetted water-gas practice. It therefore follows that the quantity of water-gas which can be produced in a process for the complete gasification of coal is under any circumstances insufficient to effect the carbonisation.

BRITISH ASSOCIATION OF CHEMISTS

The 10th Annual Meeting was held on November 26. Prof. G. T. Morgan, F.R.S., the President, being in the chair.

The Treasurer, Mr. W. H. Woodcock, in presenting the Financial Report, pointed out that the improved financial position of the Association had been maintained since

a small balance remained in hand which would be used for very special requirements. The unemployment benefit fund was now in a satisfactory position and owing to the increased subscription, had paid out this year £1,035 in benefits, the largest sum ever disbursed in one year.

Mr. S. R. Price, M.B.E., Chairman of Council, in moving the adoption of the Annual Report of the Council, said that the great increase in prestige of the Association did not mean that its efforts to increase its membership and influence ought to be abated. On the contrary the fact that a large amount of work remained to be done should encourage every member to do his utmost to increase its influence.

The following officers were elected to serve for the coming year. *President*: Prof. G. T. Morgan, O.B.E., D.Sc., F.R.S.; *Vice-Presidents*: Sir Max Muspratt, Bart., Wm. E. Kay, F. Scholefield, M.Sc., C. S. Garland, A.R.C.S., B.Sc., F.I.C., M.I.Chem.E., Prof. E. C. C. Baly, F.R.S.; *Hon. Registrar*: E. H. Rodd, D.Sc.; *Hon. Treasurer*: Wm. H. Woodcock; *Hon. Gen. Secretary*: H. T. F. Rhodes, M.I.E.I.

With great regret the resignations, owing to pressure of work, of Prof. Heilbron as Vice-President and of Mr. R. Brightman as Hon. Editor were accepted.

Considerable discussion arose in connexion with the resolution of the London Section:—"That the London Section recommends that the Political Rules Part I. XXIII (1/13) be deleted, and cease to have effect as from November 26, 1927." The London Section had suggested that, since the Association was registered as a Trade Union only for convenience, it was improbable that it would desire to canvass candidates for Parliament before election at any time, and that since in any case the rules would have to be altered in view of the new Trade Union Bill, it was probably most convenient to delete the rules altogether. On the other hand it was held that although the Association did not desire to follow the ordinary Trade Union policy, the deletion of the rules might hamper its parliamentary interests at some future date. The resolution, upon being put to the meeting, was lost by a narrow majority.

The resolution of the Birmingham Section "That the Council is hereby instructed to publish a Register of all members of the B.A.C. containing their names and addresses as at January 1, 1928," was discussed. The Council was agreed as to the principle of publishing a register, but it was contended that the whole legal question as to who should have access to the register would require to be investigated, and practical considerations such as expense ought to be considered. Upon the resolution being put to the vote, the Chairman giving the general ruling that reference back of resolutions for amendment would require their reconfirmation at another general meeting, the resolution was carried by a narrow majority.

In his address, Prof. Morgan discussed the question of the title "chemist," and touched upon the various difficulties legal and practical which arose in this connexion. The unemployment benefit fund had done work of which not only the Association, but the whole profession, ought to be proud. Of the legal aid fund

something had already been said, but he thought that the results were of an importance which extended beyond the benefits conferred upon the individual recipient. Adequate legal protection increased the status of the whole profession. The Association was a small body as yet, but its potentialities were very great and before it he felt sure was a great future.

The Annual Dinner which took place in the evening was most successful in spite of transport difficulties due to fog.

The principal guest of the evening, Mr. Irons, of the Ministry of Labour, was unfortunately absent, owing to a severe chill, but in proposing the toast of the Ministry of Labour Mr. S. R. Price referred to the cordial relations which had been established between the Association and the Government Departments with which it had been in contact.

The toast of the "Association" was proposed by the General Secretary, who alluded to the growth of the Association, and to his belief that it would do much to unite the profession of chemistry.

In his reply Prof. Morgan mentioned to the important work the Association was doing in impressing upon the public the importance of the work done for the community by the chemist. When the question of legal status arose it had to be remembered that those who were not chemists had to be consulted. It was very important, therefore, that the Association's policy should be directed to this end. It had been, and was being, thus directed. The question of registration and title was intimately connected with this matter.

Dr. E. F. Armstrong, in proposing Kindred Societies, said the chemist required a banner with a strange device. On one side ought to be the hexagon: as to that on the other he would allude to it later. One had to consider the great things the chemist had done, from the first grouping after knowledge of the alchemists through the atomic theory to the wonderful achievements of physical chemistry. Again, in the department of organic chemistry, the chemist built up out of the meanest elements things of utility and beauty. Upon the other side of the banner he thought ought to be inscribed a representation of the flapper. Upon her fingers were synthetic stones made by the chemist; there were her silk clothes and stockings, made by the chemist, there was scarcely anything she used which the chemist did not help to produce. It was a great and splendid thought, this power of the chemist to use his patiently acquired knowledge in the service of humanity, beauty and utility. It meant that the profession had always a greater and greater future before it. As to Kindred Societies the ideal was in his opinion that there should be in the end only one society. It was with pleasure that he proposed the health of Kindred Societies for as long as they existed.

Dr. P. Haas, proposing the toast of "the Officers," alluded to the excellent work done by all officials of the Association in the past year. Mr. H. W. Rowell replied.

At the conclusion of the dinner a presentation was made to the General Secretary in acknowledgment of his services to the Association. Mr. Rhodes then replied in a short speech.

CORRESPONDENCE

"RESEARCH AT HIGH PRESSURE"

SIR,—Your editorial "Research at high pressures" ought not to suggest "Research at high pressure" to a well-ordered mind. But it did to mine.

Like the man who asks you to deal with the economics of honey and cane sugar in ancient times, I would like to see an editorial from you—not on honey, but on "Research at high pressure." Research is spreading in many, but not in all directions. I am of opinion that the establishment of the research associations and of the big chemical combine will very greatly restrict the amount of research work conducted by the individual firms comprising or contributing to combines and associations. Will the advantages of centralisation compensate for decentralisation in the old system? Is it better to have one large and well-organised laboratory than to have several small ones in keen, scientific and commercial competition with each other? I doubt it.

Since you will write editorials that appeal to the chemist in the street, you must carry the penalty of being bombarded by any faddist who, like myself, wants to see his pet subject in print.

But if this must go in print please

Call me

"PERCY"

PERSONAL AND OTHER ITEMS

We are glad to learn that Mr. W. J. U. Woolcock, who has been *hors de combat* for a short time, will be able to resume his work again about a week hence.

At a meeting of the Senate of the University of London, on November 18, the resignation of Prof. E. C. Williams from the Ramsay Chair of Chemical Engineering, tenable at University College, was accepted as from the end of the second term of the session 1927—28.

The title of Professor of Chemistry in the University of London has been conferred upon Dr. J. F. Spencer, in respect of his post as head of the Department of Physical Chemistry at Bedford College.

Dr. L. J. Spencer has been appointed Keeper of Mineralogy in the Natural History Museum. Dr. Spencer has edited the "Mineralogical Museum" since 1901, and is the author of numerous publications on mineralogical and crystallographical subjects.

Dr. J. Colvin and Mr. R. S. Bradley, B.A., have been appointed demonstrators in inorganic chemistry and Dr. J. Sugden has been appointed research assistant and demonstrator in refractory materials in the Fuel Department in the University of Leeds.

At Cambridge, Mr. C. Rimington, B.A., of Emmanuel, has been re-elected to the Benn W. Levy research studentship in biochemistry for one year.

Major T. H. Crozier, H.M. Chief Inspector of Explosives, and Prof. J. S. S. Brame, of the Royal Naval College, Greenwich, have been appointed by the Ministry of Transport to hold an enquiry into the proposal to allow petrol ships to proceed higher up the River Thames than Thames Haven.

On the invitation of the Commonwealth Government, Sir Arnold Theiler, K.C.M.G., D.Sc., the South African veterinarian, and Dr. J. B. Orr, D.S.O., M.C., M.D., D.Sc., Director of the Rowett Institute, will visit Australia next year to consult with the Australian authorities in regard to Australia's pastoral problems.

Mr. S. T. Harman has joined the board of British Cyanides, Ltd.

Mr. T. Tertius Aikman has joined the boards of the Angela Nitrate and Santa Catalina Nitrate companies.

Mr. H. W. Hardinge, president of the Hardinge Co., of York, Pa., has been awarded the Edward Longstreth Medal by the Franklin Institute for his invention of a rotary air classifier, known as the Hardinge reverse current air classifier.

Dr. Vogler has resigned, on the grounds of ill-health, from his post as general director of the syndicate which controls the entire coal output of the Ruhr district.

The death is announced, at the age of 73, of Dr. P. Jeserich, a well-known German expert in legal chemistry.

The death is announced of Sir A. F. Pease, a noted Durham coalowner, who was a director of the National Benzole Company and other concerns.

The late Mr. R. G. Murray, of Gorton, Manchester, chemical manufacturer, left £19,020.

I.C.I. Research Council

In order to provide a co-ordinated body for determining the lines of general industrial research, Imperial Chemical Industries, Ltd., has established a research council, which held its first meeting on December 1. The research council will be presided over by Sir Alfred Mond, chairman of the company, and the other members will be:—Dr. G. C. Clayton, M.P., Colonel G. P. Pollitt, and Mr. J. Rogers (directors); Major F. A. Freeth, F.R.S., Dr. E. F. Armstrong, F.R.S., Dr. R. E. Slade, Mr. H. A. Humphrey, and Sir Frederick Keeble, F.R.S., all of whom are associated with Imperial Chemical Industries, Ltd., or its subsidiary companies; Prof. F. G. Donnan, F.R.S., Prof. Robert Robinson, F.R.S., Prof. W. A. Bone, F.R.S., Prof. F. A. Lindemann, F.R.S., Dr. E. K. Rideal, and Major A. E. Hodgkin, secretary. The main function of the research council will be advisory, and it will act as a clearing house for ideas. Steps have also been taken for following up all promising matters which may come before the council. The council will provide close *liaison* between industry and the universities, and will promote both long-distance scientific industrial research and research of the so-called purely academic type.

Vitamins in Margarine

The Research Laboratories of Lever Brothers, Ltd., announce the development of a process by which vitamins A and D can be incorporated in margarine. A vitamin margarine made by Planters Foods, Ltd., an associated company of Lever Brothers, is on sale throughout the country under the registered name "Viking."

British Standard Paints

The British Engineering Standards Association has recently issued three new British standard specifications for Brunswick or chrome green oil paste for paints,

indian reds (pale, middle and deep) for paints, and black oxide of iron for paints. They contain clauses regulating the composition, together with standard reception tests, for the purchase of these materials, together with Appendices giving methods of carrying out the tests. Copies of the specifications (Nos. 304, 305 and 306, 1927) can be obtained from the British Engineering Standards Association (Publications Department), 28, Victoria Street, London, S.W.1, or from the publishers, Messrs. Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.1, price 2s. 2d. each, post free.

Proposed Institute of Indexing

"It is proposed to form an 'Institute of Indexing,' to encourage the compilation of efficient indexes to books, papers, etc., to promote their intelligent use by the public, to maintain a register of qualified indexes, and to give advice where needed. Particulars may be obtained from Mr. W. R. Douglas Shaw, 'Beaufort,' Mornington Road (Chingford, London, E.4)

The Chemists' Club (N.Y.)

The transmutation of the Chemists' Club (New York) from tenant to owner of its building in East 41st Street, New York, was celebrated by a banquet on October 26. President Wagner, after reading congratulations from chemical and engineering organisations throughout the country, said that 98.8% of the stock of the Chemists' Building Company was now owned by the Club, the greater part of it having been given by the original sponsors of the project.

Coal-tar Dyes in the U.S.A.

The total production of coal-tar dyes by 61 firms in the United States in 1926 was 87,978,624 lb., an increase of 2% over the previous year. Sales in 1926 totalled 86,255,836 lb., valued at \$36,312,618, at a weighted average of 12 cents per lb., or 10% less than the corresponding average price during 1925. The average price in 1917 was \$1.42 per lb. The competition between domestic dye manufacturers was severe, and resulted in 16 fewer firms engaged in production in 1926 than in 1925. Imports of dyes into the U.S.A. during 1926 represented a decrease of 10% in quantity and 11.5% in value, as compared with 1925. Exports of dyes in 1926 increased slightly in quantity, but decreased 11% in value, as compared with 1925.

Mellon Institute of Industrial Research

From the annual report of the Mellon Institute of Industrial Research, it appears that 102 fellows are now working at investigations connected with 58 industrial fellowships. Nearly £120,000 was paid during the year in support of research under the fellowship scheme, so that the total sum provided for fellowship research by companies etc. during the first 16 years of the Institute will not fall far short of £1,000,000. The development of the work has made it necessary to provide for research in "pure" chemistry, and accordingly a department for pure chemistry (under Dr. L. H. Cretcher) and a department for analytical chemistry (under Dr. G. D. Beal) have been established.

The XIth Exposition of Chemical Industries

Visitors to the Exposition of Chemical Industries which was held at the end of September in New York

state that it was the most successful yet held. Exhibitors were numerous and there were many interesting exhibits, amongst which some of the more unusual items were as follows:—The Udylyte Co. exhibit of cadmium plating showed a metal resistant to sulphur fumes. The Matheson Co. exhibited ethylene and other liquified gases and gave a demonstration of the use of ethylene gas in hastening of ripened fruit colours on fruit. The American British Chemical Supplies Co. showed a new plastic material produced from acetyl cellulose. For the first time, a large number of displays of fatty acids, waxes, glycerol and products made therefrom were shown. The Commercial Solvents Co. exhibited synthetic methanol made in the United States. Amongst the plant shown, there were: a model wood distillation plant (Ford Motor Co. By-products Division); a cantilever filter (United Filter Co.); a new interior filter (Dorr Co.); a Monel metal tank for the transport of nitric acid (Pressed Steel Tank Co.); the new Vorce electrolytic cell (Electro-Chemical Engineering & Supply Co.); the General Electric Company's hydrogen welding process; "Vitaglass," and so on.

New Insulating Material

The General Electric Co. (U.S.A.) has developed a new insulating material composed of ground mica and lead borate. An excellent insulating material is already made from mica flakes, but the wastage of mica has been very great, for it has been estimated that only 5% of the material taken from the mines could be used. The new material, known as "mycalex," is also of interest as it is a promising outlet for the fine mica waste.

New Corrosion-resisting Material

It is claimed for a new metallurgical product, made in France by the Aciéries de Pompey and marketed under the name of "Apso," that it possesses qualities of resistance to corrosion, workability, strength, etc., similar to, and in some instances better than, nickel steel, with the advantage that it costs less.

Research in Belgium

On the initiative of King Albert and with the support of leading industrialists and financiers, a fund has been started in Belgium for the establishment of a permanent museum and a laboratory for scientific research. Important contributions have already been received.

"1914—1924"

The Académie des Sciences, in awarding the Monthyon Statistical Prize to "1914—1924—Dix Ans d'efforts Scientifiques, Industriels et Coloniaux," has "crowned" the work. This important work, published in two handsome quarto volumes under the direction of Jean Gérard, deals with the scientific, industrial and colonial progress of France during the period 1914 to 1924. It can be obtained from "Chimie et Industrie," 49, rue des Mathurins, Paris, at the price of 48s.

The I. G. and Synthetic Rubber

An impression may have been gained from reports of the speech recently made in Frankfurt by Geheimrat Dr. H. Von Weinberg, of the I.G. Farbenindustrie, that successful manufacture of synthetic rubber is in sight. This impression may be discounted by the following

translation received by the Department of Overseas Trade from H.M. Consul-General at Frankfort (Mr. V. H. C. Bosanquet) of the pertinent passage in the speech from the report appearing in the "Frankfurter Zeitung": "Through contact synthesis we shall further succeed in extracting by a more convenient method the raw materials for the synthesis of rubber and gutta percha." In another translation made at the Consulate-General in Cologne from a report in the "Deutsche Bergwerks Zeitung," the end of the sentence reads, "to produce the elements for the synthesis of rubber and gutta percha."

The only interpretation possible is that the German chemical combine with which Dr. V. Weinberg is connected has become satisfied with the progress made in its investigations towards the production of isoprene, or a related hydrocarbon, from which the rubber molecule must be built by further treatment. The reports do not mention the second and very difficult problem, that of obtaining a material which will present the essential physical and mechanical qualities of natural rubber.

German Potash Industry

The British Commercial Secretaries at Berlin state that, although the very favourable results achieved in the German potash industry during 1925 were not attained in 1926, and sales showed a diminution of some 125,500 to 1,100,000 tons, they far exceeded the 1924 sales of 843,860 tons. It is true that German inland sales, which account for nearly 60% of production, showed a reduction in 1926, but this would seem to be counterbalanced by increased sales during the first quarter of this year, largely attributable to the mild weather. Foreign sales did not develop to the extent which had been hoped, but were doubtless in some measure temporarily influenced by the change in the foreign sales organisation consequent upon the conclusion of the Franco-German Potash Agreement. Foreign sales are now undertaken conjointly by the German Potash Syndicate and the Société Commerciale des Potasses d'Alsace.

Coal Hydrogenation in Hungary

As the Hungarian coal industry is faced with over-production, attempts have been made to "liquefy" Hungarian coals. Tests with coal from the Totis mines have given excellent results and special plant is accordingly to be erected.

Agreement between the Chemical Industry and Manufacturers in Czechoslovakia

An agreement has been reached between representatives of the Czechoslovakian chemical industry and those industries using its produce, notably the glass, paper, leather, and textile industries, with the object of eliminating unnecessary competition and facilitating trade.

Stability of Acetone to Light

It is reported from the laboratory of the Holzverkohlungs-Industrie A.-G. Konstanz, that chemically pure acetone, satisfying the requirements of the German Pharmacopœia in its lack of reaction with permanganate, decolorises it after exposure to ultra-violet light. The pure material can be obtained again on rectification. Acetone of this purity should therefore be protected from light during storage.

Austrian Chemical Industry

Chemical plants in Austria number 683, employing 19,209 workmen. Among these plants the 300 in Vienna occupy 40% of all the labour employed in the Austrian chemical industry. 149 plants with 5482 workmen are situated in Lower Austria; 40 plants with 1881 workmen in Upper Austria; and 60 plants with 1518 workmen are situated in Styria. In the Tyrol there are 30 plants, and in Burgenland 5 plants.

According to the "Centralblatt für die Zuckerindustrie" the six Austrian sugar factories, which produced 79,686 tons of raw sugar during the 1926-27 campaign, will manufacture 96,550 tons this year, a figure which represents the capacity of the industry. The refineries worked up Czechoslovakian raw sugar in previous years (1926-27: 11,513 tons), but they will probably have enough home sugar this year. As the Austrian sugar factories are working to capacity there arises the question of erecting new factories. Such projects are not new, but their realisation is hindered by financial difficulties. There are projects to erect sugar factories more cheaply by adapting some vacant factories situated in the beet-growing districts, though the results from such an attempt by the Farmers' Sugar Factory in Suben were bad.

A short notice in the "Oesterreichischen Chemiker-Zeitung" reports that the chemical factory erected by the administration of the Salt Works at Hallein (Salzburg) has begun production. At present the production of this factory will amount to 1200 tons of chlorinated lime and about 1500 tons of caustic soda. As the Austrian import, in 1926, of chlorinated lime amounted to 2270 tons, a moderate import should be still required. The factory will probably produce liquid chlorine at the end of this year.

Shale Oil Furnace in Japan

An experimental shale oil furnace has been established at the Fushun collieries in Japan. It is 3 ft. in diameter and 50 ft. high, and has a capacity of 40 tons. Of the internal-heating type, it is so designed that the gas will be returned to the furnace for re-use. If this furnace comes up to expectations the plan is to build additional 40-ton furnaces. It was found that, by mixing one part of the shale oil produced at the Fushun collieries with two parts of crude Borneo oil, a product was obtained that would be satisfactory for marine purposes. An annual output of 25,000 tons of shale oil is expected.

Third Census of Production (Butter, Cheese, Condensed Milk and Margarine Trades)

In the year 1924 the amount of butter made and blended in commercial factories and creameries in Great Britain amounted to 722,000 cwt., valued at £7,005,000, compared with 422,000 cwt., valued at £2,289,000, in 1907. The total amount of cheese produced in 1907 was 73,000 cwt., valued at £187,000, compared with a selling value in 1921 of £760,000. The output of cream in 1907 was 964,000 galls., valued at £356,000, compared with a selling value in 1924 of £1,415,000. In 1924 the output of separated milk amounted to £130,000 in value, whilst the value of condensed milk, milk powder, lard compound, refined oils and acid oils in 1924 amounted

to £24,661,000. The total value of dairy produce and other goods manufactured by factories and creameries in Great Britain in 1924 was over four times that of the output in 1907, a marked increase being shown in all cases where a quantitative comparison is practicable.

The net value of the output of the factories and creameries in Great Britain engaged in the industries was £4,497,000 in 1924, the net output per person employed being, in 1924, £383, and in 1907, £159. The net output per person employed in factories and creameries in England and Wales in 1924 was £383, and in Scotland, £378. The average number of persons employed in Great Britain during 1924 in the industry was 11,747, compared with 5,100 in 1907. The total capacity of engines at the factories in Great Britain engaged in the trade was 22,857 h.p., in 1924, of which slightly over 31% was in reserve or idle during the year. The capacity returned in 1907 was 5,594 h.p. There was also recorded for 1924 a total capacity of 5,231 h.p., electric motors driven by purchased electricity, nearly 8% of which were in reserve or idle during the year. The capacity of electric generators in 1924 was 10,180 kw., against 711 kw. in 1907.

Third Census of Production (Brewing and Malting Trades)

The figures given below are of the output in 1924 and 1907 of brewers and maltsters in Great Britain:—

Products	1924		1907	
	Quantity	Selling Value £	Quantity	Selling Value £
Beer, ale, stout and porter, brewed	20,103,000 barrels of 36 gallons at 1055"	141,788,000	31,040,000 barrels of 36 gallons at 1055"	53,381,000
Aerated and mineral waters, doz. botts.	2,477,000	287,000	686,000	*31,000
Malt made for sale	6,732,000 cwt.	6,877,000	10,462,000 cwt.	6,098,000
Grains, maltummings and other offals	—	1,020,000	—	987,000
Non-alcoholic drinks, brewed	—	44,000	—	—
Liquors purchased and bottled	—	8,131,000	—	*151,000
Barrels and casks, made and repaired	—	535,000	—	292,000
Other products	—	383,000	—	130,000
Malting done on commission	—	190,000	—	87,000
Total value	—	150,273,000	—	61,314,000

* In order to avoid the possible disclosure of particulars relating to certain firms, the figures for Ireland (amounting to £17,000) were, in these cases, included with those for the rest of the United Kingdom. This sum is not included in the total shown above for the year 1907.

The amounts appearing in the above table in respect of malt produced represent only the quantity and value of malt made for sale and do not include the production of commission maltsters or malt made by brewing firms and used by them for brewing purposes. From returns received the total production of malt in Great Britain during 1924 (excepting malt made by distillers and used by them as material), may be estimated at 12,631,000 cwt., of which 6,732,000 cwt. was made for sale, the quantity made by commission maltsters being roughly 1,000,000 cwt., and the balance was made by firms for their own consumption in works.

The net output of the breweries and maltings for 1924 was £121,812,000, and the net output per person was in that year £1,816, compared with £481 in 1907, the figures in both cases being inclusive of Excise Duty. The average number of persons employed in the trade in 1924 was 67,069, compared with 78,374 in 1907, the

figures for both years, relating to Great Britain only. In 1912, a total of about 80,000 persons employed is indicated by the information received. The total capacity of engines at the works in Great Britain in 1924 was shown as 43,679 h.p., of which slightly over 19% was in reserve or idle during the year. The 1907 capacity was 57,335 h.p. In 1907, the capacity of electric motors at factories was not recorded, but in 1924, motors aggregating 57,530 h.p., driven by purchased electricity, were included in the returns. About 10% of the capacity of these motors was in reserve or idle during the year. There was also recorded for 1924 a total capacity of 7,747 h.p., electric motors, driven by electricity generated by engines at the factories. The capacity of electric generators at breweries and maltings was in 1924, 6,454 kw. and in 1907, 2,884 kw.

Improved Capillary Flow Meter for Gases

Prof. E. H. Riesenfeld has devised improved forms of the capillary flow meter suitable for all laboratory measurements of gas streams. Details of the method of calibration are given (*Chem.-Z.*, Sept. 3). These instruments are now on the market.

THE NEW BELGIAN CHEMICAL TRUST

The Union Chimique Belge, the chemical trust which has just been founded at Brussels, was formed in order to strengthen the power of the affiliated companies to compete not only in home but in foreign markets.

The new trust, possessing considerable capital, will be able to carry out investigations and develop the new processes which are essential to modern industrial progress.

It appears that the Union Chimique Belge will have a capital of 175,000,000 francs, of which 30,000,000 will be obtained by the issue of 100-franc preference shares bearing a fixed rate of interest, and the balance in ordinary shares. The preference shares will be subscribed by the Banque Industrielle Belge, La Société Générale de Belgique, La Mutuelle Solvay, and the Banque de Bruxelles. The ordinary shares will be allotted to the amalgamated companies in exchange for their shares in the following proportions: 150,000 to La Société Fours a Coke Sarnet Solvay, 60,000 to La Générale Belge de Produits Chimiques, 60,000 to La Société des Produits Chimiques de Droogenbosch, 14,000 to the Cie. des Produits Chimiques Meurice.

It is stated that the president of the trust will be M. Theunis, a former prime minister, while M. E. Janssen (of the Mutuelle Solvay) will preside over the "Comité de Direction," and M. G. Blaise and M. O. Piette will act as managing directors.

Extraordinary meetings will be held to obtain the assent of the shareholders to the amalgamation.

As the Compagnie Belge pour les Industries Chimiques owns three-fifths of the present share capital of the Société des Produits Chimiques de Droogenbosch, it has a considerable interest in the new trust; and as the Compagnie Belge, together with the Droogenbosch, the Société Metallurgique de Hoboken and the Union Minière, is interested in the Syndicat pour les Industries Chimiques, and in the Katanga Company, the chemical trust is thus assured of important outlets.

REVIEWS

MANUFACTURED GAS. By J. J. MORGAN, M.S., Ph.D.
Vol. I. Pp. 518. New York: J. J. Morgan, 1926.
Price \$7.50.

It is a somewhat remarkable fact that although in certain branches of the technique of gas production American practice may be regarded as superior to our own, the American gas engineer has been lamentably ill-provided with anything in the way of comprehensive and really up-to-date text-books. Three years ago Mr. Horace C. Porter commenced to remedy the deficiency by publishing an admirable monograph on coal carbonisation, but it has been left for Mr. Morgan to produce a really workmanlike volume in which an attempt has been made to cover not only the main, but also the many subsidiary processes which are essential features of modern gas production. The science and practice of gasmaking has, however, progressed so rapidly in the past few years, established precedents and rules have in many instances been thrown to the winds, and the research worker has applied himself with such thoroughness to the technical problems which beset the industry, that it has become a matter for serious doubt whether in the space of a lifetime any single individual could possibly assimilate all the existing information and compile therefrom a text-book which could be characterised as really complete.

At least, it may be said that Dr. Morgan and his collaborators have provided the gas engineer with a work which is more complete than anything which has hitherto been attempted, and where omissions are found, there is little doubt that they will be remedied in the second volume, which has yet to make its appearance. The earlier pages of the book, which deal with the physical and chemical characteristics of fuel gases, may be passed over as representing nothing very new; but inclusion of material of this nature is particularly desirable as it enhances the value of a book which is likely to be used largely by students as well as the matured gas engineer. The chapters which follow and which deal with the more practical aspects of gas production should be of particular utility to engineers in this country as showing the different features of design which are to be found in America and the care which is bestowed on the smallest details. It is, perhaps, rather striking to find the statement that the horizontal retort with its recent improvements in charging and discharging apparatus is still an important factor in coal carbonisation in America. One notices, too, that whereas over here the maximum number of retorts comprising a bench may be regarded as ten, in America some benches contain as many as sixteen retorts. It is not, however, difficult to realise that, when all is said and done, the American engineer undoubtedly prefers large capacity by-product coke-ovens for effecting carbonisation. More than a dozen of the largest cities now obtain all, or a considerable part, of their gas supply from these ovens, and there seems little doubt that the use of coke-ovens, in which America now leads, will play an even greater part in American gas production of the future. As to whether the retort or the oven is the more effective apparatus, so much depends upon local circumstances, and it is likely to be

many years before the English gas engineer is converted to the opinions of his American colleagues.

America, of course, is the home of water-gas, and the importance of this particular type of gas can be appreciated when it is recalled that it represents more than 60% of the total gas produced. For this reason it was only to be expected that Dr. Morgan would devote a large portion of his space to a discussion of the various plants and processes which are now utilised for the production of both blue and carburetted water-gas. Recent years have witnessed many modifications of the standard water-gas plant such as is commonly found in this country. Some of these modifications relate solely to those plants which have been developed in America for the treatment of bituminous coals—a practice which is not considered economical in this country; but many others have been adapted, for the improvement of efficiency, to the ordinary process of coke gasification, outstanding examples of which are the back run method, reversed airblast, and the Chrisman process. All these have been developed with the same idea in view, namely, that of returning to the generator heat which is not needed in the superheater and reducing the quantity of heat wasted in the wash-box.

The complete gasification of coal, regarded a few years back as the ideal process for the conversion of both coal and coke into gas in one stage, comes in for its share of attention, and it is obvious that opinion in America runs on much the same lines as that over here. Dr. Morgan sums up the situation by stating that the dream of a single-stage complete gasification process, which shall permit the recovery of by-products from bituminous coal and convert the whole of the solid matter except the ash into a gas suitable for distribution, is still unrealised, but it forms an intriguing field for research and invention. In America, of course, the situation is rather different for the reason that, two or three States apart, much higher standards of calorific value are in force; but when the time arrives that the gas undertaking is permitted to deliver such gas as it is most economical for it to manufacture and distribute there will be further opportunities for complete gasification in the cheap production of low heating power gas.

In conclusion, the author deserves the thanks of his colleagues for the pains to which he has gone to provide a work which must already be regarded as a standard. He has wisely drawn with freedom on the experience and publications of others and has freely acknowledged the sources of his information. ALWYNE MEADE

KÜNSTLICHE ORGANISCHE FARBSTOFFE. By Dr. H. E. FIERZ-DAVID. *Technologie der Textilfasern*, edited by Dr. R. O. Herzog. Vol. III. Pp. xvi + 719. Berlin: Julius Springer, 1926. Price 63 r.m.

This is a much more ambitious work than the same author's *Fundamental Operations of Dye Chemistry*, published about six years ago, and is an expansion of lectures delivered at the Technical College, Zürich. After an excellent historical introduction, in which the part played by natural colouring matters is not forgotten, and a general review, both theoretical and practical, of the dye field, the dyes themselves are treated systematically and in detail, the usual classification being followed.

On the whole, a very good balance is maintained in the systematic portion of the book, although one would expect more than a mere 48 pages on indigos and thio-indigos in comparison with 92 pages on triarylmethane dyes, 118 pages on azo dyes, and 164 pages in the anthraquinone section.

In the chapters on azo dyes it is surprising to find practically no mention of lake pigments, but the section on Rosanthenes and other fancy cotton colours from J-acid is the best account yet published. In later editions room should be found for the interesting story of dyes for acetate silk, of which the Ionamines must only be regarded as an early, if important, chapter.

Scattered throughout the book, often in small type, sometimes in footnotes, the careful reader will find numerous useful observations and hints which reveal the close familiarity of the author with the practical and technical side of his subject. It may be questioned whether a text-book is a suitable medium for the publication of new and original investigations, but no azo chemist will grudge the 23 pages devoted to the characterisation of the fission products of azo dyes, for which purpose good use is made of absorption spectra.

Although the book is intended for students of dye-chemistry, its appeal is rather to the specialist in one or other of the dye groups. The student is likely to be overwhelmed by the many pages of formulæ, and will find rather too little help from the brief general and theoretical expositions which preface them; the dye specialist will be delighted to find here a number of dye constitutions unknown to *Schultz* or the *Colour Index*—until he discovers that several of these contain serious errors (e.g., three incorrect constitutions for Algal Brilliant Violet R are given on pp. 574 and 575). The rather numerous typographical errors may be forgiven in a book of this size and complexity, and with few exceptions will readily be detected and corrected (*p*-dimethylaminobenzoyl chloride, p. 253, does not melt at 85°). The book is beautifully printed, and its interest is enhanced by the inclusion of twenty plates, of which ten are pictures of famous dye chemists. The German of the text is unusually clear and direct, and as a book of reference for practical dye technologists this work is strongly to be recommended.

C. HOLLINS

LES SUCRES ET LEURS DÉRIVÉS. By MARC CRAMER. Encyclopédie Scientifique. Publiée sous la direction de Dr. Toulouse. Pp. xiv + 349. Paris: Gaston Doin et Cie., 1927. Price 28 fr

The research school of carbohydrate chemistry at Geneva has merited the great esteem and recognition of chemists by its important investigations on polysaccharides and the anhydro-sugars, and for the series of brilliantly conceived synthetic experiments which have opened the way to a study of the vastly complex problem of polymerisation. The author of this book is therefore well qualified by his active participation in the advancement of the subject to write with experience of the problems engaging the attention of fellow-workers in the same domain. Prof. Picet communicates a delightful introduction to this volume, written by one of his distinguished pupils.

This little book presents, in a most readable and handy form, an account of the most recent developments in the chemistry of the carbohydrates. The author has expended much labour in a thorough survey of the literature of the sugars, and has given, in the course of his clear, impartial, yet critical narrative, a fascinating review of his subject. The text is freely illustrated by structural formulæ, more so than is usual in so small a book, and the reader is kept in touch with original papers by means of the frequent references given in the text and by the complete bibliography at the end. Those interested in the subject, whether research workers or students, will appreciate the simple and well-balanced form in which the matter is presented.

In this branch of the chemistry of natural products progress has been rapid during very recent years, and many of the older interpretations placed on experimental results have been profoundly changed. The task of writing the book was evidently well advanced when the new formulæ for glucose and γ -glucose derivatives were introduced nearly two years ago, a circumstance which had the effect of modifying the whole of the sugar formulæ accepted since the time of Fischer and Tollens. M. Cramer has introduced into his text the necessary revisions, although in many cases these take the form of footnotes.

Without unnecessary detail or recourse to tabular representation, the author has given a general survey of the preparation, properties, constitution, and synthesis of sugars and their derivatives, and has written in such a manner as to stimulate and retain the interest of his readers. Generally speaking, there are few interpretations of results with which one could disagree, although there are a few misprints: for example, on page 109, the formula 111b shows glucose diacetone, whereas this is referred to in the text as fructose diacetone; again, on page 173, the methylfructoside of Hudson and Brauns is referred to as a γ -form. It would have been helpful to have included an alphabetical index of subjects. The volume is a welcome addition to the collected literature of the carbohydrates.

W. N. HAWORTH

FORTSCHRITTE IN DER KAUTSCHUK-TECHNOLOGIE. By F. KIRCHHOFF. Part XIII. Technische Fortschrittsberichte. Fortschritte der Chem. Technologie in Einzeldarstellungen. Edited by Prof. B. Rassow. Pp. xi + 201. Dresden and Leipzig: Theodor Steinkopff. 1927. Price, paper, 12 m.; bound, 13.50 m.

This book is one of a series designed to present readers with a concise account of the more recent scientific and technical advances in branches of industry. It is not intended to rank as a text-book, but is written for those who are engaged in the industry and have not the opportunities for keeping abreast with the scientific and technical literature of their subject. It may be said to fulfil this purpose. The author has spared no pains to make the book complete, and it is supplied with a good index—a feature not always found in continental publications. In many respects the book may be regarded as based on our own Annual Reports, but on a more elaborate scale and covering the whole of last decade. As in our annual

Reports the first few pages of the book are devoted to a statistical review of the industry, both producing and manufacturing. This is followed by twelve technical sections dealing with latex production, production of raw rubber and so forth through the various manufacturing operations, with a final chapter on rubber testing. Many recent papers dealing with rubber are extremely complex and are difficult to abbreviate. The author has therefore dealt more fully with some researches than with others. This was inevitable, but it gives the impression of a want of balance. If the author could only have let himself go and written a book two or three times the size the result would have been more satisfactory. A few interesting details may be cited, *e.g.*, the contrasts drawn between British and American rubber machinery on the one hand and German on the other, of machines built 10 or 12 years ago and the productions of the present day. On page 171 is an illustration of the latest type of Schopper mechanical tester with the extremely ingenious modifications of the autographic attachment enabling curves for rings of different cross sectional area to be contrasted on the same sheet.

The portions of the book deserving of special mention are those dealing with fillers, recovery of solvents, synthetic rubber and artificially prepared derivatives of the hydrocarbon, and also the last section dealing with the mechanical testing of rubber. On the other hand the chapters on raw rubber and accelerators are perhaps less satisfactory than other parts of the book. The book is well provided with references to the technical and patent literature.

HENRY P. STEVENS

THE METALLURGIST'S MANUAL. BY T. G. BAMFORD, M.Sc. and HAROLD HARRIS, M.Sc., F.C.S., with a foreword by T. TURNER, M.Sc., A.R.S.M. Pp. x + 216. London: Chapman and Hall, Ltd., 1927. Price 15s.

This is not a text-book of practical metallurgy, but a collection of methods and figures useful to the metallurgist in his laboratory. It contains a fairly full account of the methods of assaying and of analysis of ores and metals, in sufficient detail to serve as a manual of analysis. Next follow the methods for determining the value of fuels, but the widely-used and accurate bomb calorimeter is not described. A section deals with the calculation of slags and fluxes in smelting operations, and this is followed by a more detailed account of pyrometric methods. More attention might have been given to the disappearing filament type of optical pyrometer, which is increasingly used, and of which several excellent British patterns are available. It is difficult to give any adequate description of metallographic methods and results in so small a space as 33 pages, and some of the photomicrographs used as illustrations are not very clear, but the practical methods of preparing microsections are well described. The closing sections contain the composition of analytical and laboratory reagents and a number of tables showing the composition and properties of technically important alloys. The printing and arrangement are clear, and there are many laboratories in which such a handy collection of metallurgical data will be found useful.

C. H. D.

PARLIAMENTARY NEWS

Iron and Steel Production

Colonel Lane Fox informed Mr. H. Williams that the amount of coal used at iron and steel works during the first nine months of 1927 was approximately 18½ million tons (including the coal equivalent of coke).—Nov. 15.

Sugar Beet

In a written reply to Mr. A. V. Alexander, Sir H. Barnston stated that under the contract arranged between the National Farmers' Union and the proprietors of the existing factories, the price to the grower for topped and washed beets delivered at factory in each of the seasons 1928, 1929 and 1930 would be 46s. per net ton of 15½% sugar content, plus an addition at the rate of 3s. for the first 1% above 15½%, and 3s. 4d. for each additional 1%. The reduction in respect of beets below 15½% will be at the rate of 3s. for each 1%.—Nov. 16.

Artificial Silk Duties

Answering Sir J. Power, Mr. Samuel stated that for the six months ended October 31, 1927, 21,524,000 lb. of artificial silk was charged with Excise Duty, compared with 14,094,000 lb. for the six months ended December 31, 1925. — November 17.

Sugar Beet Subsidy

In a written answer to Mr. Stephen, Mr. Guinness stated that the total weight of sugar produced from British beet in this country during the operation of the subsidy up to November 16, 1927, is 5,529,311 cwt. of an estimated wholesale value, duty paid, of £8,250,000. The subsidy paid has amounted to £5,385,908.—November 17.

Chemical Warfare Experiments

Sir L. Worthington-Evans, in a written reply to Mr. Cadogan, said that no horses were used for experiments at the Porton Chemical Warfare Experimental Station during August, September, and October. Experiments with animals were, unfortunately, essential in order to obtain the necessary data for ensuring adequate defence against poison gas and for evolving efficient methods of treating gas casualties. — November 17.

Safeguarding of Industries

Sir P. Cunliffe-Lister informed Mr. Ramsden that the number of applications received for safeguarding was 46. Seventeen applications had been referred to committees of inquiry, in eight of which cases the committee had reported unfavourably, in seven cases favourably, and in two the inquiries were proceeding. Safeguarding duties had been imposed in all cases recommended by the committees. In four other cases—touring cars, commercial cars, tyres and carbon electrodes duties had been imposed in recent Finance Acts. Five applications were under consideration. Of the remainder, 3 were covered by the Government's decision on iron and steel, and 17 had been rejected by the Board of Trade as failing to establish a *prima facie* case under the White Paper. — Nov. 22.

Oil Fuel Extraction

In a written reply to Mr. Wheatley, Lord E. Percy stated that it had been proved technically possible to extract oil fuel from coal, from experiments which were

being carried out at the Fuel Research Station and Richmond, and the large number of similar experiments elsewhere. It was, however, not possible for the Government to express an opinion on the commercial prospects of any process based on these experiments.—Nov. 22.

Petrol (Tetra-Ethyl Lead)

In a written reply to Mr. Hardie, Sir W. Joynson-Hicks stated that one firm in this country had lately commenced the blending of tetra-ethyl lead with petrol on a commercial scale. The Factory Department had been kept informed, and was satisfied that adequate precautions were being taken for the protection of the workers concerned in the process. There was not likely to be any danger from the handling of the spirit after blending. The whole matter would be carefully watched.—Nov. 24.

Sugar-Beet Subsidy

Mr. Guinness informed Mr. Hayes that the gross subsidy paid to November 22, 1927, on sugar and molasses had been £6,169,915. Approximately 5,791,782 cwt. of sugar and 1,222,851 cwt. of molasses had been produced. No estimate could be given of the quantity of pulp produced. In the 19 beet-sugar factories 8,400 weekly wage earners were at present employed, and the average number of hours worked daily was approximately 9.4. He had no information as to the average weekly wage paid to these workpeople.—Nov. 25

COMPANY NEWS

VICKERS, LTD., AND SIR W. G. ARMSTRONG, WHITWORTH AND CO.

Meetings of these two companies were held on November 28, at which the provisional agreement, dated October 31, 1927, for the amalgamation of certain of their important works and businesses now engaged principally in naval shipbuilding and in the manufacture of heavy and special steel and armaments, was confirmed. (Cf. CHEM. AND IND., Nov. 25, 1927, p. 1101.)

BRITISH OXYGEN CO., LTD.

An interim dividend has been declared of 9d. per share, less tax, compared with last year's interim of 6d. per share.

ANGELA NITRATE CO., LTD.

An interim dividend has been declared of 5%, less tax, being the same as last year's interim.

BRITISH CEMENT PRODUCTS AND FINANCE CO., LTDs

This company, formed in November, 1926, reports a net profit for the year to November 16, 1927, of £124,753, from which has been written off the whole of the preliminary and new issue expenses, leaving available £107,280. It is proposed to transfer £10,728 to special reserve and £24,772 to general reserve. A dividend of 15%, less tax, has been recommended on the ordinary shares, plus a bonus of 1s. per share, less tax, making 20%, and a dividend of 95%, less tax, will be paid on the deferred shares plus a bonus of 11.4d. per share, less tax, making 190%, leaving £14,780 to be carried forward, subject to income tax. During the period under review Mr. A. J. Chapman was elected to a seat on the board, and has been appointed managing director.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £30 per ton; Powder, £32 per ton; Extra fine Powder, £34 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
Lamp Black.—£35 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithopone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.

Sulphur.—£9—£11 per ton, according to quantity. **Sulphur Precip. B.P.**—£47 10s.—£50 per ton, according to quantity.

Sulphur Chloride.—4d.—7d. per lb., carboys extra.
Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.

Vermilion, pale or deep.—6s. 3d. per lb.
Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £10 5s. per ton. Good demand.
Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal
Charcoal.—£6—£9 per ton, according to grade and locality.
 Foreign competition severe.

Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
Red Liquor.—9d.—10d.

Wood Creosote.—1s. 9d. per gal., unrefined.
Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.

Wood Tar.—£4—£5 per ton.
Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic. Crystals, 7½d.—8d. per lb. Crude 60's, 2s. 4d.—2s. 5d. per gal.

Acid Cresylic, 99/100. 2s. 11d.—3s. per gal. 97/99, 2s. 4d.—2s. 5½d. per gal. Pale, 95%, 2s. 3d.—2s. 4d. per gal. Dark, 95%, 2s. 1d.—2s. 2d. per gal.

Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.

Benzole.—Crude 65's, 9½d.—10d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 7d. per gal., ex works in tank wagons.

Toluole.—90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 6d.—2s. per gal.

Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.

Creosote.—Cresylic 20/24%—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7¾d. per gal. ex works. Salty, 7d. per gal., less 1½%.

Naphtha. Crude, 9d.—10d. per gal. Solvent 90/100, 9½d.—10½d. per gal. Solvent 95/100, 1s. 3d.—1s. 4d. per gal. Solvent 90/100, 8½d.—1s. 3d. per gal.

Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.

Naphthalene. Crystals, £13—£13 10s. per ton. Flaked, £14—£15 per ton.

Pitch, medium soft.—85s.—90s. per ton, f.o.b. according to district. Market firm.

Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180 3s. 6d.—5s. per gal. Heavy.—3s.—3s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 6d. per lb.

Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.

Acid H.—3s. per lb.

Acid Naphthionic.—1s. 6d. per lb.

Acid Neville and Winther.—4s. 9d. per lb.

Acid Sulphanilic.—8½d. per lb.

Aniline Oil.—8d. per lb., naked at works.

Aniline Salts.—8d. per lb., naked at works.

Anthranilic Acid.—6s. per lb., 100%.

Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—5½d. per lb.

m-Cresol 98/100%.—2s. 7½d. per lb.

p-Cresol 32/34° C.—2s. 8½d. per lb.

Dichloraniline.—1s. 10d. per lb.

Dimethylaniline.—1s. 11d. per lb.

Dinitrobenzene. 8½d. per lb., naked at works. £75 per ton.

Dinitrochlorbenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C. 8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

a-Naphthol.—2s. per lb. d/d.

β-Naphthol.—10d. per lb. d/d.

α-Naphthylamine.—1s. 3d. per lb.

β-Naphthylamine.—3s. per lb.

o-Nitraniline.—5s. 9d. per lb.

m-Nitraniline.—3s. per lb. d/d.

p-Nitraniline.—1s. 8d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb.

R. Salt.—2s. 2d. per lb.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—8½d. per lb.

p-Toluidine.—2s. per lb., ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure. 80%—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 3½d.—2s. 4½d. per lb.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—Cryst. 36s.—39s. per cwt. Powder 40s.—43s. per cwt.; Extra Fine Powder, 42s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 6½d.—1s. 7d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 4d.—1s. 6d. per lb. Technical 11½d.—1s. per lb. Good demand.

Acid, Tannic B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Acetanilide.—1s. 6d.—1s. 9d. per lb. for quantity.

Amidol.—7s. 6d.—9s. per lb. d/d.

Amidopyrin.—8s. 6d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 6d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £31 per ton. Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—9s. per oz.

Barbitone.—5s. 9d.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—10s. 4d.—10s. 7d. per lb. Bismuth

Citrate.—9s. 10d.—10s. 1d. per lb. Bismuth Salicylate.—

9s. 10d.—10s. 1d. per lb. Bismuth Subnitrate.—8s. 4d.—

8s. 7d. per lb. Bismuth Nitrate.—6s. 1d.—6s. 4d. per lb.

Bismuth Oxide.—13s. 10d.—14s. 1d. per lb. Bismuth Sub-

chloride.—13s. 10d.—14s. 1d. per lb. Bismuth Subgallate.

—8s. 1d.—8s. 4d. per lb. Extra and reduced prices for

smaller and larger quantities respectively; Liquor

Bismuthi et Ammon. Cit. B.P. in W. Qts.—1s. 1d. per lb.;

12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal 25s. per cwt. Powder 26s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—2s. 3d. per lb. Potassium.—

1s. 10½d. per lb. Sodium.—2s. 1d. per lb. Granulated ½d. per lb. less. All spot. Large quantities at lower rates.
 Calcium Lactate B.P.—1s. 2d.—1s. 3d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ethers: S.G. 730, 10½d. 1s. 1½d. drums. Other gravities at proportionate prices.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—4s. 9d. 5s. per lb.
 Hexamine.—2s. 3d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P. 10 vols., 2s. 3d. per gal. in carboys; Winchesters, 2s. 11d. per gal.; 20 vols., 4s. 3d. per gal. in carboys; Winchesters, 5s. per gal.
 Hydroquinone.—3s. 3d.—3s. 6d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate.—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—18s.—20s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol—A.B.R. recryst., B.P., 17s. 9d. per lb. net. Synthetic detached crystals, 10s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb.; Lovig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.
 Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonal.—8s. 9d. 9s. per lb.
 Metol.—9s.—11s. 6d. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb. Less in quantity
 Phenacetin.—2s. 6d.—2s. 9d. per lb.
 Phenazone.—4s.—4s. 3d. per lb.
 Phenolphthalein. 6s. 6d.—6s. 9d. per lb.
 Potass. Bitartrate.—90/100% (Cream of Tartar) 98s. per cwt., less 2½%.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included, F.o.r. London.
 Potass. Permanganate.—6½d. per lb. spot.
 Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 11d.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 7d.—1s. 9d. per lb. Crystal, 1s. 8d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.
 Sulphonal.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.
 Aubepine (*ex Anethole*).—11s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 9d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—18s. 6d. per lb. Geraniol.—6s. 6d.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 14s. per lb.—(*ex Shui Oil*) 9s. 9d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 17s. 6d. per lb.—(*ex Shui Oil*) 13s. 9d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—32s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—16s. 6d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb. Bergamot.—26s. per lb. Bourbon Geranium.—13s. 6d. per lb.
 Camphor.—9d. per lb. Cananga, Java, 15s. 9d. per lb. Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java, 1s. 10d. per lb., c.i.f. U.K. port, for shipment over 1928. Ceylon, Pure, 1s. 8d. per lb. Clove, pure 5s. 3d. per lb.
 Eucalyptus, Australian.—2s. 2d. per lb. Lavender.—Mont Blanc, 28/40%, 17s. per lb. Lemon.—8s. 6d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. per lb. Peppermint.—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood—Mysore, 26s. 6d. per lb., 90/95%, 10s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Jan. 23rd, 1928. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Dec. 8th, 1927. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Baume, Boutier, and Chambige. 30,842. See XII.
 Bennis. Furnaces. 31,094. Nov. 19.
 Brainard. Pulveriser. 30,697. Nov. 15. (U.S., 8,427.)

Gen. Electric Co., and Pochobradsky. Pulverising machinery. 30,668. Nov. 15.

Industrial Spray-Drying Corp. Processing materials by means of gases. 31,116. Nov. 19. (U.S., 1,927.)

Jackson (Doble Steam Motors Corp.). Controlling output of evaporators etc. 30,788. Nov. 16.

Loewe. Obtaining high vacuum. 30,491. Nov. 11. (Ger., 16.11.26.)

Mann. Treatment of gases. 30,870. Nov. 17.

Pink and Reynard. Appliance for filtration of slimes. 30,522. Nov. 14.

Pneumatic Conveyance and Extraction, Ltd., and Smith. Air and gas washing apparatus. 30,482. Nov. 14.

Silica Gel Corp. Impregnated gel for adsorbing water vapour. 30,918. Nov. 17. (U.S., 19.11.26.) Manufacture of catalytic gels. 30,956. Nov. 17. (U.S., 19.11.26.)

I.—Complete Specifications

31,106 (1925). Jaubert. Liquefaction of gases. (244,168 12,349 (1926). Whatmough. *See* XII.

15,962 (1926). Bubar. Separating dust from gases (261,706.)

17,052 (1926). Baume, Chambige, and Bontier. *See* XII.

17,758 (1926). British Dyestuffs Corp., Baddiley, and Chapman. Manufacture of absorbent materials. (280,262.)

19,479 (1926). Keavell. Dehydration and kindred treatment of gases etc. (280,268.)

19,728 (1926). African Selection Trust, Ltd., Boise, and Degenhardt. Disintegrating or mixing apparatus. (280,276.)

20,068 (1926). Riley Stoker Corp. Pulverising apparatus. (260,952.)

31,725 (1926). White (Wright and Young). Separation of solids from liquids. (280,389.)

13,638 (1927). Chem. Fabr. vorm. Schering. Manufacture of colourless melted products. (272,875.)

14,314 (1927). Schwartz. Radiation pyrometers (280,454.)

*23,802 (1927). Lurgi-Ges. Producing adsorption media (280,505.)

*30,020 (1927). Zeiss. Colorimeters. (280,552.)

*30,202 (1927). Studien-Ges. f. Gas-Ind. Conveying and consuming liquid gases. (280,569.)

II.—Applications

Coley. Combustion of fuel. 30,541. Nov. 11.

Evans, Stanier, and South Metropolitan Gas Co. Manufacture of coal gas. 31,140. Nov. 19.

Forsans. Oven for distillation etc. of solid fuels. 31,124. Nov. 19.

Kegel. Determining ash or mineral content of coal etc. 31,099. Nov. 19.

Mann. 30,870. *See* I.

Maschinenbau-Austalt Humboldt. Recovery of coal from slime water. 30,144. Nov. 18. (Czecho-Slovakia, 18.3.27.)

Musker. Combustion of fuels etc. 31,087. Nov. 19.

Norgate. Washing coke etc. 30,563. Nov. 14.

Pneumatic Conveyance & Extraction, Ltd., and Smith. 30,482. *See* I.

Silica Gel Corp. Removing sulphur compounds from gas mixtures. 31,058. Nov. 18. (U.S., 19.11.26.)

Widgren and Widgren. Gas-producers. 30,588. Nov. 14. (Sweden, 22.11.26.)

Wolf. Coal-washing apparatus. 30,550. Nov. 14.

Wright. Manufacture of carbon black. 30,748. Nov. 16.

II.—Complete Specifications

26,565 (1926). Rogers. Fuel. (280,349.)

27,947 (1926). Allgem. Ges. f. Chem. Ind. Purification of hydrocarbons etc. by liquid sulphur dioxide. (268,726.)

*30,087 (1927). Sharples Specialty Co. Refining of petroleum. (280,559.)

III.—Applications

Armstrong (Plauson). Tar products. 30,988. Nov. 18.

Billinghame. Emulsification of tar etc. 30,742. Nov. 16.

IV.—Applications

Benz. Manufacturing chloropercylene quinones. 30,948. Nov. 17. (Austria, 26.11.26.)

British Alizarine Co., Ltd., and Beghin. Pyranthrone dyestuffs. 30,879. Nov. 17.

British Dyestuffs Corp., Ltd., Linch, and Rodd. Preparing triarilmethane dyes. 30,911. Nov. 17.

Carmichael (I. G. Farbenind.). Manufacture of ortho-cyanaryl thio glycolic acids. 31,066. Nov. 18.

I. G. Farbenind. Manufacture of diacidyl-derivatives of naphthalene etc. series. 31,053. Nov. 18. (Ger., 30.5.27.)

Scottish Dyes, Ltd., Barnes, Harris, and Thomas. Dyes and dyings. 30,910 and 31,151. Nov. 17 and 19.

Scottish Dyes, Ltd., Bingham, and Thomas. Production of substituted benzol habiles. 31,039. Nov. 18.

Scottish Dyes, Ltd., Fairweather, and Thomas. Production of dyestuffs etc. 31,040. Nov. 18.

Scottish Dyes, Ltd., Beckett, Thomas, and Woodcock. Production of anthraquinone derivatives. 31,152. Nov. 19.

Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. 30,551. Nov. 14. (Switz., 13.11.26.)

Manufacture of stable diazo compounds. 31,052. Nov. 18. (Switz., 18.11.26.)

IV. Complete Specifications

25,178 (1926). I. G. Farbenind. Manufacture of derivatives of benzanthrone. (259,608.)

12,126 (1927). Imray (I. G. Farbenind.). Manufacture of a greenish-yellow azo dyestuff. (280,436.)

11,052 (1927). I. G. Farbenind. Manufacture of orange vat dyestuffs of the anthraquinone series. (280,492.)

*26,447 (1927). Bohme A.-G. Production of pyridine compounds. (280,511.)

*30,551 (1927). Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. (280,595.)

V.—Applications

British Celanese, Ltd., Ellis and Olpin. Treatment of cellulose derivatives etc. 30,657. Nov. 15.

I. G. Farbenind. Treating cellulose. 30,795. Nov. 16. (Ger., 22.11.26.)

MacDowall and MacPhail. Noninflammable solvents for cleaning. 31,088. Nov. 19.

V. Complete Specifications

19,206 and 21,192 (1926). I. G. Farbenind. Protecting wool from damage by bacteria. (256,273 and 261,342.)

VI.—Applications

Auchterlone, and Franklin Processes, Ltd. Dyeing or bleaching fibres. 30,975. Nov. 18.

British Celanese, Ltd., and Ellis. Treatment of textiles. 30,658. Nov. 15.

Sassoon & Co. (Sassoon). Dyeing yarn. 30,806. Nov. 16.

Scottish Dyes, Ltd., Barnes, Harris, and Thomas. 30,940 and 31,151. *See* IV.

VI.—Complete Specifications

22,059 (1926). British Dyestuffs Corp. and Baddiley. Dyeing. (280,320.)

*5,283 (1927). Soc. des Condenseurs Delas. Dyeing, cleaning, mordanting, etc. (280,489.)

*12,822 (1927). Chem. Fabr. vorm. Sandoz. Preparation of effect threads. (280,493.)

VII.—Applications

Rivers. Manufacture of oxide of iron etc. 30,891. Nov. 17.

Silica Gel Corp. 31,058. *See* II.

VII.—Complete Specifications

19,487 (1926). Still. Manufacture of sulphur. (256,638.)

25,265 (1926). I. G. Farbenind. Production of carbon disulphide from its elements. (260,969.)

31,052 (1926). Möller and Kreith. Manufacture of readily soluble salts of hydrofluosilicic acid. (263,780.)

* 8,783 (1927). Goldschmidt. *See* XVIII.

*19,544 (1927). Suida. Recovering concentrated acetic acid from dilute acetic acid. (280,501.)

*30,040 (1927). Deuts. Gold- u. Silber-Scheidanstalt. Oxygen-evolving preparations for respiratory apparatus etc. (280,554.)

*30,339 (1927). Messer & Co. Separation of air into oxygen and nitrogen. (280,581.)

VIII.—Application

Krydel. Opacifying substance for enamels etc. 30,949. Nov. 17. (Austria, 4.1.27.)

IX.—Applications

Armstrong (Plauson). Artificial asphalt. 30,989. Nov. 18.

Lucas. Treatment of bricks etc. 31,161. Nov. 19.

Miller Bros., and Miller. Damp insulating material for buildings etc. 30,964. Nov. 18.

IX.—Complete Specifications

27,948 (1926). Wolman, Peters, and Pflug. Preservation of wood etc. (263,757.)

*30,190 (1927). Lindman. Manufacture of porous clinker-like materials. (280,567.)

X.—Applications

Asheroff. Metallurgy of ores. 31,142. Nov. 19.

Duffield. Reduction of ores. 30,718. Nov. 15.

Hagens. Metal alloys. 30,837. Nov. 16.

Picard and Sulman. Extraction of tin etc. from ores. 30,838. Nov. 16.

Smith. Extraction of zinc from ores etc. 31,139. Nov. 19.

X.—Complete Specifications

24,334 (1926). Stephan. Chlorinating roasting of burnt ore. (262,392.)

*29,176 (1927). I.-G. Farbenind. Purifying magnesium and high-percentage magnesium alloys. (280,530.)

*29,731 (1927). British Thomson-Houston Co., Ltd. Alloys. (280,537.)

*29,751 (1927). Gustafsson. Producing metals from their sulphides in electric furnaces. (280,540.)

XI.—Applications

Loke. Electric furnaces. 30,952. Nov. 17.

Marks (Stabilimenti Chimica Industriale). Manufacture of elastic dielectrical material. 30,706. Nov. 15.

Orniston. Electric battery. 31,090. Nov. 19.

Read. Selenium cells. 30,508. Nov. 14.

Russ. Induction furnaces. 30,666. Nov. 15.

Soc. Anon. Le Carbone. Accumulators. 30,710. Nov. 15. (Fr. 4.6.27.)

XI.—Complete Specification

542 (1927). Telefunken Ges., and Karolus. Photo-electric cells. (264,173.)

XII.—Applications

Baume, Boutier, and Chambige. Manufacture of emulsions etc. 30,842. Nov. 16. (Fr. 17.11.26.)

Gómez. 31,072. *See* XX.

Nobel's Explosives Co., and Scharfl. Prevention of rancidity in vegetable oil. 30,941. Nov. 17.

Welter. Manufacturing soap. 30,586. Nov. 14.

XII. Complete Specifications

12,349 (1926). Whatmough. Production of emulsions. (280,096.)

17,052 (1926). Baume, Chambige, and Boutier. Preparation of emulsions or suspensions. (255,074.)

XIII.—Applications

Kunstharzfabr. Pollak. Production of condensation products. 30,725-6. Nov. 15. (Austria, 6.4.27 and 28.6.27.)

Wright. 30,748. *See* II.

XIII.—Complete Specifications

11,286 (1927). Laporte, Alcock, and Weber. Manufacture of a white pigment. (280,435.)

*28,629-30 (1927). Bakelite Corp. Phenol resin compositions. (280,520-1.)

XIV.—Application

I.-G. Farbenind. Treatment etc. of latex. 31,025. Nov. 18.

XIV.—Complete Specifications

13,038 (1927). Rubber Latex Research Corp. Rubber compositions. (272,187.)

*30,433 (1927). I.-G. Farbenind. Preservation and treatment of latex. (280,587.)

XV.—Application

Dixon. Treatment of gelatin. 30,973. Nov. 18.

XV.—Complete Specification

*25,066 (1927). Röhm & Haas A.-G. Emulsions, particularly for tanning. (280,509.)

XVI.—Application

Rhenania-Kunheim Verem Chem. Fabr. Production of mixed manures. 30,637. Nov. 15. (Ger., 8.1.27.)

XVI. Complete Specifications

19,826 (1926) and 13,700 (1927). I. G. Farbenind. Manufacture of mixed fertiliser. (256,972 and 280,447.)

XVII.—Application

Anc. Etabl. Savy, Jeanjean, et Cie., Prescott, and Baker, Perkins, Ltd. Sugar-boiling etc. processes. 30,945. Nov. 17.

XVII.—Complete Specifications

19,820 (1926) and 10,519 (1927). Kienzle. *See* XIX.

22,544 (1926). Brier. Molasses and sugar-juices. (280,321.)

XVIII.—Complete Specifications

32,795 (1926). Hansan A.-G., and Nathan. Treatment of beer wort and beer. (280,395.)

8,783 (1927). Goldschmidt. Obtaining concentrated potassium solutions from distillers' mash. (268,790.)

XIX. Application

Schering-Kahlbaum A.-G., and Schoeller. Manufacture of mineral waters. 30,927. Nov. 17.

XIX. Complete Specifications

19,820 (1926). Kienzle. Making fodder from sugar cane. (280,284.)

20,510 (1926). British Dyestuffs Corp., Hollins, and Chapman. Manufacture of aerated waters, sparkling drinks, and the like. (280,302.)

3,702 (1927). Chem. Fabr. vorm. Schering. Diminishing or preventing loss of carbohydrates in root-crops when stored. (266,695.)

10,519 (1927). Kienzle. Manufacture of substances from sugar cane for use in the preparation of food and beverages. (280,432.)

XX. Applications

Edelman. Production of derivative of 1 methyl-3-oxy-4-isopropylbenzol. 30,819. Nov. 16.

Gómez. Esterification of fatty acids. 31,072. Nov. 18.

Holzverkohlungs-Industrie A.-G., and Fuchs. Utilising ethyl alcohol. 30,489. Nov. 14.

Schering-Kahlbaum A.-G. Manufacture of thymol etc. 30,799. Nov. 16. (Ger., 16.11.26.)

XX.—Complete Specifications

30,202 (1926). British Dyestuffs Corp., Payman, and Hall. Aromatic acid anhydrides. (280,373.)

*28,747 (1927). I.-G. Farbenind. Manufacture of organic compounds containing oxygen. (280,522.)

*29,170 (1927). Boehringer. Preparing tetrazoles. (280,529.)

*30,025 (1927). Traube and Hallriegel. Producing monoalkyl derivatives of the aminophenols. (280,553.)

*30,229 (1927). Merck, Merck, Merck, Merck, and Merck. Manufacture of aryl-amino-alkyl carbinols. (280,574.)

XXI. Applications

Halden & Co., Ltd., and Holden. Production of sensitised printing-surfaces. 30,648. Nov. 15.

Kalle & Co. Photographic processes. 30,524 Nov. 14. (Ger., 12.11.26.)

Murray and Spencer. Production of colour photographs on paper. 30,731. Nov. 15.

Soc. Indus. des Applications Chimiques, and Botson. Preparation of photographic toning-salt. 30,520. Nov. 14.

XXI.- Complete Specifications

12,161 (1926). Martinez. Colour photography. (280,053.)

12,518 (1926). Martinez. Manufacture of photo-sensitive surfaces. (280,252.)

16,585 (1926). McDougall & Yalding, Ltd., and Fryer. Insecticides, sheep dips, etc. (280,256.)

*29,011 (1927). I.-G. Farbenind. Photographic developers. (280,525.)

*30,524 (1927). Kalle & Co. Photographic processes. (280,593.)

XXIII. Complete Specification

30,040 (1927). Deuts. Gold u. Silber-Scheideanstalt. See VII.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W., has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number: *Albania*: Galvanised sheets, iron joists and bars, templates, red copper, tin, lead, caustic soda, sodium silicate for soap making, pharmaceutical products, quinine (413). *British India*: Aniline dyes (410). *British West Indies*: Medicines, chemicals (411). *Colombia*: Air compressors (A.X.5505). *Egypt*: Steel reservoirs (A.X. 5191, 5162). *Germany*: Tubes (416); Fish, meat and bone meal (417). *Holland*: Acetone, acetic, boric, sulphuric and other acids, liquid ammonia, Peruvian balsam, glycerin, seed oils, soft soap (B.3977). *Japan*: Textile leathers (1177/27). *Latvia*: Lubricating oils, petrol (B.X. 3985). *New Zealand*: Glass bottles (B.X.4001); Transformer and switch oil (B.X. 4002); Centrifugal pump (A.X.5512); Copper wire (B.X. 4007); Bottle caps (B.X. 4008). *Norway*: Olive oil (419). *Turkey*: Zinc (A.X. 5501); Powdered graphite, manganese dioxide (B.X. 3989). *Uruguay*: Bare copper wire and cables (B.X. 4003); Twenty-two cranes (A.X. 5178). *Australia*: Steel (A. 5526 and A. 5527); *Chile*: Paper, earthenware, paints, iron, steel, metals in ingots (417). *France*: Cellulose enamels, imitation leather (431); *Germany*: Artificial silkspunners (435); *Holland*: Rubber (439). *Italy*: Vegetable oils (440). *South Africa*: Steel (A.X. 5345). *United States of America*: Soap sheets (446).

Merchandise Marks Act

Gelatin is declared by the Board of Trade, with the concurrence of the Ministry of Agriculture, not to be a food stuff for the purpose of definition under the Merchandise Marks Act, 1926.

An application received by the Board of Trade for the marking of imported size and gelatin has been referred

to the Standing Committee. Applications relating to typewriter carbons and enamel zinc sheets have also been referred to the Committee.

Safeguarding of Key Industries

The Treasury have made an Order, under Section 10 (5) of the Finance Act, 1926, exempting the following articles from Key Industry duty from November 28, 1927, to December 31, 1928: -Bromural (dormigene), eukodal, lithium carbonate, lithium hydroxide, nickel hydroxide, papaverine, R. potassium permanganate, quinine ethyl-carbonate, resorcin (resorcinol), and styracol (guaiacol cinnamate).

The Treasury Order will be published shortly.

News from Advertisements

Applications are invited for the appointment of Government Analyst and Bacteriologist, Cyprus (p. vi).

An Assistant is required in the laboratory of a water company (p. vi).

A chemical engineer is required by the builders of carbonising plant (p. vi).

Junior partnership required in a chemical concern (p. vi).

Assistant chemist wanted for paint and varnish works (p. vi).

A lady science graduate is required for general library duties, etc., etc. (p. vi).

A young graduate with experience of colour etc. manufacture is required (p. vi).

Sets of chemical journals are advertised for sale (p. vi).

Two patents are offered for negotiation (p. vi).

There are now 129 firms represented in our Buyers' Guide

PUBLICATIONS RECEIVED

L'ÉTAT COLLOÏDAL ET L'INDUSTRIE. By W. Kopiczewski. Vol. 2 of Applications Industrielles des Propriétés Colloïdales. Pp. viii + 344. Paris and Liège: Librairie Polytechnique Ch. Beranger, 1927. 70 fr.

CHEMICAL REVIEWS. Vol. IV., No. 2, September, 1927. Contributions by V. C. Vaughan, V. Henri, and J. C. Irvine. Pp. 167-229. Baltimore, U.S.A.: The Williams & Wilkins Co.; London: Baillière Tindall & Cox, 1927. 23s. 6d. post free per annum.

THE INDUSTRIAL AND ARTISTIC TECHNOLOGY OF PAINT AND VARNISH. By A. H. Sabin, M.S. Third edition, revised. Pp. xi + 459. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd., 1927. 25s.

BROWN'SCHE BEWEGUNG UND NICHT FLÜSSIGE DISPERSE SYSTEME. I. AEROSOLE II. FESTE DISPERSE SYSTEME. Papers read at the meeting of the Kolloid-Gesellschaft in Essen on June 10, 1927. Edited by Dr. W. Ostwald. Pp. 193-304. Dresden and Leipzig: Th. Steinkopff, 1927. 6 m.

THE JOURNAL OF THE FUEL SOCIETY OF JAPAN (NENRYO KYOKWAI SHI). Vol. VI. Ser. Nos. 52-59. January to August, 1927. Published by the Fuel Society of Japan (Nenryo Kyokwai), Saitama-Kawaguchi, Japan.

OUTLINES OF THEORETICAL CHEMISTRY. By F. H. Getman, Ph.D. Fourth edition, revised and partly rewritten. Pp. xiii + 728. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, 1927. 18s. 6d.

HANDBUCH FÜR DEN DEUTSCHEN BRAUNKOHLENBERGBAU. By G. Klein, with collaborators. Third edition. Vol. I. Part I. Die deutsche Braunkohlenindustrie. Pp. xv + 511. Halle (Saale): W. Knapp, 1927. 45 rm.

- HYDROCHLORIC ACID AND SODIUM SULFATE.** By N. A. Laury. American Chemical Society Monograph Series. Pp. 127. New York: Chemical Catalog Co., Inc., 1927. \$4.00.
- HANDBUCH DER KOKEREI.** By Dr. W. Glaud, Dr. G. Schneider and Dr. H. Winter. Band I. Pp. vii + 302. Halle (Saale): W. Knapp, 1927. Paper, 26.50 rm.; bound, 29 rm.
- GROUPING OF SOILS ON THE BASIS OF MECHANICAL ANALYSIS.** By R. O. E. Davis and H. H. Bennett. U.S. Department of Agriculture. Department Circular 419. Pp. 14. Washington: Government Printing Office, 1927. 5 c.
- MINERAL RESOURCES OF THE UNITED STATES, 1923.** By F. J. Katz. Department of the Interior, U.S. Geological Survey. Part I.—Metals. Pp. 653. 1927. Part II.—Nonmetals. Pp. 750. 1926. Washington: Government Printing Office. \$1.00 per volume.
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Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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LONDON, DECEMBER 9, 1927

No. 49

EDITORIAL

Europe and U.S.A.

GR^{EAT} interest is still being taken in the possibility of a combine or strong working agreement being effected between great chemical organisations in this country, in Germany and in France and nowhere are the consequences of such a combine being more extensively discussed than in the United States. In spite of many rumours, nothing really definite has emerged, although there can be little doubt that the conversations which have been taking place for months past between leaders of the British, German and French chemical manufacturers are gradually bringing co-operation into existence. Should such develop, the trade position in respect of European chemicals will be eased and the European chemical industries will be able to present a bold front to the world and to make a strong bid for world markets. At the same time, we believe that no one need fear the creation of a monopoly here. An industry cannot survive very long in a kind of *laissez faire* somnolence induced by a supposed control of markets. There is, fortunately, no evidence that a European chemical combine would be content to rely upon an unstable monopoly or to live in the light of its past triumphs, but, quite to the contrary, it is clear that a vigorous policy of research and development would ensue. The recently announced research committee and policy of Imperial Chemical Industries, Ltd., and its past record, as well as the policy which the German I. G. pursued even when it had a virtual monopoly in the field of synthetic dyestuffs, afford us proof of this. It is, of course, clear that internecine competition and useless price-cutting would be reduced and that the closer inter-working of various factories would become possible. The conservation of capital and liquid resources and the reduction in production costs, together with the strong combined front presented towards competitors outside Europe, would considerably strengthen the European chemical industries, but it is idle to pretend that America has been singled out for attack. What many of the American newspapers have characterised as an offensive alliance against America is a natural consequence of the extremely bad European post-war economic position, and whilst it may react upon the American chemical

industry, there is no reason why a scheme for a greater unification of the European chemical industries should cause offence.

We are glad to note that responsible American opinion—and particularly that most directly concerned, that is, American chemical opinion as expressed in reputable journals—has found in the possible intensified competition from Europe a spur to greater effort. Competition is the life blood of progress, and that the American chemical industry will progress to greater triumphs we have no doubt. Advances in America will demand a progressive policy in Europe, and the world will go on from strength to strength. The challenge is a legitimate one and has been received as such, and we should like to quote from the current issue of an American contemporary in order to show that future competition will, indeed, act as a profound stimulus to effort in America and, therefore, of necessity, in Europe. It is stated that "All this (the consequences of the European combine) is a challenge to American technical brains and business ability. We have no control over the methods of organisation or trade agreements of foreign industrialists, but we know beyond a doubt the general course to pursue in meeting this new form of foreign competition. We cannot set up monopolistic organisations, but we can reduce costs through better management and elimination of waste. We cannot allocate production and markets, but we can redouble our efforts in scientific and industrial research. We cannot make price-fixing agreements, but we can pursue still further our studies in marketing methods. . . . There has been a general assumption that the European cartel movement is specially directed against American commerce. It is doubtful if this is the case."

If a solid working agreement between the European chemical manufacturers matures there will, undoubtedly, exist a "challenge to American brains," but we are confident that the American chemical industry will throw out, in due course, a challenge to European brains.

It will serve neither American nor European chemistry "to lay him down and bask him in the sun" of any monopolistic trade agreement, but challenge and counter-challenge will stimulate effort, and so with Touchstone, we shall see "how the world wags."

INDUSTRIAL FILTRATION AND FILTER AIDS

The first historical mention of filtration dates back to early in the first century A.D., and there is a great deal of interest to be read on the subject. We are only interested here, however, in the historical data in so far as they permit us to profit by experience gained in the past. This would confine us almost entirely to the subject of water filtration and sand filters, and is a subject in itself which will not be discussed here.

The first patent for a pressure filter was taken out by a Frenchman for filtering water in the first decade of the nineteenth century, but the real development in filtration and filtration apparatus seems to have taken place in the various industries proportionately to the stage of development of the process in which it is used.

We may define filtration generally as the separation of liquids from solids or solids from liquids. Such a definition is very broad and would include centrifuges, which are not generally referred to as filters and form a subject apart.

The differentiation between the separation of liquids from solids and solids from liquids may be illustrated in two extreme cases, such as the filtration of oil flotation or concentrates, wherein a relatively small percentage of water is removed from the solids by vacuum filters, and the clarification of sugar liquor such as produced from raw cane sugar, wherein a relatively small percentage of solids is removed from the liquids. In filtration various names are given to the liquid and the solids. The mixture before entering the filter is generally referred to as sludge, unfiltered liquor, dirty liquor, etc. The filtered liquid is generally called filtrate or effluent. The solids retained by the filter are generally referred to as deposit, residue, sediment, cake, etc. We will endeavour here to refer to unfiltered material, or sludge, and filtrate and cake respectively.

In order that we may have a clear understanding of what constitutes an aid to filtration, it is necessary that we review briefly what occurs in filtration and, in general, the types of apparatus used to effect filtration.

We may classify filters generally in two classes: one, those having loose filtering layers such as a sand water filter or a paper-pulp filter such as is used in the beverage industry; and, secondly, filters having woven or matted filter layers such as those which employ cloth, either woollen, cotton, or other similar materials. Metallic woven fabrics, asbestos, various fibres, and many other such materials used in the form of filter mediums come under this classification. We might make a third classification of those filters having rigid filter layers, such as are found in mechanical plants where various stone-ware and moulded porous plates are employed. There are, of course, modifications to each of these general types, but in the main two general classifications indicated may be made. Of especial interest to us is the class of filtration which employs cloth or other woven fabrics as the filter medium.

To effect filtration, of course, it is necessary that a differential exist on the two sides of the filter medium. This is accomplished in various ways. The hydrostatic head or gravity pressure of the mixture being filtered may be employed, or induced pressure by the use of various types of pumps may be used. Some of the

filters utilise atmospheric pressure by creating a vacuum on the filtrate side of the filter medium. In any case, the result is the same. The liquid is forced through the filter medium, and the solids, being too large to pass, are retained in the form of an even deposit over the surface of the filter medium. It is very rarely the case that the filter medium itself is capable of retaining all the solids during the initial period of the flow, and generally to obtain a clear filtrate it is necessary to depend upon the first layer of solids which is deposited on the woven fabric to act as the true filter medium for the remainder of the filtration period.

Certain theories can be applied and formulae evolved, and from these theories can be arrived at, but thus far it has been impossible to solve filtration problems by the use of such formulae. The rate of flow in the filter is directly proportional to the pressure applied, and inversely as the thickness of the cake. Certain constants must be arrived at, however, for inclusion in a formula derived from this theory, and in determining these constants the problem is solved in so far as concerns practical results long before the constants have been reduced to such a form that they would be applicable for inclusion in the formula.

For those who are interested in a technical and detailed discussion of this phase of the subject, the matter is discussed in an article by Sperry (*Chem. and Met. Eng.*, August 15, 1917), and another by Alliott (*J. Ind. and Chem. Eng.*, Nov., 1921). The English translation by John Joseph Eastick, of F. A. Buhler's German edition of "Filters and filter presses" is also of interest in this connexion, because it is one of the few books dealing with filters and filtration. The constants referred to depend upon such factors as viscosity and density of the liquid and the physical characteristics of the solids. The nature of the solid is generally the more important, and has direct bearing upon the result.

Solids found in filtration problems may be given two very broad classifications: First, those solids which are rigid and will not be distorted or changed in size or shape within the limits of pressure employed by filtration; and, second, non-rigid solids which include the gummy and colloidal matter which is susceptible to various physical changes in the filtration period.

It is, of course, a simple matter to visualise a high rate of flow of liquid through a cake composed of a form such as would occur in a mixture of water and sand as compared with the rate of flow which would exist where the cake formed was comprised of extremely colloidal organic matter found in domestic or industrial sewage. In the filtration of a mixture of water and sand, we have deposited on the filter cloth a layer of solids which are not distorted as the pressure increases. There would probably exist a more uniform size of channel through the cake, and channels which would be straighter and less sinuous than if the solid had been distorted and packed tightly into the interstices of the cloth and the cake itself.

Formation of the filter cake affects other results than that of rate of flow. If the solids are of a gummy and colloidal nature they enter the pores of the cloth, and even pass through into the filtrate at the beginning of the cycle and make it very difficult to clean the cloth

quickly and efficiently. If the filtrate is of value, and it is desirable to recover the filtrate remaining in the cake in the form of moisture by the use of a wash, it is desirable for the cake to be permeable, and in such condition that it will offer the minimum of resistance to the flow of the wash solution. This is especially true inasmuch as the wash water has to pass through the maximum thickness of the cake during the entire time of the washing period. Likewise it is desirable to have as permeable a cake as possible if it is desired to reduce the moisture obtained by the cake by passing air or steam through it.

It becomes apparent then that permeability of the built-up filter cake is of great importance if the greatest economy is to be obtained, and that to attain the maximum possible permeability of the cake it is necessary to have present such solids as will give maximum porosity and permeability to the cake at all times during the filtration period.

Aids to filtration, therefore, have to do with changing the physical characteristics of the solids and the liquid or introducing other solids which will change the physical characteristics of the cake. Generally, however, it will be found that the solid part of the mixture will demand more attention and will affect results more widely. Increase in temperature, of course, generally aids filtration, because of reduction of the viscosity of the liquid. The solid content of unfiltered liquids may be changed in some instances so as to produce the desired result, such as coagulation with alum in water filtration. The number of cases in which chemical treatment can be applied, however, is limited, unless some other demand proposed by the process chemically affects the result before the filtration stage is reached. Generally it is found more economical and efficient to employ the addition of a form of filter aid which when added to the mixture to be filtered becomes thoroughly intermingled with the other solids in the liquid, and finally is deposited homogeneously throughout the body of the cake.

More often than not filtration has become necessary where it is desired to effect a final clarification of the liquid. In such cases the coarser and more free filtering particles have been separated from the liquid by various roughing operations such as straining, settling, and other forms of clarification, and it is only the more finely divided and refractory solids that do not lend themselves readily to separation by any other method that we have to contend with in the final clarification.

As a typical example of such a case we may cite the filtration of sugar liquors derived during the refining of raw beet and cane sugar, glucose, syrups formed by the conversion of starch, clarification of the various vegetable oils, cereal beverages, beer, chemicals and a host of other products found in all kinds of industrial plants.

Some of the requisites of a filter aid of this kind are that it be :—

Chemically inert.

Rigid.

Porous, yet of a structure that will permit the removal to a minimum of the valuable liquids in the press cakes.

Light in weight in order that it will not settle out in filters or tanks.

Uniform in purity and structure.

Sufficiently cheap in price so that it can be employed economically.

In such form that it can be cheaply and easily applied.

A micro-analysis reveals to a great extent the adaptability of diatoms to filtration processes. An ideal combination consists almost entirely of two structures. The one a flat circular body, honeycombed, the other a thin bamboo-like spicule, but solid. These are the ideal types if found in combination and of sufficient purity.

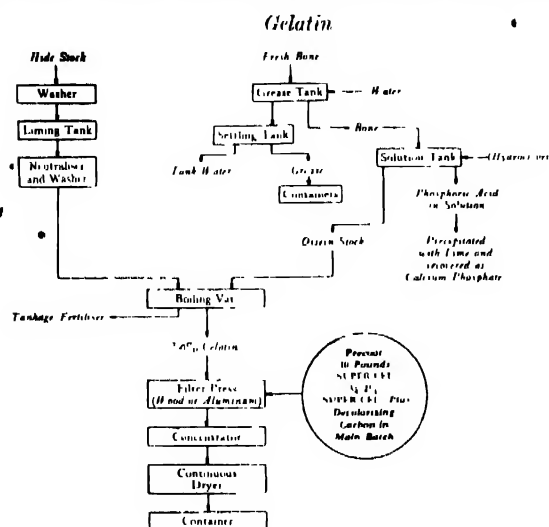
The pod-shaped hollow types, very common and generally of fresh water origin, are cored like pea pods, and have a high retention for liquids, which cannot be removed by air or steam blowing of the press cakes. They may be cheap per ton, but are very expensive in process owing to the valuable liquids which need be discarded with them. These types should be avoided.

Chemical analysis also is a factor and high silica content, above 90%, is desirable. Iron and lime content should be avoided as they are soluble and give off colours to the filtrates. Such aids are generally powdered, silicious material, and of a diatomaceous formation.

Super-Cel is a filter aid prepared from the mineral Celite which more nearly meets all of the requisites of a satisfactory filter aid than any other known material. It is very finely divided, each particle is porous and of a structure which presents the maximum permeability in the form of a filter cake, at the same time preventing even the finest suspended matter ordinarily found in filtration problems from passing through into the filtrate. It is extremely light, weighing only 6 to 8 lb. to the cubic foot loosely packed, and it is easily and simply handled. Whilst no chemical action occurs with the addition of Super-Cel in the great majority of cases, it possesses a decided energy in the presence of a great majority of gummy and colloidal substances which causes the one to be absorbed by the other. Not only, therefore, does Super-Cel intermingle inertly with the solids in the cakes, thereby increasing the permeability of the cake, but also does it decrease the number of solid particles by combining with them physically, thereby increasing the size of the cake particles, permitting greater flow through the cake and reducing the possibility of the more finely suspended matter passing through with the filtrate.

A great deal more of interest might be said on the effect of adsorption of the various liquids and solids and the changes which the filter aid effects upon the structure of the cake and the passage of the liquid and subsequently the wash solution through the cake. Each filtration problem is different in some one of its attendant factors. Changes in temperature, pressure, kinds of cloth used, the length of time for which the cloth has been in use, the kind of pump employed for inducing pressure, the manner in which the pressure is applied, the design of the filter equipment itself, all have a very vital bearing on the result, to say nothing of the fact that very seldom are the liquid and solid constituents of the mixture being filtered anywhere near the same.

Super-Cel can be applied with practically all types of filters and without changing arrangements which exist in most works. It is only necessary to add the powder in a dry form to the liquid which is to be filtered, provision being made for thoroughly agitating or mixing



in the filter aid so that it will come into intimate contact with the suspended solids.

In order that perfect clarity may be ensured from the start of the filtration cycle it is very often advisable to mix a small part of the filter aid with water or a quantity of previously filtered liquid, and charge this into the filter ahead of the main liquors to be filtered, or to charge more heavily the initial amount of liquid entering the filter in order that a deposit or skin of the finely-divided free filtering agent may be deposited immediately upon the cloth. This not only ensures retention of suspended matter from the start of the cycle, but also creates a barrier between the more gummy and colloidal substances and the cloth, thereby allowing the filter cloth to be readily cleaned without washing and as free filtering for the succeeding cycle as the one before.

The advantage of such a filter aid, therefore, resolves itself into the following:—

1. Greater clarity of the filtrate.
2. Increased rate of flow.
3. Longer filtration cycles, thereby necessitating less filters and less labour to handle a given quantity of liquids.
4. Less expense in connexion with cleaning the filter cloth.
5. Elimination of filter papers.
6. Lower pressure because of less resistance offered at the cake surface, thereby decreasing duty imposed on pumps and the filter equipment.
7. Higher clarity liquids which often reflect savings in equipment further on in the process, such as evaporators, heaters, etc., which must be periodically cleaned of deposited suspended matter.

SOME TYPICAL APPLICATIONS

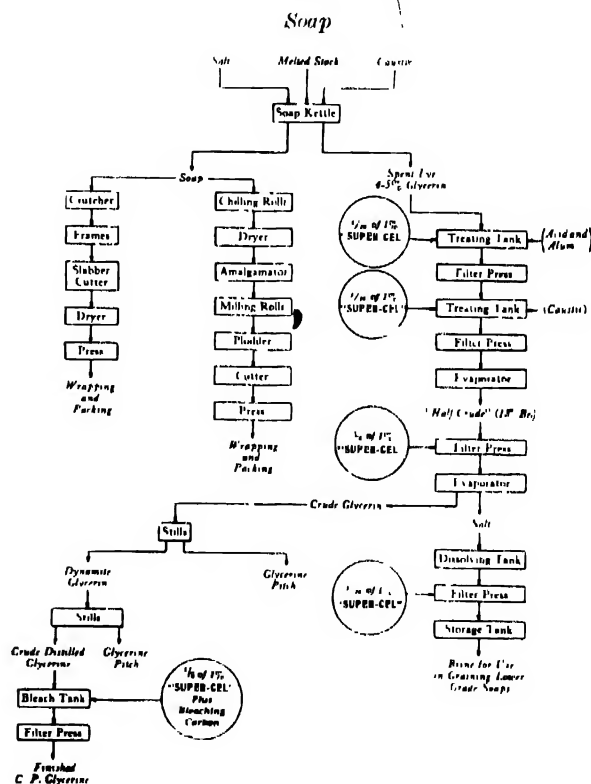
Beet sugar, juices and syrups.—Fifteen per cent. of the soluble matter entering into the raw beet juice during the

diffusion process consists of "non-sugars," or impurities, and the main problem of the beet sugar factory is the removal or elimination of these impurities from the juice.

This elimination is accomplished by changing the non-sugars from a soluble to an insoluble state, whereupon they may be separated from the sugar juice by the process of filtration.

Obviously once the impurities have been changed to the insoluble state, they should be removed from the juice thoroughly and completely, since the subsequent treatment which the juice receives oftentimes changes the solids back to the soluble condition with resulting increase in sugar loss. Two other important operations are influenced by the presence of cloudy matter in the juice—evaporation and boiling. Cloudy juice sent to the evaporators will cause undue scale formation within the tubes. Cloudy syrup in the boiling pans will decrease the yield of crystallised sugar.

Before the invention of the filter-press, the best liquors were clarified by decantation, and then filtered through large cylindrical tanks filled with bone-char. These



methods have long been abandoned, and now filter-presses and leaf type filters are in general use. The diagram on the following page illustrates the use of a filter aid in the manufacture of beet sugar.

Varnish.—Recent developments have changed entirely the position which filter presses formerly held in the clarification of varnish. For some years they have occupied a "middle" position. They were recognised as more efficient than the settling process. Yet, while giving better clarity, the filter press was handicapped

by its relatively low capacity and higher operating costs when compared with the centrifuge.

Now the costly items of filter press operation have been reduced, the use of Super-Cel instead of filter papers at a third their cost, enables rates of flow from 2 to 8 times

10—15 lb. Super-Cel per 100 sq. ft. filter area and 0.25% (on the weight of liquor) in the main batch, was found to be $4\frac{1}{2}$ gals. per sq. ft. per hour.

Many other illustrations of the uses of filter aids could be given as in the preparation of soap, sulphur dyes, azo dyes, intermediates, and so on. Of interest, too, are the flow-sheets given on p. 1146, which indicate the various steps in the manufacture of gelatin and of soap.

In these flow sheets the precoat is given in pounds of Super-Cel per 100 sq. ft. of filter area, whilst the amount used in the main batch is given on the weight of liquor to be filtered.

A great deal more can be written on the subject, as filters and filter aids find application in practically every modern plant.

CARBONISATION IN VERTICAL RETORTS*

By T. CAMPBELL FINLAYSON, M.Sc., A.M.I.Chem.E.†

The success attained by the various systems of carbonisation in continuous vertical retorts is one of the outstanding features in gas engineering during the past two decades. Twenty years ago continuous carbonisation was in the experimental stage. to-day it is computed that over 50% of the coal carbonised in British gasworks is treated in continuous vertical retorts. For there to have been such a general acceptance of new methods of carbonisation in a comparatively short period, vertical retorts must hold some very big attractions to gas engineers. One of the objects of this paper is to examine closely these advantages.

The success attained in the construction of continuous vertical retorts is attributable to the careful development of certain main features:—(1) The development of suitable devices for coke extraction. (2) The design of top ironwork through which the coal enters the retort. (3) Correct taper of the retort. (4) The method of heating the retort. (5) The construction of the retort.

The advantages which can be claimed for the process of carbonisation in continuous vertical retorts may be summarised as follows:—

A. Large output of gas per square foot of ground space.—In these days of increasing demand for gas, the problem of producing the maximum output from a given ground space is becoming a matter of increasingly great importance. Of all the forms of carbonising plant, continuous vertical retorts give the largest output of gas per sq. ft. of ground space occupied, and in this direction striking developments have been made within the past few years as illustrated in the attached table.

(Ground space occupied by four typical installations of W-D continuous vertical plant)

Installation	Year	Capacity tons per 24 hrs.	Ground space occupied sq. ft.	Sq. ft. ground space per ton carbonised per 24 hrs.	Cb. ft. gas* (500 B.Th.U.) per sq. ft. ground space per 24 hrs.
A	1914	120	4970	41.4	377
B	1919	200	8230	41.2	378
C	1925	512	13,420	26.2	595
D	1927	695	14,232	20.5	761

* Based on an average yield of 15,000 cb. ft. per ton

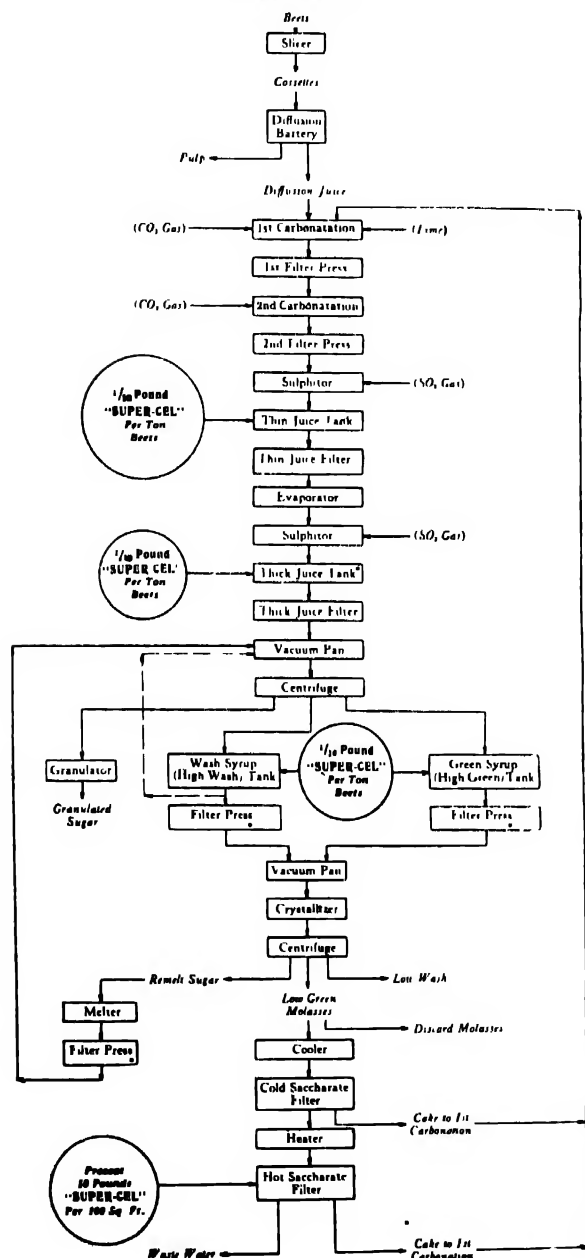
In comparison with the old hand-charged stop-end horizontal retorts of twenty years ago, the modern

* Abstract of a paper read before the London and Southern District Junior Gas Association, London, on Nov. 25, 1927.

† Of the Research Section, The Woodhall-Duckham Companies.

Beet Sugar

Including Sieffen's House



* High green—high wash—remelt and thick juice generally filtered in common battery of interchangeable filters.

as rapid and gives perfect clarity. The filter aid is added either in the set pot or kettle and the material is run directly to the filter to save heat, though, if desired, the filter aid can be added in a mixing tank. The rate of flow, with one medium gum varnish, using a precoat of

vertical retort installation can produce approximately eight times as much gas per sq. ft. of ground space and approximately three times the amount of modern machine-charged horizontal retorts.

B. High thermal yield per ton of coal. At present gas is sold on the basis of calorific value. This has increased the tendency to supply a mixture of coal-gas and water-gas for town's purposes. In the continuous vertical retort, mixed coal-gas and water-gas can be made in one apparatus by introducing steam at the base of the retort, whereby a two-fold object is served. The red-hot coke passing down to the bottom of the retort is cooled and the steam usefully employs the sensible heat of the coke in the production of water-gas.

C. Flexibility.—Continuous vertical retorts are flexible as regards the calorific value of the gas and output. The calorific value can be altered by variation in the percentage of steaming, and the output by the simple operation of altering extractor speed.

D. Heat Conservation.—The modern continuous vertical retort installation is highly efficient from the thermal point of view. The factors which have led to this state of affairs are:—(1) Design of step grate producers (2) silica construction of the retorts; (3) installation of waste heat boilers; (4) heat insulation of settings, flues and boilers.

In the modern type of continuous vertical retort setting, as much as 1500 lb. of steam per ton of coal carbonised can be obtained. In assessing the thermal value of a process of carbonisation, it is the net amount of fuel consumed, or in other words the heat supplied to the producer less the heat value of the steam recovered, which is important: 1500 lb. of recovered steam is equivalent to at least 188 lb. of dry coke. With modern installations the net fuel consumption is not more than 7%.

E. Satisfactory operating conditions.—From the point of view of those operating the plant, continuous vertical retorts give more favourable conditions than any other form of carbonising plant. Heavy work is reduced to a minimum, and by suitable use of heat insulating material the double object is achieved of improved operating conditions and effecting heat conservation.

F. Low capital cost.—Although there have been many developments in design and improvements in the output per square foot of ground space, the factor which is probably the most striking and has the greatest influence at the present time is the fact that capital cost is low. The present-day installation costs no more than the old fireclay type of settings erected 12 years ago.

A recent development of interest in connexion with continuous vertical retorts is that blue water-gas can successfully and economically be made by charging them with graded coke. In brief, the process consists of charging the retort with graded coke in place of coal, and extracting unconsumed coke at the bottom to the extent of approximately 2 lb. per 1-in. retort major axis per hour. Saturated steam is introduced through the normal steaming jets in the curved plate of the extractor box to the extent of 3 lb. per 1-in. retort major axis per hour. The retort is operated under normal heating

conditions and at level gauge at the gas offtake. Under these conditions, good quality blue water-gas is produced to the extent of about 75 cb. ft. per 1-in. retort major axis per hour. The composition of the water-gas remains very constant, containing on an average 4% CO₂ and 44% CO, with a calorific value of 290 to 300 B.Th.U. Operation of retorts for a period on water-gas production has the advantage that the scurf in the retort is removed by the interaction between the steam and the scurf.

The subject of carbonisation in vertical retorts would be incomplete without some attention being given to vertical retorts on the intermittent as well as the continuous principle. Carbonisation in intermittent vertical chambers has for many years been a system very popular on the Continent, although it has not yet been widely adopted in this country. In comparison with other forms of static carbonisation, intermittent vertical chambers have the advantage that an increased output can be obtained per sq. ft. of ground space; in addition, a larger gas yield per ton of coal carbonised can be obtained than from either horizontal retorts, inclined retorts or coke ovens, due to the steaming of the charge during the last few hours of the carbonisation period. The chambers are economical to operate, in that once having elevated the coal to the overhead bunkers, the charging and discharging of the chambers both take advantage of the laws of gravity. These chambers have the advantage that they can carbonise any class of coal or slack, and the plant has many attractions in a number of instances. The continuous and static forms of carbonisation in vertical retorts are not necessarily competitive. In one large installation at present being erected for the Glasgow Corporation Gas Department, the plant is to comprise a combination of W-D continuous vertical retorts and W-D intermittent vertical chambers, the combination being such as to give with the particular coals which are to be carbonised, and the particular calorific value which is to be made, the best all-round results. In brief, the position is that, in general, Scotch coals are of relatively low caking quality. This, whilst making them particularly suitable for giving maximum throughputs and relatively high thermal yields when treated in continuous vertical retorts, yet has the disadvantage that the small material tends to remain in the form of breeze after carbonisation. In this new scheme at Glasgow, the continuous vertical retorts are operated under steaming conditions, treating the coal above $\frac{3}{4}$ in. The coal below $\frac{3}{4}$ in., after washing and drying, will be blended with caking slacks, and the mixture treated in the intermittent vertical chambers operated to make high calorific value gas and high-quality coke. This arrangement will give flexibility as regards selection of coals and calorific value, and secure the production of high-quality coke.

CANADIAN INDUSTRIAL NOTE

The British Empire Steel Corporation announces it has sold the entire output of the Bell Island Iron Mines, Newfoundland, for the year 1928. The total quantity to be mined is 1,300,000 tons, of which 800,000 tons will go to Germany, 100,000 tons to the United States, and 400,000 tons to the Corporation's own works at Sydney, N.S.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

BINDING CASES FOR BRITISH CHEMICAL ABSTRACTS AND JOINT INDEX

Abstracts "B" and Index to "A" and "B"

Binding cases for the above publications, in dark blue cloth, will be available, commencing with the 1927 issues.

The price will be 3s. 9d. per set of two cases, postage 6d. extra, or, separately, 2s., postage 3d. extra.

Abstracts "A" and Index to "A" and "B"

Cases are also available in Maroon or blue cloth, price 3s. 9d. per set of two cases, postage 6d. extra.

Orders, accompanied with remittance, should be forwarded to Messrs. Gurney & Jackson, 33, Paternoster Row, London, E.C.4.

LONDON SECTION

At the meeting, held on December 5, a paper, entitled "The automatic analysis of liquids and its application to control of water softening plants," was read by Dr. H. S. Hatfield. A summary of the paper follows.

Liquids, such as ordinary hard water, boiler water, wash waters, and other liquors in industry, are automatically titrated with suitable reagents in an apparatus which takes a measured sample of the liquid, delivers it into a reaction vessel, and gradually adds reagent until an end point is reached, when the reaction vessel is emptied automatically, and a fresh sample of liquid delivered to it. The amount of reagent added each time is recorded on a chart. The end point for hard water, which is titrated with standard soap solution, is given by the formation of froth, air being blown through the liquid in the reaction vessel. The vessel is pivoted so as to be overweighted by its contents, and the weight of the froth overflowing from it is used to trip a catch and allow it to empty itself. It then returns to its original position, and in doing so trips a catch which causes the measuring vessel, full of a fresh sample, to empty its contents into the reaction vessel. With other titrations, such as acid-alkali, the end point is given by the cessation of current delivered to a relay from an electrode in the reaction vessel separated by a porous partition from another electrode in a buffer solution representing the end point.

Further mechanism was described, by which the indications of such automatic titrators are caused to control the valve by which reagents, such as softening chemical, are delivered to the main bulk of the liquid, a sample of which is being titrated. Another form of apparatus is of a hit-or-miss type, in which a single measured bulk of reagent is added to a measured bulk of liquid, and a signal is given to denote whether the reagent is sufficient to effect full reaction or not. Such an apparatus is used to give a signal when a water supply exceeds a certain degree of hardness.

OTTAWA SECTION

The regular meeting held on November 17 was preceded by dinner at the University Club: there was a very good attendance, in spite of the inclement weather.

The first paper was by Mr. John Macoun, and bore the title, "The determination of alcohol in solutions containing acetone." Experiments carried out in the laboratory of the Department of National Revenue resulted in a method for quantitatively eliminating acetone and closely related ketones from solutions of ethyl and methyl alcohols. The errors involved are larger than is desirable, but less than in any other methods yet suggested. Until a better method is found, it is permissible to use this one for fiscal purposes. As the errors always tend to show an alcoholic content lower than that actually present, the method is never a source of injustice to the tax-payer. The method consists of a condensation with benzaldehyde in the presence of potassium hydroxide, when, if acetone is the ketone, dibenzylidene acetone is formed. It is not applicable at present to mixtures of both alcohols with acetone.

An outline of the manufacture and application of vitreous enamels was given by Mr. W. Mayor. Enamel frit is not made by the firms engaged in enamelling processes, but is the special care of supply houses. Frit usually is a complex alkaline borosilicate containing fluorine, though individual formulae vary and are kept secret. The metal to be enamelled is carefully cleaned, and the enamel mixture made from the frit is sprayed on, or the piece is dipped. The pieces are dried and the enamel is burnt on in electric or oil-fired muffles. As, after cleaning, the ware is pickled, a rough surface is left, on which the enamel fuses during the burning, and to which it adheres when cold. Colours are obtained by mixing metallic oxides with the enamel mixture.

CALENDAR OF FORTHCOMING EVENTS

Dec. 9.—**Society of Dyers and Colourists, Manchester Section.** Jointly with the Manchester Section of the Institution of the Rubber Industry (cf. *CHEM. AND IND.*, December 2, p. 1122.).

Dec. 9.—**Institute of Metals, Sheffield Local Section.** The University, St. George's Square, Sheffield, at 7.30 p.m. "Stresses in non-ferrous castings," by Prof. C. H. Desch.

Dec. 9.—**Institution of Engineering Inspection.** "Low-temperature distillation of coal," by F. R. Wade and C. H. Parker.

Dec. 9.—**Biochemical Society.** Imperial College of Science and Technology, Royal School of Mines, Prince Consort Road, South Kensington, S.W.7, at 4.45 p.m. (cf. *CHEM. AND IND.*, December 2, p. 1122.).

Dec. 12.—**Institute of Chemistry, Manchester Section.** Address by the Chairman, Mr. L. Guy Radcliffe, followed by a dinner and dance.

Dec. 12.—**Institute of Metals, Scottish Local Section,** 39, Elmbank Crescent, Glasgow, at 7.30 p.m. "Age hardening of alloys," by R. Hay.

Dec. 12.—**Ceramic Society.** North Staffordshire Technical College, Stoke-on-Trent, at 7.30 p.m. "Combustion of carbonic oxide," by Prof. W. A. Bone.

Dec. 13.—**Royal Colonial Institute.** Luncheon at the Cannon Street Hotel, E.C.4. Address by Sir John Russell.

Dec. 13.—Institution of Petroleum Technologists. *General Meeting.* House of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m. *Symposium on "Detonation in motor fuels,"* opened by H. R. Ricardo.

Dec. 13.—Hull Chemical and Engineering Society, Hull Photographic Society's Rooms, Grey Street, Hull, at 7.45 p.m. "Steel—its structure and tempering," by C. C. Hall.

Dec. 13.—Institution of Mechanical Engineers. Meeting at Swansea. "Reduction of steel works costs by the use of waste-heat boilers," by J. Adamson and F. Jones.

Dec. 13.—Royal Institution of Great Britain, 21, Albemarle Street, W.1, at 5.15 p.m. "A year's work in X-ray crystal analysis," by Sir W. Bragg.

Dec. 13.—Royal Photographic Society, Scientific and Technical Group, 35, Russell Square, W.C.1, at 7 p.m. (1) "Chemical effects of radiations," by M. P. Villard. (2) "Change of focus when the object possesses great depth," by H. W. Lee. (3) "Rate of desilveration of the wet collodion silver bath," by P. P. O'Shaughnessy.

Dec. 13.—Society of Chemical Industry, South Wales Section, The Technical College, Cardiff, at 7.30 p.m. "Notes on coal research," by Dr. S. R. Illingworth.

Dec. 14.—Royal Society of Arts, John Street, Adelphi, W.C.2, at 8 p.m. (*Ordinary Meeting.*) "The evolution of modern road surfaces," by Major R. G. H. Clements.

Dec. 14.—Society of Glass Technology, University College, Gower Street, W.C.1, at 2.40 p.m. (1) "Analysis of opal glasses," by J. H. Davidson and Miss V. Dumbleby. (2) "Durability of iron-containing glasses," by Miss V. Dumbleby and Prof. W. E. S. Turner. (3) "Effect of iron oxide on the properties of glass," by S. English, H. W. Howes, and Prof. W. E. S. Turner.

Dec. 14 to 16.—Institute of Chemistry. Jubilee Celebrations. (Cf. 1151 of this issue.)

Dec. 15.—Chemical Society, Burlington House, Piccadilly, W.1, at 8 p.m. *This Ordinary Scientific Meeting has been abandoned.*

Dec. 15.—Institute of Metals. *Birmingham Local Section.* Engineer's Club, Waterloo Street, Birmingham, at 7 p.m. "Duralumin," by L. Aitchison. (*Arranged by the Co-ordinating Committee.*)

Dec. 15.—Royal Institution of Great Britain, 21, Albemarle Street, W.1, at 5.15 p.m. "Petroleum natural gases and their derivatives," by J. Kewley.

Dec. 15.—Society of Dyers and Colourists, West Riding Section. Leeds University. "Leather dyeing," by H. Salt.

Dec. 15.—Society of Dyers and Colourists, Midlands Section. Leicester Technical College, at 7.30 p.m. "Hydrogen peroxide bleaching," by I. E. Weber.

Dec. 16.—Society of Chemical Industry, Liverpool Section. Joint meeting with the Chemical Engineering Group. The University, Liverpool, at 6 p.m. "Oil pollution of seas and harbours and a remedy," by C. S. Garland.

Dec. 16.—Manchester Literary and Philosophical Society, Chemical Section, at 7 p.m.

Dec. 21.—Ramsay Chemical Dinner, held under the joint auspices of Society of Chemical Industry, Institute of Chemistry, Society of Dyers and Colourists, Glasgow University Alchemists' Club, Andersonian Chemical Society, Ardeer Chemical Club, and the Royal Philosophical Society of Glasgow, in the Trades House, Glassford Street, Glasgow, at 6 for 6.30 p.m. This year the Dinner has been subtitled "The Institute of Chemistry Jubilee," and the Chairman will be Prof. A. Smithells.

CHEMICAL SOCIETY

Fifty-three new Fellows were elected at a meeting held on December 1, the President, Prof. H. Brereton Baker, C.B.E., F.R.S., occupying the Chair. Fellows were reminded that the meeting arranged for December 15 has been abandoned, and that remittances (5s. 6d.) for the Annual Reports, 1927, will be received (from Fellows only) up to Christmas Day. Fellows of the Chemical Society can now obtain the *Chemisch Weekblad* and the *Recueil des travaux chimiques* at reduced rates on application to Dr. A. D. Donk, Verspronckweg 100, Haarlem, Holland.

Mr. H. Paget read the following paper :—

Action of Beckmann's chromic acid mixture on some monocyclic terpenes. [With T. A. Henry.]

As a preliminary to work already published (J., 1925, 127, 1649), the action of chromic acid, under similar conditions, on α -terpinene, *l*-limonene and α -phellandrene was examined. α -Terpinene is known to be oxidised mainly to dimethylacetylacetone, only traces of $\alpha\delta$ -dihydroxy- α -methyl- δ -isopropyladipic acid being formed (J., 1921, 119, 1714; 1923, 123, 1878). *l*-Limonene is converted into 1 : 2 : 8-trioxyterpan and a keto-lactone, $C_{10}H_{16}O_3$, both of which have already been obtained by Wallach by the oxidation of terpineol, so that the latter appears to be the first product of the action of chromic acid on limonene.

α -Phellandrene is oxidised to two keto-lactones, $C_{10}H_{16}O_3$, and $C_9H_{14}O_3$, for which constitutional formulae are suggested, isopropylsuccinic acid, thymoquinol, and thymoquinone; the disemicarbazone of the latter has been obtained for the first time in two stable yellow modifications and one colourless labile form.

Dr. J. L. Simonsen remarked on the difficulty of identifying monocyclic terpenes, and on the advantage of using chromic acid as a reagent in this field of work.

Dr. F. L. Pyman described the following two investigations :—

The condensation of glyoxalines with formaldehyde. [With R. Grindley.]

A study of the condensation with formaldehyde of several derivatives of glyoxaline containing various substituents shows :—(1) that glyoxalines containing a free imino-group yield 4(5)-hydroxymethyl derivatives, (2) that N-methylglyoxalines yield either 2- or 5-hydroxymethyl derivatives, (3) that no condensation products of nitroglyoxalines with formaldehyde could be isolated.

Glyoxaline-4(5)-formaldehyde. [With W. Hubball.]

METHYLATION of glyoxaline-4(5)-formaldehyde, its 5(4)-methyl-homologue and methyl glyoxaline-4(5)-carboxylate shows that the carbonyl group behaves like the nitro-group in directing the formation predominantly of substances in which the carbonyl and methyl groups are in the 5 : 1-position.

Dr. O. L. Brady asked whether the authors had considered the configuration of glyoxalineformaldoxime;

α -oximes seem characteristic of the benzene ring and β -oximes of aliphatic aldehydes.

Prof. C. S. Gibson inquired whether catalysts had been employed in the condensation of glyoxaline with formaldehyde, and whether any abnormality or resin-formation had been observed. Crystalline products, for example, are obtained when certain catalysts are used in condensing *m*-cresol with formaldehyde.

Dr. Pymon replied that the configuration of the oxime had not been investigated. Catalysts had not been employed; the reaction was effected at 125–135° in a sealed tube with 40% formaldehyde, the yields being usually 40–50% of the theoretical. Much resin was also produced.

Prof. T. M. Lowry discussed :—

Studies of dynamic isomerism. Part XXVI. Consecutive changes in the mutarotation of galactose. [With G. F. Smith.]

(a) THE mutarotation of galactose does not conform even approximately to the unimolecular law, since the velocity-coefficient for a solution of α -galactose in water at 20° decreases from $k_e = 0.0256$ at 7 min. to a limiting value $k_e = 0.0192$ as the rotation approaches the equilibrium value $[\alpha]_{5461} = 94^\circ$. On the other hand, the velocity-coefficient for β -galactose increases from zero to the same limiting value. Since the form of the curve is the same for solutions containing 2.5, 5, 10, and 15% of α -galactose, these anomalies are attributed to consecutive unimolecular reactions.

(b) The initial stage of mutarotation of α -galactose can be interpreted as a unimolecular change, proceeding with a velocity coefficient 0.064 between the limits $[\alpha]_{5461} = 169^\circ$ to 135° . The initial change of β galactose is not accompanied by any alteration of rotation; mutarotation is therefore due to further changes undergone by an initial product of similar rotatory power to the β -sugar, namely $[\alpha]_{5461} = 63^\circ$. The mutarotation curve is inflected, the inflexion having an "intercept-ratio" 0.09, which approximates closely to the theoretical maximum value 0.0939 of this ratio.

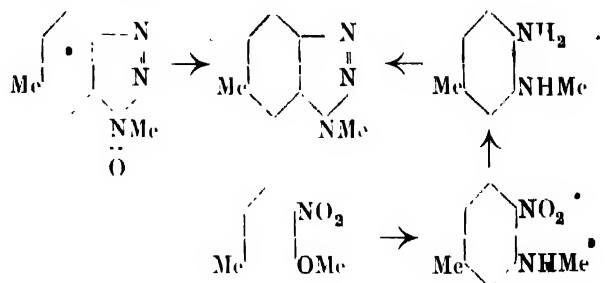
(c) These observations show that the intermediate form or forms through which α - and β -galactose are converted into one another in aqueous solution play an important part in mutarotation, and persist as major constituents in the final equilibrium.

Dr. O. L. Brady discussed :

Triazole compounds. Part II. Methylation of some 1-hydroxy-1 : 2 : 3-benzotriazoles. [With C. V. Reynolds.]

THE methylation of 1-hydroxy-1 : 2 : 3-benzotriazole and of 1-hydroxy-6-methyl-1 : 2 : 3-benzotriazole gives a larger proportion of N- to O-methyl derivative than does the methylation of the more strongly acidic nitro-hydroxy-benzotriazoles previously studied (J., 1923, 123, 2258). It seems that the alkylation of these compounds is analogous to that of the oximes (J., 1926, 2394), and that the O-methyl derivative is formed by an ionic and the N-methyl derivative by a molecular reaction.

The constitution of the N-methyl derivative is established as follows :



Prof. D. R. Boyd discussed :

The reaction between diaryloxyisopropyl alcohols and phosphorus oxychloride in the presence of pyridine. [With D. E. Ladhams.]

WHEN di-*p*-toloxyisopropyl alcohol reacts at 0° with excess of phosphorus oxychloride in the presence of pyridine, the product obtained, on treating the reaction mixture with ice, is chiefly di-*p*-toloxyisopropyl phosphate ($C_6H_7 \cdot O \cdot (CH_2)_2 \cdot CH \cdot O \cdot PO(OH)_2$), but if the reaction mixture is heated at 100° before decomposing with ice, di-*p*-toloxyisopropyl chloride is formed, together with a comparatively small amount of the corresponding pyridinium salt, $C_5H_5N \cdot CH((CH_2)_2 \cdot O \cdot C_6H_7)_2 \cdot Cl$. Similar results have been obtained with other diaryloxyisopropyl alcohols. Pyridine forms with phosphorus oxychloride a crystalline additive compound $(C_5H_5N)_2 \cdot POCl_3$. An explanation of these observations is offered.

INSTITUTE OF CHEMISTRY

JUBILEE CELEBRATION, DECEMBER 14–15, 1927

The arrangements for the Jubilee Celebration of the Institute are well in hand. The occasion will afford an exceptional opportunity for the reunion of old friends from all parts of the country. Representatives of many professional and scientific societies and institutions, and of the Local Sections of the Institute, will be present. The members of the Committee of the London and South Eastern Counties Section will act as stewards. Over 1250 guests are expected at the *Conversazione* to be held at the Wharnccliffe Rooms on the evening of Wednesday, December 14. Members of the Institute and of allied chemical societies and institutions who have accepted the invitation extended to them by the President and Council and who have received tickets are asked to note that the President and Mrs. Smithells and the Council of the Institute will receive them from 7.30 p.m.

Over 1000 tickets have been issued for seeing the films illustrating British industries, which will be shown by the courtesy of the Federation of British Industries and the Gaumont Company at the New Gallery Cinema, 123, Regent Street, on Thursday, December 15, from 10.30 a.m. to 12.30 p.m. Ticket holders will be admitted from 10 a.m. and are advised to be in their places in good time.

A large and distinguished company is expected at the Jubilee Dinner, which is to be held at the Wharnccliffe

Rooms on Thursday, December 15, at 7 for 7.30 p.m. Guests are advised to arrive in good time.

Sir Alfred Mond will propose the toast of the evening.

On Wednesday, December 14, and Thursday, December 15, at the Institute's headquarters, 30, Russell Square, documents and portraits of historical interest, particularly in connexion with the foundation of the Institute, will be exhibited. In addition, Mr. George H. Gabb has kindly promised to lend a number of very interesting documents and apparatus relating to Joseph Priestley, Mr. Cecil H. Cribb has kindly promised to lend a selection of prints and other exhibits of interest to chemists, and the Institute's collection of lantern slides, illustrating the history of chemistry, will be displayed.

On Thursday, the 15th, the Master and Wardens of the Worshipful Company of Salters, in honour of the occasion, will entertain to luncheon, at Salters' Hall, the President, Officers and Council of the Institute and the representatives of many societies and institutions.

CORRESPONDENCE THE HISTORY OF SUGAR

SIR.—Referring to your Editorial on Sugar in the current number of CHEMISTRY AND INDUSTRY, there are several references in the Old Testament to "sweet cane" or "sweet calamus," which, used as an ingredient for anointing oil, might be an article of merchandise coming from afar; on the other hand, it may have been the root-stock of the sweet fig (*Acorus calamus*). Mr. Fairrie, in his valuable book "Sugar," quotes the following lines, in reference to sugar cane, from the Atharva Veda

"I have surrounded thee with a clinging sugar cane,
so thou shalt not be averse to me"

I think we owe our first European knowledge of sugar to the peregrinations of Alexander the Great. At any rate Nearchus, an Admiral of the famous tyrant, found a "kind of honey growing in canes or reeds," in the East Indies about 325 B.C. It was in use in the Greek and Roman Empires, but only as medicine probably owing to its prohibitive price. Dioscorides, a physician, calls it "sugar," but "Indian salt" seems the more common term. "Zucra" has come down to us from one Albertus Agnensis, a monkish writer of the twelfth century, who calls it the product of "sweet honeyed reeds" which Crusaders used to suck in Tripoli.

It was planted by the Moors in Spain soon after 716 A.D. who no doubt got it from Egypt, and it seems likely that the latter country gave it in abundance to Greece (via Syria and Rhodes) and Sicily (via Tunis and Malta).

As one who is very interested in sugar, I hope some of your readers will be able to offer some information on the subject.—Yours, etc.,

J. BADGER-CLARK

PERSONAL AND OTHER ITEMS

At the anniversary meeting of the Royal Society, on November 30, the following medals were presented by the President, Sir Ernest Rutherford:—The Copley Medal to Sir Charles Sherrington, a Royal Medal to

Sir Thomas Lewis, and the Buchanan Medal to Dr. Greenwood. A Royal Medal had been awarded to Prof. J. C. McLennan, the Hughes Medal to Dr. W. D. Coolidge, and the Davy Medal to Prof. A. A. Noyes, but they were unable to be present.

The following sectional presidents (*inter alios*) have been appointed for the meeting of the British Association in Glasgow next year from September 5-12, under the presidency of Sir William Bragg:—Section A (Mathematical and Physical Sciences), Prof. A. W. Porter; Section B (Chemistry), Prof. E. C. C. Baly; Section I (Physiology), Prof. C. Lovatt Evans; Section L (Education), Prof. A. Smithells.

Lord Stanmore and Messrs. J. T. Phelan and H. S. Sugden, representing the Ship Canal Portland Cement Manufacturers, have been elected to the board of the Holborough Cement Company.

Messrs. W. L. H. Roberts, R. M. Cook, and A. Clarke Vincent have resigned from the board of the Holborough Cement Company.

The death is announced of Dr. Milton Whitney, the agricultural chemist, who had been head of the U.S. Bureau of Soils from 1891 until a few months ago.

The family of M. Solvay has given 25 million francs (about £143,000) to the Belgian National Fund for Scientific Research.

Oil Pollution

An important meeting will be held jointly by the Chemical Engineering Group and the Liverpool Section of the Society of Chemical Industry on Friday, December 16, 1927, for which an attractive programme has been arranged. In the afternoon a visit will be paid to the s.s. *Adda*, a Diesel-engined vessel; afternoon tea will subsequently be served in the Chemistry Department Library of the University; and at 6 p.m. the joint meeting will be held in the Electricity Lecture Theatre of the University, when Mr. C. S. Garland, B.Sc., A.R.C.S., F.I.C., M.I.Chem.E., a former chairman of the Chemical Engineering Group, will deliver a paper on "Oil pollution of seas and harbours—and a remedy." The paper will be illustrated by lantern slides and a cinematograph film of a prolonged test carried out by H.M. Admiralty.

Chemical Society

The Library of the Chemical Society will be closed for the Christmas holidays at 1 p.m. on Friday, December 23, and will re-open at 10 a.m. on Thursday, December 29. The meeting arranged for December 15 will not be held.

British Photographic Research Association

The report of this Association for the year 1926-27 announces that the Department of Scientific and Industrial Research has offered the Association a block grant for the five years ending May 31, 1932, which, added to a minimum amount guaranteed by the Association, would make the income £5000 per annum. A new condition was imposed requiring the appointment of a governing Committee of five technical and scientific persons, appointed partly by the Association and partly by the Department, to supervise the scientific investigations of the Association. We are glad to learn that, with the acceptance

of this offer, the valuable work which the Association has been doing will be continued. The important investigations on silver halides, the fundamental studies of photographic sensitivity, especially in relation to gelatin and other important problems, are being carried on, and co-operation between the technical members of the firms and the Association is steadily increasing. A large number of papers and confidential reports was published by the staff of the Association during the year and the valuable work which it has accomplished in the past promises well for the future.

Cast Iron Research Association

At the annual general meeting, held on November 30, Mr. H. B. Weeks, chairman of the Council, who presided said that the long protracted coal dispute proved a serious handicap. General difficulties were responsible for several withdrawals from membership particularly among small foundries. That was particularly unfortunate in view of the hopes entertained of a fuller response from the industry following the highly satisfactory report made by the committee of the Department of Scientific and Industrial Research at the end of the first five years' working of the Association. The Association, like others of its type, had always been handicapped by the fact that it had no capital. It worked entirely from income, which it was expected to expend in its legitimate activities. Only a limited amount of money, therefore, saved from income, was available for capital expenditure. Out of some 2000 foundries throughout the country, the subscribing membership of the Association in all classes was only 299, of which 226 were ordinary and trade members. Over £40,000 had been spent by the Association in research work during its six years of existence.

Major-Gen. Sir Philip A. M. Nash was elected president of the Association for the coming year in succession to Sir John Dewrance. Mr. T. Donaldson, Mr. A. W. Steven, Mr. W. Reavell, and Mr. W. Turner McLellan were elected vice-presidents, and Sir William Bird and Mr. T. V. Miles were re-elected as vice-presidents.

First International Conference on Light and Heat in Medicine

The First International Conference on Light and Heat in Medicine, Surgery and Hygiene will be held at the Central Hall, Westminster S.W. 1, from December 13 to 16, inclusive. On December 15, the chair will be taken by Prof. E. C. Baly, C.B.E., F.R.S., and the following papers will be given: (1) "Ultra-Violet in sunlight and artificial light sources," by L. Hill, M.B., F.R.S. (2) "Vitamin D and its relation to the irradiation of foodstuffs," by Prof. I. M. Heilbron, Ph.D., D.Sc. (3) "Can the chemist and physicist be of use in actinotherapy?" by F. H. Humphries, M.D., D.M.R.E.

In connexion with the Conference, an International Exhibition in the Central Hall will be opened by Sir Alfred Mond at 2.30 p.m. on December 13, and will remain open until December 19, from 2.30 to 9 p.m. each day.

Molybdenum Development in Canada

Of interest for the manufacturers of special steels is the announcement that arrangements are being made for the development of the large deposit of molybdenite at Lake Malartic, near Amos, Quebec.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
Acid Boric, Commercial.—Cryst., £30 per ton; Powder, £32 per ton; Extra fine Powder, £34 per ton.
Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
Copper Sulphate.—£25—£25 10s. per ton.
Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
Nickel Sulphate.—£38 per ton d/d.
Nickel Ammon. Sulphate.—£38 per ton d/d.
Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d. £18 per ton, according to strength. 20s. less for contracts.
Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crinson.—1s. 4d.—1s. 6d. per lb., according to quality.
Arsenic Sulphide, Yellow.—1s. 9d. per lb.
Barytes.—£3 10s.—£6 15s. per ton, according to quality.
Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
Carbon Bisulphide.—£20—£25 per ton, according to quantity.
Carbon Black.—5½d. per lb., ex wharf.
Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 1d. per lb.
Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £10 5s. per ton. Good demand.
 Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32" Tw.; 1s. per gal. 24" Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha. Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead. £40 15s. per ton.

TAR PRODUCTS

Acid Carbohc. Crystals.—7½d.—8d. per lb. Crude 60's. 2s. 4d. 2s. 5d. per gal.
 Acid Cresylic, 90/100. 2s. 11d.—3s. per gal. 97/99. 2s. 4d.—2s. 8d. per gal. Pale, 95%o, 2s. 3d.—2s. 6d. per gal. Dark, 95%o, 2s. 1d.—2s. 3d. per gal.
 Anthracene Paste. A quality, 2½d. per unit, 40%o, £5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9¾d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d. 1s. 6d. per gal., ex works in tank wagons.
 Toluene.—90%o, 1s. 4d. 1s. 8d. per gal. Pure, 1s. 6d. 2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.
 Creosote.—Cresylic 20/24%o.—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d. 7¾d. per gal. ex works. Salty, 7d. per gal., less 1%o.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.—10d. per gal. Solvent 95/160, 1s. 3d.—1s. 4d. per gal. Solvent 90/190, 8½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals, £13—£13 10s. per ton. Flaked, £14—£15 per ton.
 Pitch, medium soft.—85s.—90s. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 9d.—6s. 6d. per gal. 90/180—3s. 6d.—5s. per gal. Heavy.—3s.—3s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 6d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—8d. per lb., naked at works.
 Aniline Salts.—8d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb., 100%o.
 Benzaldehyde.—2s. 3d. per lb.

* Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—5½d. per lb.
 m-Cresol 98/100%o.—2s. 3d.—2s. 5d. per lb.
 p-Cresol 32/34° C.—2s. 3d.—2s. 5d. per lb.
 Dichloraniline. 1s. 10d. per lb.
 Dimethylaniline.—1s. 11d. per lb.
 Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—10d. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb.
 β-Naphthylamine. 3s. per lb.
 o-Nitraniline.—5s. 9d. per lb.
 m-Nitraniline.—3s. per lb. d/d.
 p-Nitraniline.—1s. 8d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb.
 R. Salt.—2s. 2d. per lb.
 Sodium Naphthionate.—1s. 8½d. per lb. 100%o basis d/d.
 o-Toluidine.—8½d. per lb.
 p-Toluidine.—2s. per lb., ex works, naked.
 m-Xyldine Acetate.—2s. 6d. per lb. 100%o.
 N.W. Acid.—4s. 9d. per lb. 100%o.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%o.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 3½d. 2s. 5d. per lb.
 Acid, Benzoic B.P. 2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. 36s.—39s. per cwt. Powder 40s.—43s. per cwt.; Extra Fine Powder, 42s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 6¾d.—1s. 7d. per lb. Less 5%o.
 Acid, Gallic. 2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst. 7s. 3d. per lb. Resublimed.—8s. 3d. per lb.
 Acid, Salicyche.—B.P. pulv. 1s. 2½d. 1s. 4½d. per lb. Technical 11½d.—11¾d. per lb.
 Acid, Tannic, B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%o.
 Acetanilide.—1s. 6d. 1s. 9d. per lb. for quantity.
 Amidol.—7s. 6d.—9s. per lb. d/d.
 Amidopyrim. 8s. 6d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 5d. per lb., according to quantity.
 Ammon. Carbonate B.P. Lump £37 per ton. Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—9s. per oz.
 Barbitone.—5s. 9d.—6s. per lb.
 Benzonaphthol. 3s. 3d. per lb.
 Bismuth Carbonate.—10s. 4d.—10s. 7d. per lb. Bismuth Citrate.—9s. 10d.—10s. 1d. per lb. Bismuth Salicylate.—9s. 10s.—10s. 1d. per lb. Bismuth Subnitrate.—8s. 4d.—8s. 7d. per lb. Bismuth Nitrate.—6s. 1d.—6s. 4d. per lb. Bismuth Oxide.—13s. 10d.—14s. 1d. per lb. Bismuth Subchloride.—13s. 10d.—14s. 1d. per lb. Bismuth Subgallate.—8s. 1d.—8s. 4d. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi et Ammon. Cit. B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal 25s. per cwt. Powder 26s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.
 Bromides.—Ammonium.—2s. 3d. per lb. Potassium.—

1s. 10 $\frac{1}{2}$ d. per lb. Sodium.—2s. 1d. per lb. Granulated $\frac{1}{2}$ d. per lb. less. All spot. Large quantities at lower rates.
 Calcium Lactate B.P.—1s. 2d.—1s. 3 $\frac{1}{2}$ d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.
 Chloroform.—2s. 3d.—2s. 7 $\frac{1}{2}$ d. per lb., according to quantity.
 Creosote Carbonate.—6s. per lb.
 Ethers: S.G. 730, 10 $\frac{1}{2}$ d.—1s. 1 $\frac{1}{2}$ d. drums. Other gravities at proportionate prices.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiaccol Carbonate.—4s. 9d.—5s. per lb.
 Hexamine.—2s. 3d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal.; 20 vols., 3s. 4d. per gal.
 Hydroquinone.—3s. 3d.—3s. 6d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—18s.—20s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2 $\frac{1}{2}$ %; Heavy Commercial £21 per ton, less 2 $\frac{1}{2}$ %; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol—A.B.R. recryst., B.P., 17s. 3d. per lb. net. Synthetic detached crystals, 8s. 6d.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig. 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb.
 Special prices for larger quantities.
 Methyl Salicylate.—1s. 9d. per lb.
 Methyl Sulphonal.—8s. 9d.—9s. per lb.
 Metol.—9s.—11s. 6d. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 4d. per lb. Less in quantity.
 Phenacetin.—2s. 6d.—2s. 9d. per lb.
 Phenazone.—4s.—4s. 3d. per lb.
 Phenolphthalein.—6s. 6d.—6s. 9d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 96s. per cwt., less 2 $\frac{1}{2}$ %.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—6 $\frac{1}{2}$ d. per lb. spot.
 Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.
 Resorcin.—3s. 9d.—4s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 11d.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.
 Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 7d.—1s. 9d. per lb. Crystal, 1s. 8d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.
 Sulphonal.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 2d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.
 Aubepine (*ex Anethole*).—11s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 3d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—8s. 6d. per lb. Geraniol (Palmarosa).—17s. 9d. per lb. Geraniol.—6s.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. per lb. Linalol.—(*ex Bois de Rose*) 14s. per lb.—(*ex Shui Oil*) 9s. 9d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 17s. 6d. per lb.—(*ex Shui Oil*) 13s. 9d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Norolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—31s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpineol.—1s. 8d. per lb. Vanillin.—15s. 3d.—16s. 6d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb.
 Bergamot.—26s. per lb. Bourbon Geranium.—13s. per lb.
 Camphor.—9d. per lb. Cananga, Java, 15s. 9d. per lb.
 Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java, 1s. 9d. per lb., c.i.f. U.K. port, for shipment over 1928. Ceylon, Pure, 1s. 7d. per lb. Clove, pure 6s. per lb.
 Eucalyptus, Australian.—2s. 1d. per lb. Lavender.—Mont Blanc, 28/40%, 17s. per lb. Lemon.—8s. 6d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. 3d. per lb. Peppermint.—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST.

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Jan. 30th, 1928. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Dec. 15th, 1927. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Baudini. Quick-drying process for plastic masses. 31,413. Nov. 22.

Bentham, and Simon, Ltd. Extraction of solid materials from air. 31,249, 31,250. Nov. 21.

- Brécat. Purifying gases etc. 31,682. Nov. 24.
 Outlack. 31,564. *See* XVIII.
 Eppenbach. Homogenising-mill. 31,420. Nov. 22. (U.S. 19,727.)
 • Gram, Söderlund, Testrup, and Techno-Chemical Laboratories. Drying-apparatus. 31,253. Nov. 21.
 • Levêque. Heat-exchangers. 31,327. Nov. 22. (Belg. 26,11,26.)
 Marks (Lister et (ie.). Manufacture of emulsions etc. 31,908. Nov. 26.
 Mond (Metallbank und Metallurgische Ges.). Treating gases etc. 31,421. Nov. 22.
 Pilat. Adsorption processes etc. 31,396. Nov. 22.
 • Studienges. für Gasindustrie. Adsorption and drying of gases. 31,555. Nov. 23. (Ger., 23,11,26.)
 Weir, Ltd., and Son. Evaporators. 31,314. Nov. 22.

I.—Complete Specifications

- 13,029 (1926). I.-G. Farbenind. Manufacture of aqueous emulsions and suspensions of substances insoluble in water. (252,392.)
 20,287 (1926). General Electric Co., Ltd., and Bell. Furnaces. (280,634.)
 20,850 (1926). Billwiler. Prevention and removal of incrustation in boilers. (257,915.)
 22,681 (1926). Riley, and Scott & Son (London), Ltd. Tubular evaporators. (280,666.)
 29,960 (1926). Fairweather (Selden Co.). Regeneration of catalysts. (280,712.)
 1511 (1927). Benson and Denholm. Rotary cylinder drying-apparatus. (280,740.)
 12,021 (1927). Petersen. Filter for fine filtration of liquids (280,802.)
 *30,491 (1927). Loewe. Obtaining a very high vacuum. (280,908.)
 *30,842 (1927). Baume, Chambige, and Boutier. Manufacture of emulsions or suspensions. (280,930.)
 *30,956 (1927). Silica Gel Corp. Manufacture of catalytic gels. (280,939.)
 *31,058 (1927). Silica Gel Corp. *See* VII.
 *30,918 (1927). Silica Gel Corp. Impregnated gel for adsorbing water vapour. (280,934.)

II.—Applications

- Clancy. Manufacture of low-boiling oils etc. 31,228. Nov. 21.
 Coley. Manufacture of gas. 31,636. Nov. 24.
 Friedlaender & Co. Briquetting etc. non-caking fuels. 31,910. Nov. 26. (Ger., 27,11,26.)
 Ges. für Linde's Eismaschinen. 31,290. *See* VII.
 Hansen. Manufacture of liquid hydrocarbons. 31,913. Nov. 26.
 Humphreys and Glasgow, Ltd. Apparatus for making carburetted water-gas. 31,280. Nov. 21. (U.S., 10,12,26.)
 Mueller. Regenerative coke ovens. 31,628. Nov. 24.

III.—Complete Specifications

- 19,860 (1926). Continentale A.-G. I. Chemie. Fuel for internal-combustion engines. (267,079.)
 20,380 (1926). I.-G. Farbenind. Manufacture of hydrocarbons or derivatives from carbonaceous materials. (257,912.)
 22,903 (1926). Rolfsen. Manufacture of lubricants. (258,606.)
 30,125 (1926). Chem. Werke Carbon. Manufacture of highly-active carbon blocks or granules. (266,674.)
 31,593 (1926). Stratford. Evaporating oils. (280,727.)
 731 (1927). Internat. Bergen-Gie. voor Olie- en Kolen-chemie, and Debo. Hydrogenation and cracking of hydrocarbon compounds. (280,734.)
 5296 (1927). Urbain. Simultaneously producing a gas of the nature of water-gas, phosphoric acid, and an aluminium silicate slag. (280,763.)

*28,748 (1927). I.-G. Farbenind. Recovering acetylene from gaseous mixtures. (280,885.)

*30,588 (1927). Widegren and Widegren. Gas-producers. (280,912.)

III.—Application

I.-G. Farbenind. Production of aromatic hydrocarbons. 31,501. Nov. 23. (Ger., 24,11,26.)

IV.—Applications

- Carpmael (I.-G. Farbenind.). Manufacture of copper ammine complex azo compounds. 31,230. Nov. 21. Manufacture of hydrogenated aromatic amino compounds. 31,394. Nov. 22.
 I.-G. Farbenind. Manufacture of phenylthioglycolic acids etc. 31,393. Nov. 22. (Ger., 24,11,26.)
 Imray (I.-G. Farbenind.). Manufacture of nitro 2:3-dichloro 1:4-naphthoquinone. 31,369. Nov. 22.
 Johnson (I.-G. Farbenind.). Production of vat dyestuffs 31,218. Nov. 21.
 Scottish Dyes, Ltd., Beckett, Thomas, and Woodcock. Manufacture of amino-halogen-anthraquinones 31,254. Nov. 21.

IV.—Complete Specifications

- 20,316 (1926). Carpmael (I.-G. Farbenind.). Manufacture of dyestuffs of the anthracene series. (280,637.)
 20,511 (1926). British Dyestuffs Corp., and Hailwood. Manufacture of a solubilised vat-dye and process of dyeing therewith. (280,647.)
 20,857 (1926) and 16,731 (1927). British Dyestuffs Corp., Shepherdson, and Thornley. Manufacture of black and grey vat-dyes. (280,652.)
 21,065 (1926). I.-G. Farbenind. Manufacture of vat-dyestuffs. (257,618.)
 *9471 (1927). I.-G. Farbenind. Manufacture of vat dyestuffs. (280,846.)
 *28,062 (1927). Silesia. Verein Chem. Fabr. Separation of mono- and dialkyl derivatives of aromatic amines. (280,877.)
 *28,749 (1927). I.-G. Farbenind. Manufacture of vat dyestuffs. (280,886.)
 *31,052 (1927). Soc. Chem. Ind. in Basle. Manufacture of stable diazo-compounds. (280,945.)

V.—Applications

- Rohm. Chlorination of hair, wool, etc. 31,678. Nov. 24. (Austria, 1,12,26.)
 Imperial Chemical Industries, Ltd., and Savage. Treating greasy fibrous materials. 31,431. Nov. 23.
 Lohfeld. Treatment of artificial fibrous material. 31,292. Nov. 21.
 Morden. Manufacture of cellulose acetate. 31,786. Nov. 25.
 Scutan Co. Proofed paper. 31,704. Nov. 21. (U.S., 26,11,26.)
 Vles. Preparing partially hydrolysed cellulose acetates etc. 31,828. Nov. 25.

V.—Complete Specifications

- 15,291 (1926). Sajitz, Sajitz, and Pospiech. Spinning of viscose solutions. (280,608.)
 20,205 (1926). Carpmael (I.-G. Farbenind.). Manufacture of artificial silk. (280,628.)
 20,235 (1926). Nanji. Manufacturing pulp for paper. (280,629.)
 27,709 (1926). Schulz. Spinning of artificial threads according to the stretch-spinning process. (261,365.)
 14,667 (1927). Hagglund. Treatment of the black liquor obtained in the manufacture of wood fibre by the soda process. (273,267.)
 19,424 (1927). I.-G. Farbenind. Opening-up materials containing cellulose. (274,892.)

21,442 (1927). I.-G. Farbenind. Opening-up materials containing cellulose. (276,025.)

*30,795 (1927). I.-G. Farbenind. Treating cellulose. (280,922.)

VI.—Applications

British Celanese, Ltd. Treatment of materials consisting of cellulose derivatives. 31,485. Nov. 23. (U.S., 30.12.26.)
Dyeing textile fibres etc. 31,486. Nov. 23. (U.S., 11.12.26.)

Morton. Manufacture of colour-printed fabrics. 31,309. Nov. 22.

Waddell and Watson. Treating yarn etc. with liquids. 31,719. Nov. 25.

VI.—Complete Specifications

20,511 (1926). British Dyestuffs Corp., and Hailwood. *See* IV.
27,216 (1926). British Celanese, Ltd., and Ellis. Mordanting and colouring materials made of or containing cellulose derivatives. (280,698.)

26,706 (1927). I.-G. Farbenind. Treatment of fibres or fibrous materials with aqueous liquids. (278,752.)

VII.—Applications

Ges. für Linde's Eismaschinen. Extracting ammonia from gases. 31,290. Nov. 21. (Ger., 27.11.26.)

Norsk Hydro Elektrisk Kvaestofakt. Concentration of dilute nitric acid. 31,529. Nov. 23. (Norway, 6.12.26.)

VII.—Complete Specifications

31,051 (1926). Moller and Kreth. Preparation of solutions of hydrofluosilicic acid. (263,779.)

5296 (1927). Urban. *See* II.

5610 (1927). Lederer, Stanczak, and Kassler. Obtaining metal hydroxides free from iron. (267,491.)

10,039 (1927). I.-G. Farbenind. Recovery of sulphur from solutions of ammonium polysulphides. (269,546.)

17,628 (1927). Titan Co. Akt. *See* X.

18,850 (1927). Deutsche Gold- u. Silber-Scheideanstalt. Production of alkali hydride. (276,313.)

*31,058 (1927). Silica Gel Corp. Removing sulphur compounds from gas mixtures. (280,917.)

VIII.—Complete Specifications

*29,297 (1927). Vollkommer. Melting of enamels, frits, and glazes. (280,895.)

*30,428 (1927). Dents. Gasglühlicht Auer-Ges. Manufacture of articles of highly refractory material. (280,907.)

IX.—Applications

Hinton. Making cementitious material. 31,608. Nov. 24.
Lanes. Manufacture of bituminous macadam etc. 31,825. Nov. 25.

Longley and Watson. Cements etc. 31,618. Nov. 24.
Artificial stone etc. 31,619. Nov. 24.

Schenkel. Manufacture of artificial stone. 31,817. Nov. 25. (Ger., 19.2.27.)

IX.—Complete Specifications

5296 (1927). Urban. *See* II.

14,901 (1927). Doughty. Producing coloured cement. (280,813.)

X.—Applications

Internat. Nickel Co. Manufacture of carbon-free metals. 31,557. Nov. 24. (U.S., 19.5.27.)

Krupp Grusonwerk A.-G. Treatment of sulphide ores. 31,664. Nov. 24.

Lindhorst. Hardening iron etc. 31,242. Nov. 21.

Metropolitan-Vickers Electrical Co., Ltd., Baron, and Phillips. Production of aluminium silicon alloys. 31,707. Nov. 24.

Royen. Production of pure iron. 31,898—9. Nov. 26. (Ger., 14 and 15.12.26.)

X.—Complete Specifications

20,208 (1926). Western Electric Co. Magnetic materials. (273,628.)

20,250 (1926). Liban. Applying zinc coatings to iron articles. (257,262.)

20,677 (1926). Western Electric Co., Inc. Magnetic materials. (274,136.)

27,165 (1926). Dickel (Philips' Gloeilampenfabr.). Coating a body with platinum. (280,697.)

17,628 (1927). Titan Co. Akt. Treatment of titaniferous materials. (275,579.)

18,215 (1927). Soc. Ital. di Elettrochimica. Production of aluminium in electric furnaces. (274,108.)

18,706 (1927). Racheef and Gofmann. Chemical process for welding metals. (274,481.)

*28,392 (1927). Aluminium-Ind. A.-G. Electrolytic extraction of aluminium. (280,881.)

XI.—Applications

Bayes, Bentley, and Punter. Electrolytic cells. 31,532. Nov. 23.

Campbell, and General Electric Co. Photoelectric cells. 31,197. Nov. 21.

Chloride Electrical Storage Co. (Electric Storage Battery Co.). Secondary etc. batteries. 31,251. Nov. 21.

Clifton. Selenium cells. 31,614. Nov. 24.

Joel. Electric batteries etc. 31,350. Nov. 22.

Johnson (I.-G. Farbenind.). Production of electrodes for electric accumulators. 31,773. Nov. 25.

North. Electric furnaces etc. 31,543. Nov. 23.

Woodbridge. Separators for electrodes of electrolytic cells. 31,534. Nov. 23.

XI.—Complete Specifications

8176 (1926). Aletter. Producing electric lead accumulators. (268,366.)

16,006 (1927). Metallwerk Plunsee Ges., and Schwarzkopf. Electrical resistance furnaces. (272,933.)

18,215 (1927). Soc. Ital. di Elettrochimica. *See* X.

*28,392 (1927). Aluminium-Ind. A.-G. *See* X.

XII.—Applications

Imperial Chemical Industries, Ltd., and Scharff. Prevention of rancidity in vegetable oils etc. 31,520. Nov. 23.

Marks (Laster et Cie.). Manufacture of emulsions etc. 31,908. Nov. 26.

Oel- u. Fett-Chemie Ges. Treating tall oil. 31,208. Nov. 21. (Ger., 4.12.26.)

XII.—Complete Specification

*30,842 (1927). Baume, Chambige, and Bontier. *See* I.

XIII.—Applications

British Celanese, Ltd. Manufacture of thermo-plastic materials. 31,487. Nov. 23. (U.S., 29.12.26.)

Carpmael (I.-G. Farbenind.). Manufacture of synthetic resins. 31,395. Nov. 22.

I.-G. Farbenind. Preparing surfaces for reception of cellulose lacquers. 31,655. Nov. 24. (Ger., 24.11.26.)

XIV.—Complete Specifications

20,332 (1926). Potts (Koepp & Co.). Coagulation of rubber latex. (280,639.)

21,767 (1926). British Dyestuffs Corp., Cronshaw, and Naughton. Manufacture of vulcanised rubber. (280,661.)

XV.—Application

Alcan. Tanning-materials. 31,432. Nov. 23. (Belg., 23.11.26.)

XVI.—Applications

Johnson (I.-G. Farbenind.). Obtaining crystals in fertiliser salts. 31,639. Nov. 24.

Liljenroth. Producing fertilisers etc. 31,402. Nov. 22. (Sweden, 12.7.27.)

XVII.—Complete Specification

16,095 (1927). Elektro-Osmose A.-G. Purifying sugar solution. (272,943.)

XVIII.—Application

Cutlack. Sterilising pulp for filtration of beer etc. 31,564. Nov. 24.

XVIII.—Complete Specifications

*22,504 (1927). Claassen. Manufacture of baking-yeast. (280,861.)

XIX.—Applications

Barrett, Barrett, Crepin, and Felstead. Extraction of preservatives from liquid food. 31,895. Nov. 26.

Johnson (I.-G. Farbenind.). Production of vitamin D. 31,219. Nov. 21.

Kjaergaard. Manufacture of feeding-cakes. 31,527. Nov. 23.

Whatmough. Manufacture of fruit preserves etc. 31,792. Nov. 25.

XIX.—Complete Specifications

12,708 (1926). Bartmann. Treatment of cereals. (280,605.)

8930 (1927). Posternak and Posternak. Separating and purifying the three phosphorus-containing bodies derived from the proteids contained in egg yolk. (268,806.)

*22,504 (1927). Claassen. See XVIII.

XX.—Applications

Arnold (Standard Oil Development Co.). Manufacture of esters. 31,246. Nov. 21.

Carpmael (I.-G. Farbenind.). Manufacture of ortho-aminophenylmercaptans. 31,540. Nov. 23.

Klapproth. Purification of lactic acid. 31,342. Nov. 22. (Ger., 22,11,26.)

Schering-Kahlbaum A.-G. Manufacture of thymol. 31,231. Nov. 21. (Ger., 22,11,26.)

Selden Co. Catalytic oxidation of organic compounds. 31,605. Nov. 24. (U.S. 24,11,26.)

XX.—Complete Specifications

17,156 (1926). Newbery, and May & Baker, Ltd. Manufacture of organic compounds of arsenic. (280,613.)

27,014 (1926). I.-G. Farbenind. Manufacture of alkaline esters of *n*-substituted ortho-aminobenzoic acid. (260,605.)

10,085 (1927). Rubber Service Laboratories Co. Manufacture of acetaldehyde and of acetaldehyde-amine condensation products. (269,556.)

*30,799 (1927). Schering-Kahlbaum A.-G. Manufacture of thymol, its isomers or homologues, and their hydrogenation products. (280,924.)

*31,231 (1927). Schering-Kahlbaum A.-G. Manufacture of thymol or its isomers and their homologues, and their hydrogenation products. (280,956.)

*31,342 (1927). Klapproth. Purification of lactic acid. (280,969.)

XXI.—Complete Specifications

11,980 (1927). I.-G. Farbenind. Manufacture of photographic plates or films. (275,933.)

*27,509 (1927). I.-G. Farbenind. Photographic developer. (280,873.)

XXII.—Applications

Matter. Explosives. 31,819. Nov. 25. Manufacture of heavy metal azides. 31,820. Nov. 25.

XXIII.—Application

Buckle. Treatment of water containing materials in suspension. 31,621. Nov. 24.

XXII.—Complete Specifications

21,935 (1926). Scheidt. Sterilising liquids by means of ultra-violet rays. (257,956.)

24,731 (1926). California Fruit Growers Exchange. Insecticides and fungicides. (267,878.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*British India*: Artificial silk yarn (451); Steel (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Colombia*: Zinc roofing (A.X. 5554). *Germany*: Shellac (458). *Hungary*: Artificial silk yarn (461). *Lithuania*: Bronze wire (A.X. 5552). *South Africa*: Steel plate tanks (A.X. 5565); Structural steelwork (A.X. 5566); Anti-friction grease (B.X. 4020). *United Kingdom*: Indian gum tragacanth (Indian Trade Commissioner, 42, Grosvenor Gardens, London, S.W.1, Ref. I.T.C., 51261).

Solvents and Plasticisers in the Cellulose Lacquer Industry

Messrs. W. J. Bush & Co., Ltd., and the Methylating Co., Ltd., announce that they have merged their interests in the manufacture of solvents and plasticisers used in the cellulose lacquer industry.

Safeguarding of Key Industries

There will be a hearing on Tuesday, January 17, of the complaint which the Board of Trade has received under Section 1 (5) of the Safeguarding of Industries Act, 1921, that calcium biphosphate (baking powder quality) has been improperly excluded from the list H ii. of articles chargeable with duty under Part I of that Act, as amended by Section 10 of the Finance Act, 1926. The hearing will take place at 11 a.m. in the Main Conference Room, Board of Trade, Great George Street, London, S.W.1, and the tribunal will consist of Mr. A. A. Hudson, K.C., the Referee, and Prof. F. G. Donnan, C.B.E., F.R.S., and Prof. J. F. Thorpe, C.B.E., F.R.S., who have been selected by the Lord Chancellor for the purpose of this arbitration from the panel constituted under Section 10 (4) of the Act of 1926.

News from Advertisements

The Sir John Cass Technical Institute invites applications for the post of lecturer in inorganic and physical chemistry (p. vi).

Applications are invited from mechanical draughtsmen (p. vi).

A chemist is required for confectionery works (p. vi).

Various sets of the JOURNAL etc. are required (p. vi).

There are now 129 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

CENTENARY ADDRESSES BOUND TOGETHER IN ONE VOLUME.

With a Preface by Dr. R. W. Chambers. University of London, University College. Pp. viii + 355. London: University of London Press, Ltd., 1927. 12s. 6d.

ARCHIMEDES OR THE FUTURE OF PHYSICS. By L. L. Whyte.

Pp. 96. New York: E. P. Dutton & Co.; London: Kegan Paul, Trench, Trubner & Co., Ltd., 1927. 2s. 6d.

THE PHASE RULE AND ITS APPLICATIONS. By A. Findlay

M.A., D.Sc., F.I.C. Sixth edition, revised and largely re-written. Textbooks of Physical Chemistry, edited by Sir W. Ramsay, K.C.B., D.Sc., F.R.S., and F. G. Donnan, C.B.E., M.A., Ph.D., F.I.C., F.R.S. Pp. xv + 326. London: Longmans, Green & Co., Ltd., 1927. 10s. 6d.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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No. 50

EDITORIAL

More About Research

WE are very grateful to Professor Thorpe for the information contained in the letter we publish in this week's JOURNAL, and are glad to explain more fully what we really meant by our recent editorial. Our statement was, substantially, that most of the research conducted by students was valuable as a training for them, but of no great value to others, and that, subject to this, we had the highest opinion of the research carried on by the Universities. Having now learned that students do not, as we supposed, conduct research, we must withdraw any qualification, and we are now enabled to express our highest opinion of the research carried on by the Universities. Our opinion, which must be valuable, otherwise no one would take the trouble to correct it, is based on the great advance which chemistry has made during many years, an advance in which this country has been prominent, and on the admirable papers published in the proper journals. Our loose way of using the words "research" and "conduct" is responsible for our ambiguity, and it was aggravated by our ignorance, which we mentioned. If we had stated that students assisted in research, probably we should have escaped the pit into which we fell and from which Professor Thorpe rescues us. We have a vague recollection of hearing of "research students", probably as incorrect as many of our other recollections; also we think we have met with comparatively young chemists who have told us of the research they did in the days when they were still in *statu pupillaris*. We attach no importance to these statements. If we were a few, say twenty, years younger and a happy student at some University, how we should enjoy being allowed to conduct a piece of research? It would teach us a great deal; but now our brain is not so receptive as it was; we have given hostages to fortune and cannot spare the time to widen our experience in this way. We are not yet vain enough to think that our research would have been of any value, except to ourselves. Professor Thorpe tells us that students work at problems which are part

of a general scheme of research. We feel sure that the Universities do not do the main thinking, leaving the student merely to carry out a set of specified experiments: this would, no doubt, facilitate the research, but would relieve the student of too much responsibility. From the point of training the more responsibility the student has had at the University, the better fitted he will be to undertake research in the works laboratory. In all probability Professor Thorpe's facts and opinions do not differ from our own; the main difference is that he knows the facts fully, and we do not, and that we use the word "research" in that vague sense current among manufacturers, and he uses it in the precise sense prevailing in academic circles.

The Government and Research

We have been gently chided also for writing that the Government was lavish in its expenditure on research. This opens up a difficult question, exposes it to criticism, as it were; and it would require several columns, more than we can spare this side of Christmas, to sketch even lightly our views on this topic. The Army, the Navy, and the Air Force are becoming more and more dependent upon chemistry and chemical research. In this country, as in America, chemistry is called in to protect the Inland Revenue Department, that none who dwell beneath the spangled banner shall rob the Customs of a single tanner! Chemical research is essential to the Board of Trade and the Office of Works, and if our great coal problem, a political problem of the first importance, is solved, it will be by the chemist, the chemical engineer and the man of business, not by the politician. Such requirements cause the Government to spend considerable sums on research, and it seems to us that this money is usually wisely and economically spent. On the other hand, we have come across instances where the Government has been in the habit of spending a sovereign when to us, with no exact knowledge, it seemed that it only got five shilling's worth of value. This is what we call lavish expenditure. The prosperity of the nation, the worldly hope men set their hearts

upon, demands in these times a hard-hearted man who is quite prepared to spend money on research until captive science yield her last retreat, but grudges a waste of money even in the pursuit of so laudable an object. It is hard to lay down general rules—one man's waste is another man's income, as the proverb has it; it is still harder to give specific instances, that let no man expect. there are times in the history of governments, as there have been times in the history of companies and societies, when economy is of the greatest importance. But who can think of economy at Christmas time! Perish the thought! When we write our prose ode on the departing year, let us choose a more exhilarating key, something that fits the clarion or trombone; we have had enough of the dying notes of the oft-complaining flute.

The Ionoclast

There is a small and select body of men which is determined on a number of reforms in chemical thought and chemical verbiage. One special reform is the use of the word "ion," on those few occasions when its use is justified at all, in the sense used by Faraday seventy or eighty years ago. To this small but not silent band many of the modern conceptions of physical chemistry are vague and misleading phantasmagoria: there is an old chemistry, the chemistry of Dalton, Lavoisier, Frankland, and Hofmann, a chemistry to which the atom was nearly sufficient and in which the word "ion" played a very small part. This chemistry seems to be the only chemistry which those who detest the ion and the ionic nomenclature consider as of much value: they are out to put the ionists and the ion in their proper place, which we suppose to be the gutter. These ionoclasts are hardy and bold and quite unaccustomed to fear: they include Prof. H. E. Armstrong, Calorier, Struwpeter Redivivus, and a few other chemists who write in these columns and in other columns to which they have access. As a rule, their unanimity is admirable: they hardly ever contradict each other, and this, the only present, school of philosophers, like the old Cynics or Epicureans, has its own traditional language, favourite authors and peculiarities. Of this school Prof. H. E. Armstrong is the founder, and he has impressed himself so strongly on his followers that their literary effusions are often mistaken for his own. We are not clear whether Sir Ernest Rutherford, Prof. Lowry, and the other writers who are now put in the pillory will mend their ways or not; for their own peace of mind and the advancement of knowledge it is to be hoped that they will, perhaps they are old enough and determined enough to fend for themselves, whether this is so or not, we feel that the chief ionoclast will persist with his efforts until chemists and physicists adopt the meaning of the word "ion" acceptable to him. The Archbishop of York recently stated, amid laughter, "It requires a man in full vigour to do anything quite so strenuous as to retire. When that time is past, a man generally drifts into the position of having only one desire, and that is to prove to people that he can do things which everyone knows he cannot." One of Prof. Armstrong's followers gives us a good dressing down this week for the ambiguity of the language

of lawyers and, in particular, our humble selves. This is one of the few occasions when there is a lack of harmony between two members of the school, for the professor has often deplored to us that chemists were not as precise in their language as lawyers. We recollect a sentence or two of Hobbes in which he speaks of the absurdities to be found in the books of philosophers. "And the reason is manifest. For there is not one of them that begins his ratiocination from the definitions or explications of the names they are to use: which is a method that hath been used only in geometry, whose conclusions have thereby been made indisputable." Also, "metaphors, and senseless and ambiguous words, are like ignes fatui: and reasoning upon them, is wandering amongst innumerable absurdities; and their end, contention, and sedition, or contempt." We quote these words with approbation, for we prefer precise words ourselves.

We are satisfied that, as a body, lawyers are as precise in their use of words as scientific men, and the banter of Struwpeter on this matter does not disturb us in the least. In all matters of the use and meaning of words, of grammar, of arrangement of words, and such attempts at style as are suitable for an editor, we have only one standard. It is a standard to which, of course, we do not always attain: it is better to have an ideal that is a little loftier than one's practice. Our standard is the usage of those writers who, in present times, are careful of their writing, and may be considered as masters in their art: so far as scientific terms are concerned, the only standard we recognise is the modern usage of scientific men. We admit that we have a few fads of our own: we do not object to a few fads, probably our own fads verge on pedantry: this is immaterial. In a living language like English, each writer will choose his own class of those whose works are to form a standard. Struwpeter refers us to a dictionary for a definition of the word "theory": we do not know who wrote this passage nor when: it does not matter to those who think as we do, if those scientific men who are careful in their writing, who write easily and gracefully, use the word theory only in the sense Mr. S. quotes, then we think we ought to do the same. We merely quoted Lyell and Faraday and Darwin as writers belonging to the type we have in mind. We could quote in addition Sir Edward Thorpe, Prof. Aston, Prof. Dale the astronomer, Profs. Dawson, Briscoe, Whiddington and Robinson, and probably a good many more. Mr. S. - or is it Prof. S! - wishes us to write in "immutable" words: we recall a passage written about two hundred and thirty years ago by a very learned man: "Every living language, like the perspiring bodies of living creatures, is in perpetual motion and alteration: some words go off, and become obsolete: others are taken in, and by degrees grow into common use; or the same word is inverted to a new sense and notion, which in tract of time makes as observable a change in the air and features of a language, as age makes in the lines and mien of a face." The exact meaning to be attributed to the word ion, to the word theory, and to other words, depends on the employment of these words by a numerous body of men, and we think that the ionoclasts can do very little to affect the result. We trust, with some degree of confidence, that this will not deter them.

OIL POLLUTION OF SEAS AND HARBOURS—AND A REMEDY*

By C. S. GARLAND, B.Sc., A.R.C.S., F.I.C., M.I.Chem.E.

That so much of the advance of civilisation during the past thirty years depends upon the application of oil as a source of motive power is of special interest to this country, which, with its island position and having practically no natural sources of petroleum, depends upon supplies of oil carried to its shores. This absence of natural sources of oil and the long experience of steam engines deriving their power from coal-fired boilers, accounts for the comparative slowness with which British shipping, extremely jealous of its high reputation for reliability, has adopted oil as a source of power for marine propulsion, either for the raising of steam under boilers or in internal combustion engines. The advantages of oil fuel in respect of the weight and size of machinery, the convenience of handling and stowing, as well as in increased speed, are, however, now generally recognised. The rapidity with which the world's shipping is being converted to oil burning is shown by the increased tonnage of oil-burning vessels, the total for 1926 being more than fourteen times that for 1914

	Oil fuel steamers	Motor ships	Total
1914	1,306,000	245,000	1,551,000
1919	5,300,000	752,000	6,052,000
1926	18,200,000	3,190,000	21,390,000

Of the total tonnage at present building in this country 35.5% is oil-driven, the corresponding percentage for the more important Continental shipyards being 55.5%. Although experiments are being made in the use of powdered coal for ship propulsion, and in the application of higher steam pressures from coal-fired boilers, it appears almost certain that within the next fifteen or twenty years practically the whole of the world's shipping will depend upon oil as the source of power.

Few such revolutionary advances have been made which have not carried with them some compensating disadvantage, and without question one of the greatest objections to the extended use of oil in this way is the pollution of the seas to which it has given rise. There are three principal sources of pollution:

A. Discharge of oil contaminated ballast, bilge and other water;

B. The cleaning and flushing of oil tanks at sea;

C. Accidents, both to the ships themselves, and more particularly to tankers' valves and pipe lines during the fuelling operation. The use of the oil tanks for carrying ballast water, when the ship has consumed the bulk of the oil and when it is light of cargo, and the carriage of oil in the otherwise useless space of the double bottom, offer such advantages as would ensure their general adoption, but for the absence of facilities for pumping out this ballast water in port.

The practice of carrying refuse, sewage and other waste materials out to sea to be dumped is so universal as naturally to give rise to the question why refuse oil cannot be dealt with in the same way. We are indebted to the United States Bureau of Mines for an

extensive investigation of this question, in the course of which samples of crude oil and of Diesel oil suitable for motor ships were agitated in thin films for many months on the surface of sea water, simulating as nearly as possible the condition of oil on the surface of a wind-swept sea. The result showed conclusively that the oil was indestructible, and the summary of the report stated "The Bureau experiments showed that when heavy asphaltic fuel oils are agitated with sea water, viscous emulsions are formed which, after months of standing, continue to float on the surface of the water." Unlike other sources of pollution, therefore, the contamination of the sea by oil is persistent and cumulative.

The fact of oil pollution is undoubted, and frequent and serious representations have been made by the authorities of the sea coast towns, particularly in this country and America, for the compulsory application of some means of avoiding the nuisance. In both countries legislation has been passed to deal with the problem. In this country, under "The Oil in Navigable Waters Act" (1922) it is an offence for oil to be pumped overboard from any vessel within British territorial waters. In an official report published by H. M. Board of Trade in 1925, following an inquiry, the statements of more than sixty local authorities from the more important sea-coast towns were given, serious complaints being made of the pollution of their beaches, of the wholesale destruction of fish and sea birds, of harbour fires and the destruction of fisheries, and of bathing being rendered impossible at certain states of the tides. In the United States a similar enactment, "The Oil Pollution Act, 1924," provides for the punishment by a fine not exceeding \$2500, nor less than \$500, with or without imprisonment not exceeding one year nor less than 30 days, for each offence of discharging or permitting the discharge of oil upon the coastal navigable waters of the United States, and the report to the Secretary of State for the purpose of the International Conference in Washington in 1926 gave abundant evidence showing that the evil of oil pollution was felt to an even greater extent in the United States than in this country.

The effect of pumping oil overboard from seagoing ships can be summarised as follows:

1. Loss of valuable oil.
2. Danger of fires in harbours and creeks and increased fire risks to wharfs and quays, through the accumulation of masses of waste oil.
3. Damage to the paintwork of boats, yachts and structures on the sea board.
4. The destruction of fishing nets and the driving away of fish from the natural feeding grounds by the presence of oil; also the destruction of immature fish, and particularly of shell fish in their motile condition, by the exclusion of air by the surface layer of oil.
5. Discomfort to bathers and other users of the beach and damage to their clothes and boots, with the resultant loss to the livelihood to those depending upon the seaside.

* Read at the Joint Meeting of the Chemical Engineering Group and the Liverpool Section at Liverpool on Dec. 10, 1927.

6. The destruction of sea birds, which die a lingering and painful death through the feathers becoming impregnated with oil.

Of these, the last, which is, perhaps, of the least importance economically, at the same time constitutes the greatest reflection upon our civilisation. "Those who



FIG. 1

frequent our coast have no need of the great mass of evidence of the cruelty to sea birds due to the continued discharge of oil. In such places, particularly the Isle of Wight and the Firth of Forth, and, in fact, all round our coast, the sight of dead or dying sea birds, with their feathers clogged with oil, is so common that the societies whose special function is to protect bird life and prevent cruelty to animals are insistent that effective measures



FIG. 2

should be taken to deal with this problem. There is no means of escape when once the plumage of the bird is fouled. On one day in May, 1925, 27 birds were seen dead, coated with oil, between Filey and Hunmandley Gap (a distance of about 1½ miles). Mr. H. S. Gladstone, M.A., F.Z.S., has found, in addition to guillemots, razor-

bills and scoters, a number of puffins, eiders, long-tailed ducks, gannets, and even some wagtails and starlings, and other and rarer birds, which have met their death by contact with waste oil. The photograph, Fig. 1, shows birds washed up on to Freshwater beach during a single tide, and Fig. 2 shows another bird which must have died in agony from the same cause.

This loss to seaside communities and the injury to health of the bathers affected are factors of some national importance. Reports from sea coast towns of the great interference with bathing are almost universal around the coasts of England and America. Bathing at Stanshaw, Portsmouth, is reported to have been completely stopped owing to oil from Portsmouth Harbour. The trouble has been noticed, also, at Mablethorpe, Sheringham, Aldeburgh, Felixstowe, Walton-on-Naze, Clacton, Herne Bay, Margate, Broadstairs, Ramsgate, Dover,

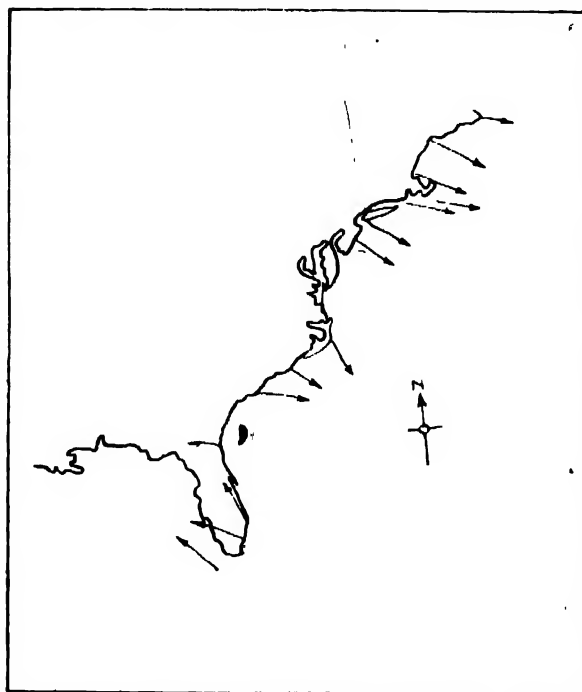


FIG. 3

Folkestone, Hythe, Bexhill, Seaford, Brighton, Worthing, Littlehampton, Bognor, the Isle of Wight, Portsmouth, Crofton on Southampton Water, Swanage, Weymouth, Teignmouth, Salcombe, Ilfracombe, Colwyn Bay, St. Annes, and Blackpool.

At one point where careful records were taken, it was shown that of one hundred possible bathing days, bathing was rendered impossible on twenty-three owing to the presence of oil, and the actual loss in destroyed bathing suits and towels at one bathhouse in Galveston, Texas, was estimated at \$2000 in a single season.

While our compassion is aroused by the sight of sea-birds starving to death or a helpless prey to their natural enemies on account of their inability to fly, and public feeling protests against the discomfort experienced by bathers meeting a patch of waste oil, the economic side of the question is even more serious. It has been

estimated that the total loss of oil discharged into the sea every year amounts to no less than 500,000 barrels, worth, approximately, £250,000, and the United States Shipping Board gave, in December, 1925, an estimate that if only half the ships entering New York Harbour in ballast, pumped out that ballast in the harbour, there would be poured into the harbour 5500 tons of oil annually. On the assumption that the ship would normally commence to pump ballast water 12 hrs. before entering the three-mile limit, and taking into account the prevailing winds along the Atlantic Coast, which are mostly off-shore, as shown in Fig. 3, the estimate was made that the total quantity of this oil which would be permanently washed on to the New Jersey and Long Island shores would be, allowing for ballast water alone, some 1.65 lb. of oil for each linear foot of beach per annum, or, estimating the other sources of oil pollution, a total quantity of 2 to 3 lb. per foot could be expected. This would account for only some 17% of the total oil pumped from the ships entering New York Harbour, but no suggestion is advanced as to the destination of the other 83%, which, on account of its indestructible nature, must eventually be carried by tide and wind to some shore.

Risk of fire is emphasised in a report from Liverpool, and in the fact of two fires directly traced to oil in Portsmouth Harbour, and is supported by the statement of the New York Fire Department, "that this is still the greatest fire hazard with which they have to contend." A special report on fires resulting from oil pollution was made by the United States Bureau of Mines to the Inter-Departmental Committee at Washington in 1926.

The presence of oil is undoubtedly the reason for those movements of the feeding grounds of the fish which have been very noticeable within the last ten or fifteen years, so much so that in many instances fishing fleets have altogether left certain districts and in others they have to go very much further afield for their catch, both resulting in higher costs and prices for fish. This results in raising the cost of living, not only directly, but indirectly, by creating an increased demand for meat and other foods, most of which have to be imported. Oil pollution thus has an undoubted, though perhaps small, effect on those of our present industrial troubles which arise from the high cost of living.

Whilst the evidence as to the destruction and driving away of fish and the destruction of fishermen's nets is overwhelming, there has been some difference of opinion as to whether oil had any deleterious effect upon the fish themselves. This matter seems to have been definitely settled by the work (published in 1926 in the *Journal du Conseil International pour l'Exploration de la Mer*) by Mr. D. Hayden Roberts, who made a series of tests with three-inch fish to ascertain the result of immersing them in sea water in which a range of oils varying from thin Diesel oil to the heaviest asphaltic crude oil had been shaken up. In all cases the fish rapidly lost equilibrium and subsequently died, in periods varying from 3 to 26 min.

Stephen has shown that pelagic larvæ, such as plaice and flounders, are adversely affected in water covered with a film of paraffin 0.03 mm. thick.

Weigelt showed that fish completely disappeared from pools and lakes into which mineral oil was discharged.

Jee and Roberts found that fresh water shrimps are killed by contact with fuel oil, and that caddis larvæ and fresh water shrimps are killed by contact with fuel oil extract. At the last Colchester oyster feast, 1927, the limiting of the supply of oysters to six per person for, it is believed, the first time in the history of that function, was stated to be due to the adverse effect on the oyster beds of oil pumped from ships.

The price and scarcity of oysters in this country and the United States provide evidence that their development has been impeded by some cause of recent occurrence, and this supports the belief, based on experiments, that oil has a very harmful effect on the development of these molluscs while in their immature and motile state. The oyster industry of the United States is estimated to produce over 15 million dollars worth of food per year, or the equivalent of 400,000 dressed oxen, while the total value of the fisheries products of the United States approximates to 80 million dollars per annum. One investigator, reviewing the problem in the broader sense, considers that "oil, gallon for gallon as thrown out, to be the most destructive to aquatic life of all the foreign substances now entering coastal waters."

Before discussing the methods of dealing with the problem, it is, perhaps, useful to analyse exactly what has to be done. Large oil-using ships will pump from 1000 to 2000 tons of ballast water at the end of each voyage, and this will normally be carried in tanks of up to 200 or 250 tons capacity. The average content of oil in each tank will be from 2 to 3%, and the bulk of this (probably 95%) will be floating on the top of the water, and will be discharged in a body when the bottom of the tanks is reached. It has been demonstrated that this 95% of the oil is in masses averaging more than 0.2 mm. in diameter, which will rise to the surface of the mixture, if eddy currents are avoided, in from 1 to 2 min. The balance of 5% or so of the oil can be divided into two forms, which the American Bureau of Standards has designated as "suspended" and "emulsified" oil. The suspended oil, consisting of particles of from 0.01 to 0.2 mm. in diameter, which will settle out in water free from disturbing currents in 2 to 4 hrs. There remains a small quantity (0.1 to 0.5%) of oil in a truly emulsified form, which is still completely dispersed in the water even after months of standing in a quiet condition.

On the score of economy it is important that the time lost in port between voyages should be as short as possible, and one of the great advantages of oil—the rapid fuelling of the ship—would be lost unless the oil tanks can be rapidly emptied of ballast water. This pumping operation should not occupy more than 10 hrs., and the oil-water mixture must therefore be dealt with at a rate of 100 to 200 tons an hour, and must give an effluent of such oil content as not to produce a film on the surface of the water. The thickness of oil films has been studied particularly by Lord Rayleigh, Devaux, Hoog, Hardy, and Langmuir, and Devaux estimates that an oil film has an ultimate thickness of about 1×10^{-7} cm., while D. H. Roberts has prepared, in the course of his experiments, oil films having a thickness of 0.0000195 cm. On this basis, 1 gall. of fuel oil would produce a film over an area of more

than 1100 acres, so that the permitted oil content of the effluent water should be extremely low. The specification of H.M. Admiralty for a satisfactory plant demands a continued test at the full rated output of 200 tons an hour, for 10 hrs., with an oil content in the ballast water varying from the normal washings of a tanker, say 5% up to 15%, of Navy fuel oil, the average content of oil in the effluent water not to exceed 0.0005%, i.e., 1 part in 200,000.

With a problem of this magnitude and importance there have naturally been many attempts to produce satisfactory plants for the purpose, and the development is, perhaps, best traced from the records of the patent journals, where we find that the first patent was taken out by I. F. McDougall in 1892, which, in common with the "Rocket" separator of H. M. Alexander, patented in 1923, the White-Conyn separator of 1923, and the H. & H. Dehydrator of 1924, depended upon the tendency of the oil to rise through the water and up a channel decreasing in sectional area, or up the sides of a cone to the oil outlet. The illustration (Fig. 1) of the "Rocket" separator of H. M. Alexander is typical of this form of construction.

Another type illustrated by the J. Nicolaussé patent of 1903 (Fig. 5), including that of W. E. Lake of 1904, and the Pirbright separator patented by F. Pink in 1923, and to some extent also the J. H. Palmer patent of 1921, follow a different method, in which the mixture is made to pass along the bottom of a rectangular tank of cross section gradually decreased by an inclined roof, the oil being arrested by a series of baffles across the length of the tank and ascending, passes in a direction opposite to that of the mixture along the inclined upper surface of the tank to the oil collecting point. The Nicolaussé separator can be taken as typical of these, although

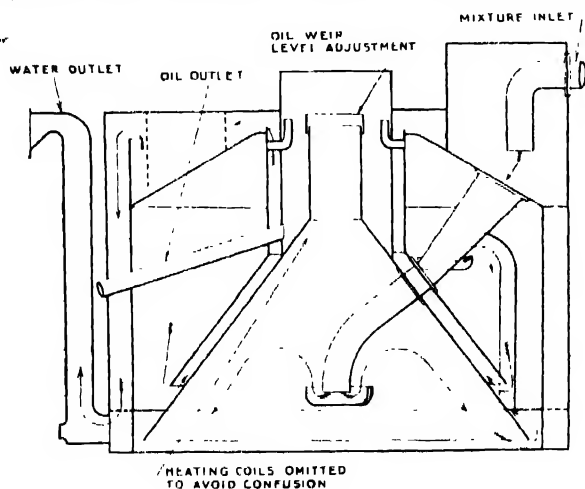


FIG. 4

certain of them incorporate other features, such as heating coils for the oil, air vents and automatic oil discharge gear.

Two other types of separator were produced prior to 1925, the one illustrated by the Sir James McKechnie patent of 1923, consisting of a series of concentric passages through which the oily mixture is made to pass, the oil ascending to the top of the vessel, which

is inclined to facilitate its collection at a central discharge point. Another type is illustrated by the Conduit separator of R. C. Knight and H. C. Smith of 1923, and the Fisher separator, an American invention, both of which provide a long vertical passage for the oily mixture, in the latter the separation of the oil being

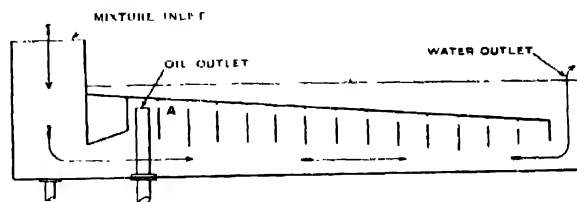


FIG. 5

facilitated by a spiral screw to the lower surface of which it is intended the oil shall adhere in the passage of the mixture through the apparatus.

One characteristic of all the designs mentioned is that increase in capacity can be obtained only by increasing the size of the vessels, and therefore the cross sections of the passages through which the oily mixture has to pass. It is obvious from the figures given of the size and time for separation of the bulk floating and emulsified oil respectively, that one essential feature of a satisfactory separator must be the absence of eddy currents, as if there is any substantial amount of eddying the oil particles, even of moderate size, cannot be separated by gravitation. A consideration of the designs shown would indicate that the baffles, while reducing the effective cross section of the separators, would tend to promote rather than to reduce eddying, but in any case the throughput demanded in practice from these plants is such as to render steady flow out of the question. Applying the well-known criterion of Reynolds to determine the limiting velocity at which steady streamline flow is possible in a circular pipe, we have where v = the velocity of flow, d the diameter of the pipe, μ the viscosity and ρ the density of the fluid $\frac{vd}{\mu/\rho}$ must not be greater than 2000.

For water at normal temperature the substitution for μ/ρ gives :-

vd must not be greater than $\frac{1}{40}$ ft.²/sec. The volumetric rate of flow Q through a pipe of diameter d is $\frac{\pi d^2}{4} \times v$.

Hence we see that Q must not exceed

$$\frac{\pi d}{4} \times \frac{1}{40} \text{ ft.}^2/\text{sec.}$$

$$\text{or } \frac{\pi d}{160} \text{ ft.}^3/\text{sec. if } d \text{ is in feet.}$$

* For a throughput of 200 tons per hour d is obtained from the equation :-

$$\frac{200 \text{ tons}}{\text{hour}} \times \frac{35 \text{ cb. ft.}}{\text{ton}} \times \frac{\text{hour}}{3600 \text{ secs.}} = \frac{\pi d^3}{160} \text{ cb. ft./sec.}$$

$$\text{i.e., } d = \frac{200 \times 35 \times 160}{3600 \pi} = \text{approx. } 100 \text{ ft.}$$

so that if eddying is to be avoided in a simple, circular

pipe, which in itself offers the best conditions for streamline flow, for a throughput of 200 tons per hour, the diameter would have to be 100 ft., and for any cross section other than circular the dimensions would need to be even greater.

It is obvious, therefore, that unless special precautions are taken to avoid eddying, the cross section of these types of separator must be extremely large for a reasonable output. Further, very misleading results may be obtained by experiment on small-scale models, in view of the fact, not always appreciated, that for steady conditions the permissible throughput increases only as the diameter, and not as the square of the diameter, as would perhaps be expected.

In the separator invented by Hele-Shaw and Beale in November, 1925, this difficulty has been avoided by providing for increased throughput by the multiplication of the same standard tube unit, which is used even in the smallest sizes, and as the number of tubes which can be packed into a given space varies as the square of the diameter streamline conditions can be maintained in machines of reasonable size.

In its simplest form the separator consists of a cylindrical vessel containing a large number of tubes of small diameter ($1\frac{1}{2}$ in.) arranged between two tube plates so placed that the whole of the oily mixture flows through the tubes. The tubes are perforated along their upper surface to provide for means of egress of the collected oil into still water, there being a direct connexion between the dead space round the tubes and the oil collecting outlet. The length and diameter of the tubes are so arranged that steady streamline flow is ensured when the separator is working at anything up to 50% above its rated output, while the dimensions of the whole plant are adjusted so that there is ample time during the passage of any given volume of oily mixture through the plant for the complete separation of all the oil which can be removed by gravitational means.

It has been recognised for some time past that it is impossible, without the aid of a filter or some coagulating device, to remove from the water the last traces of emulsified oil, and to bring performance to the very high standard needed if the formation of oil films is to be prevented. Various means for removal of this last trace of oil have been suggested, including electrical precipitation, depending upon the slight electrolysis of the water, in which it was hoped that the liberated ions would carry the oil to one of the electrodes, precipitation by alumina, and the filtration of the resulting precipitate with which the oil would be entangled, and the use of plain filtration methods, through cotton wool, felt pads, cow hair, and layers of cotton or linen towelling. All these methods have met with some success, particularly on the small scale, but the conditions of large throughput with low back pressure have militated against the use of materials which have a tendency to felt, whilst the objection to the towelling is high back pressure and the cost and trouble of frequent renewal. It has been suggested that the organic fibres mentioned could be effectively cleaned by organic solvents, but this would necessitate removal from the filter, and would seem to prevent their convenient application, especially on ship-board.

A type of filter has been devised to work in conjunction with the Stream-Line oil separator, which depends upon the adhesive properties towards oil of the surface of glass silk. The actual construction of the filter unit is shown in Fig. 6. The glass silk, the filaments having a diameter of 0.009 in., is pressed into an annular basket consisting of galvanised wire mesh or galvanised expanded iron, so arranged that the thickness of the glass silk layer is equal throughout. The advantages of this material

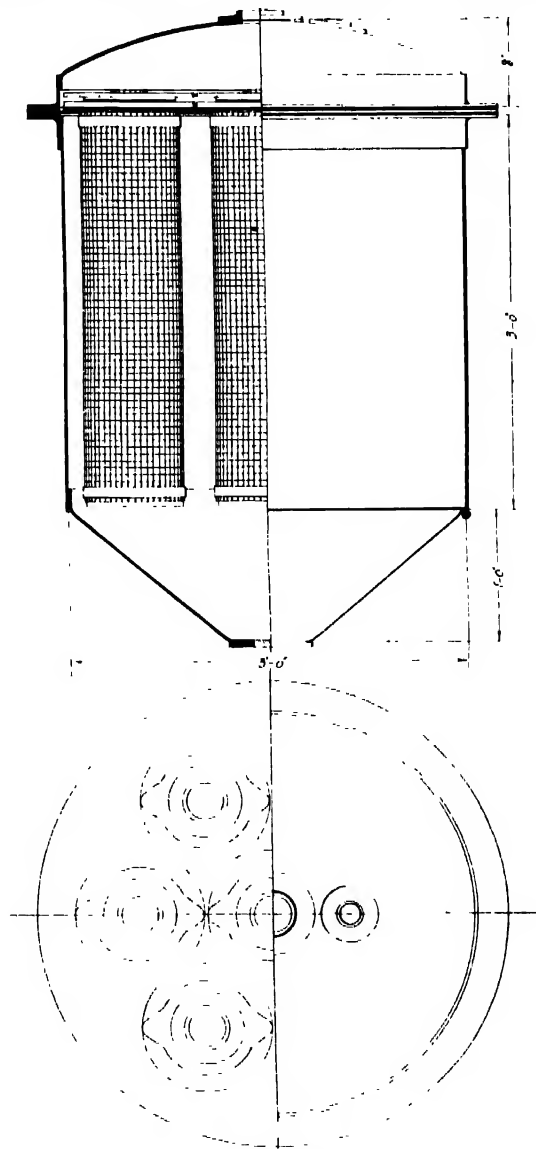


FIG. 6

are (1) it has the very high surface area of over 9000 sq. ft. per lb. (2) It will deal with a very large quantity of water before needing cleaning, as each lb. will attract to itself 2.83 lb. of oil before becoming clogged. (3) Its back pressure is negligible, and on account of its structure it does not tend to pack down and impede the passage of water, even after long use. (4) The glass silk is not in any way injured by steam, so that the filter can be completely cleaned by reversal with steam, which

removes the oil and leaves the surface of the glass silk in a condition to take up readily further quantities of oil.

A number—usually three or seven—of these filter

separates as bulk oil. The efficiency of this steam-cleaning operation is illustrated in Fig. 7, taken from the records of a 50-ton unit, which has run continuously

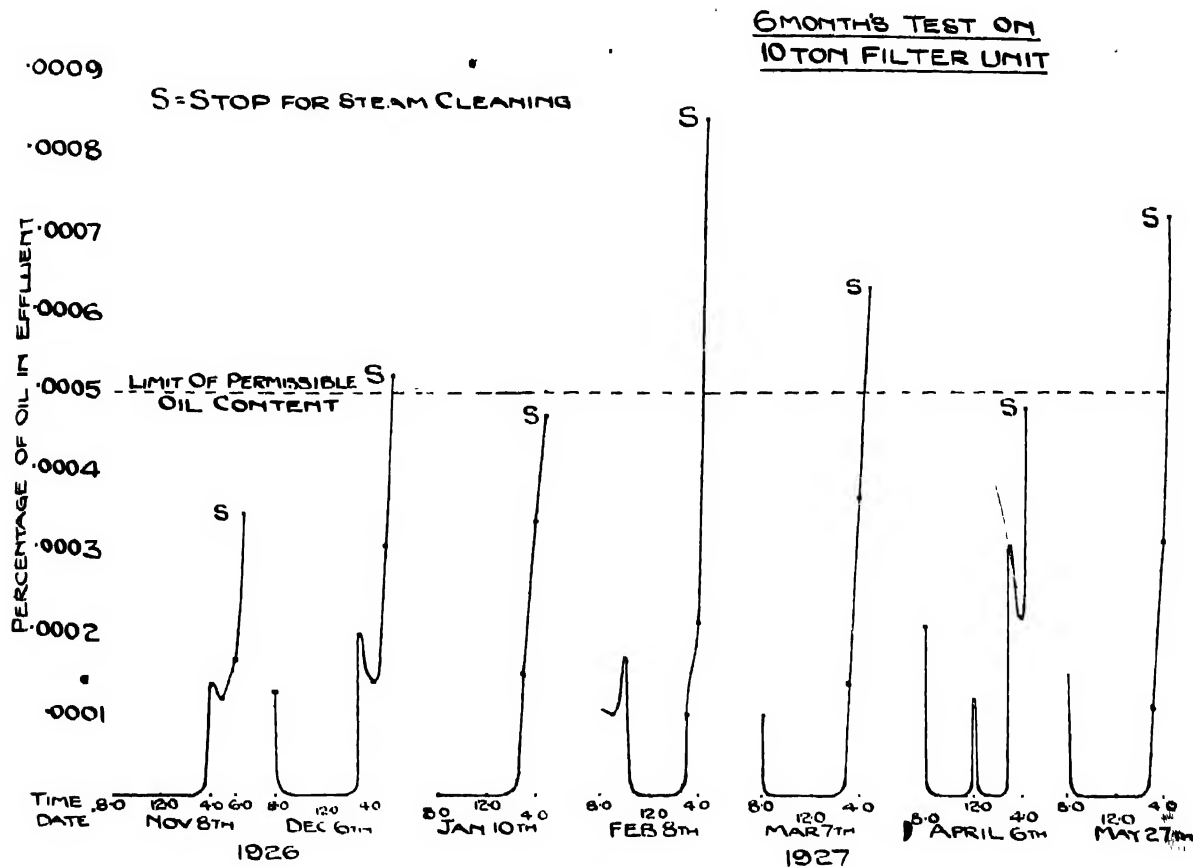


Fig. 7

units is suspended in a mild steel rivetted or welded casing from a top plate by means of a cast-iron top member. This facilitates drainage of the elements during the cleaning operation, when steam is admitted

from November 8, 1926, to May 27, 1927, 10 or 11 hrs. a day, of which from 9 to 10 represented running times with an oily water from the separator, containing from 0.001 to 0.004% of oil. It was not anticipated, when

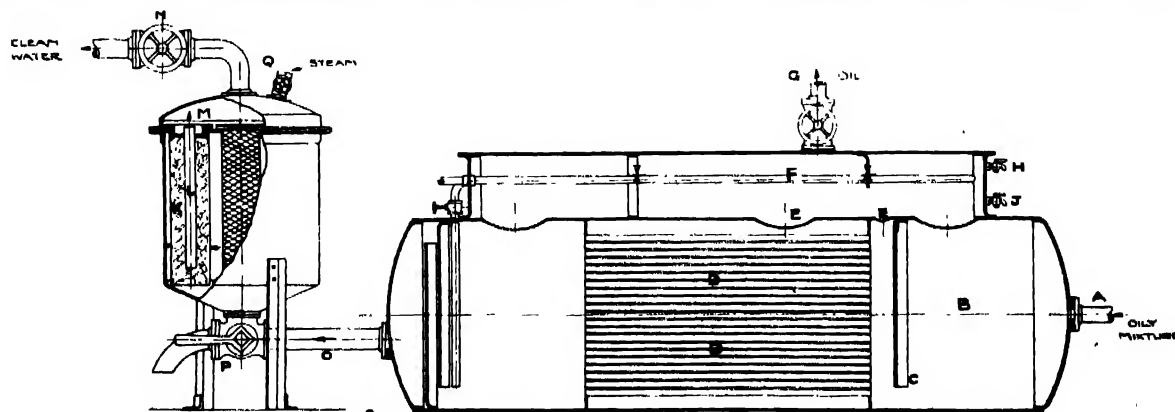


Fig. 8

in the reverse direction and blows out the collected oil, which runs into the bilges, from which it is in due course pumped through the separator and at once

the test was started, that the change from the clean condition to the clogged condition of the filter would be so sudden. This period, from clean to dirty, which was

just over 10 hrs. at the commencement of the run, had fallen to something over 8 hrs. after 6 months' continued running. This decrease was believed to be due to the fouling of the surface by solid particles carried in with the oil.

Fig. 8 illustrates a complete plant consisting of one separator and one filter unit. A is in the direct pipe line of the ship's bilge or ballast pump, and here the

the filter, entering the unit L and ascending the centre of the annulus M, whence it passes to the connexion to the bilge line N and so overboard. For cleaning, valves N, O are closed, P is opened, and steam is passed in reverse direction through the filter medium for an hour or less according to its condition.

Reference has been made to the year 1925, for the reason that the United States Bureau of Standards and

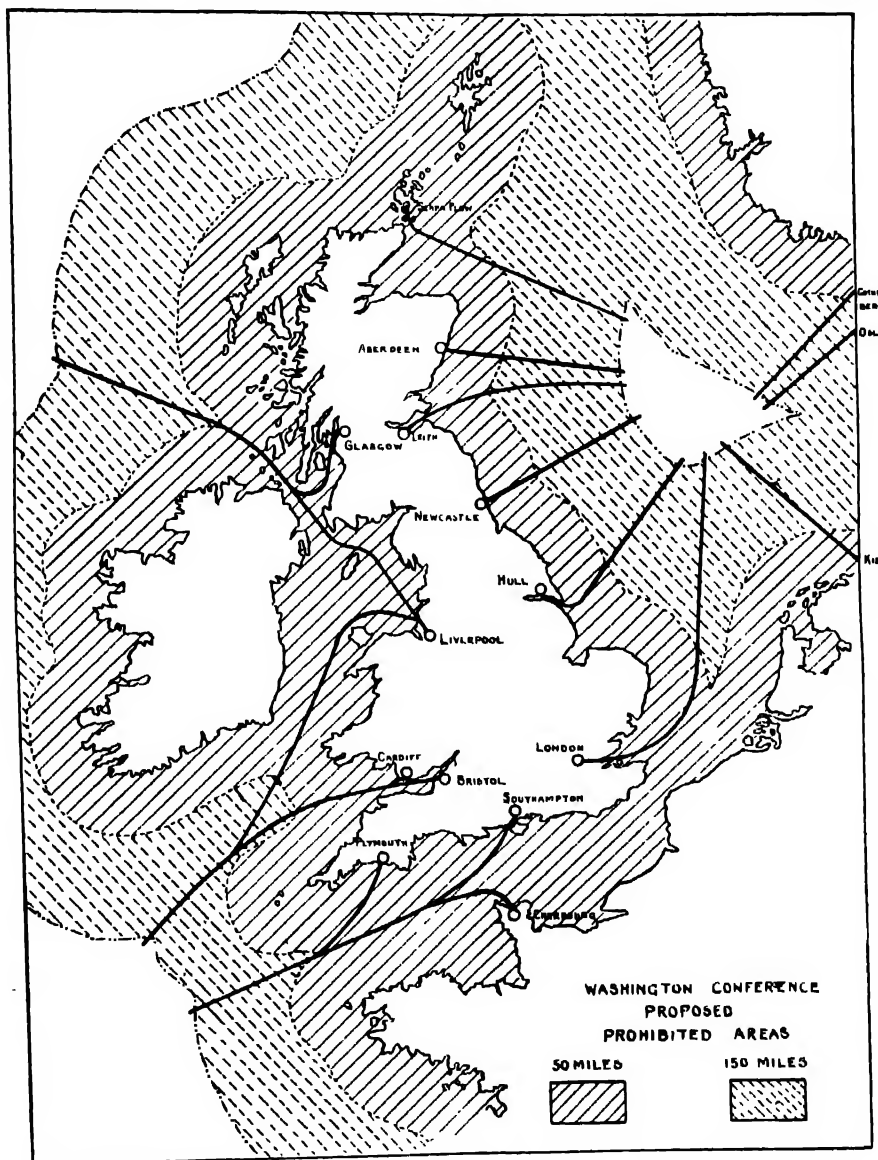


FIG. 9

oily mixture enters. Some of the bulk oil separates at once in the two chambers B, assisted by the baffle C—the water passes on through the tubes DD, the oil escaping through the perforations and thence through the port E into the oil collecting chamber F, from which it is periodically returned by opening the valve on the return G to the ship's oil tanks. Two test cocks, H, J, serve to indicate the necessity for this. The water, now containing only some 0.001 to 0.004% of oil, passes into

Bureau of Mines then reported to the Inter-Departmental Committee for the Washington Conference:—

"1. No thoroughly reliable and adequate methods and devices are yet generally available for the proper disposal of the large quantities of oil-contaminated ballast water and other oil wastes from ships.

"2. Several of these devices now in use on ship-board may be expected to remove from 95 to 99% of the oil found in ships' ballast water.

"3. The oil content in the water effluent from the most successful separators on ship-board would not usually average more than 0.01 of 1% of the total mixture."

From this it is evident that none of the separators

be satisfactory for ships' ballast water to be pumped at a distance of 50 miles or, in congested areas, 150 miles from shore. That this is quite an unsatisfactory position in which to leave the matter is evident from the established indestructibility of the oil, which ensures

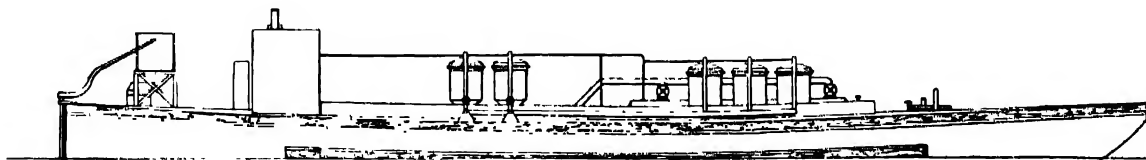


FIG. 10

Profile of lighter, as fitted. Stream-line oil separator in Admiralty lighter C73

produced up to that time was able to give an effluent of the high standard required and demanded by the British Admiralty. It is believed that the low standard

that no matter where it is pumped it will ultimately, by the action of wind and wave, reach some shore, and it is particularly unsatisfactory for this country,

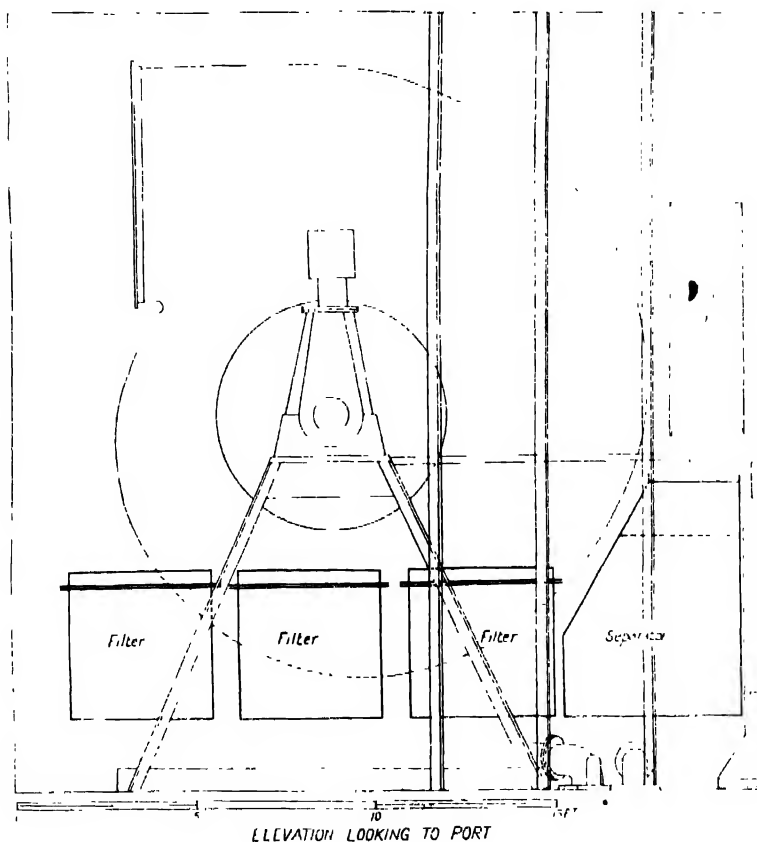


FIG. 11

of performance of the separators then available was the cause of the decision of the International Conference at Washington, contrary to the strong recommendations of the technical representatives of the United States and of Great Britain, that, as a temporary measure, it would

owing to its island position, a comparatively short distance from other islands and from the European mainland. A map of England (Fig. 9), with (on the same scale) the borders of an area 50 miles in the one case and 150 miles in the other case, from land, shows that

the distances from British ports at which it would be permissible to pump ballast water are :—

	To limit of 50 mile area	To limit of 150 mile area
Liverpool	270 miles	380 miles
Southampton	250 miles	350 miles
Bristol	150 miles	330 miles
Cardiff	130 miles	310 miles
London	150 miles	320 miles
Newcastle	50 miles	150 miles
Hull	60 miles	180 miles
Glasgow	170 miles	280 miles

Thus a ship entering Liverpool would have to pump out its ballast water and come a distance of 270 miles in the one case and 380 in the other, with its ballast tanks empty, through the Irish Sea. Similarly, a boat entering Southampton would have to pump ballast tanks empty west of Ushant, and come from 250 or

another shore. It might be of some slight service to New York and the Atlantic coast of America, where the prevailing wind is, as already shown in Fig. 3, largely off shore. A cure for the oil pollution nuisance is now available in a really efficient separator, which will give an effluent containing less than 1 part of oil, in 200,000 of water, which can be put in the ordinary bilge line, and operated, without extra power or attention, by the ordinary ship's bilge pump. The question as to whether there is greater efficiency in using a relatively smaller number of separators fitted to barges stationed in the principal harbours and making it a regulation that all ships should pump bilge or ballast water through these harbour service vessels, or whether the separator itself should be actually installed on board the ship,

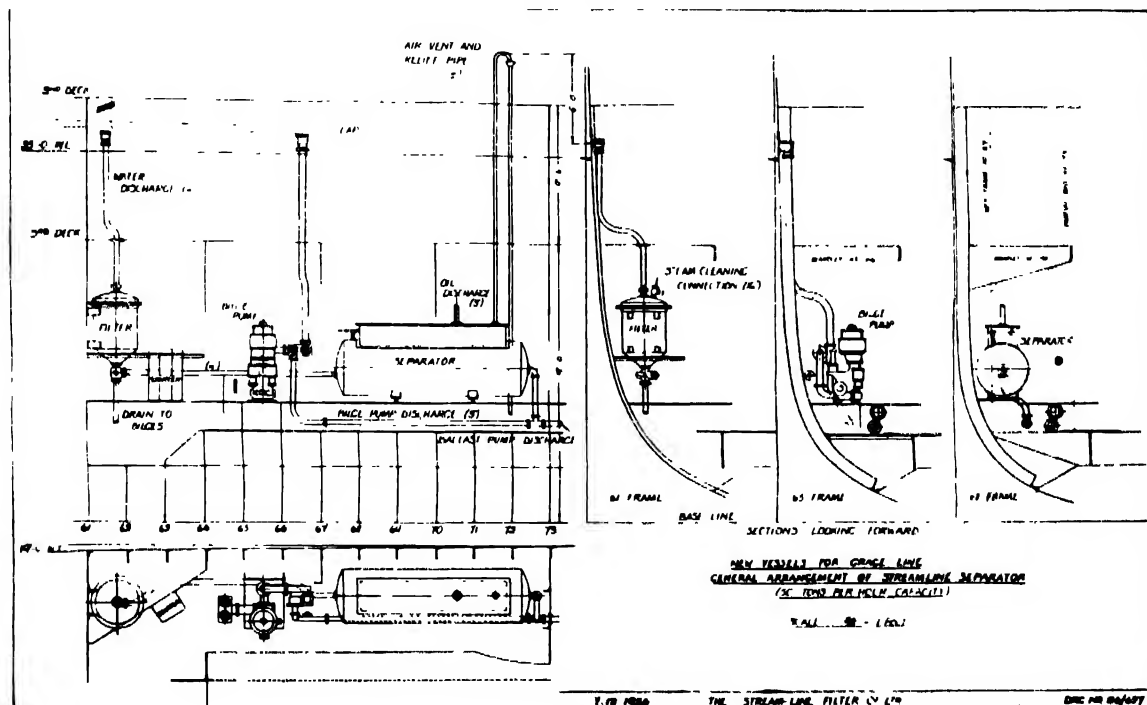


FIG. 12

350 miles up the Channel without ballast water. Even this highly dangerous proceeding would not ensure that the oil would not reach English shores within a few days of the boat entering port. It is to be expected that the shores of Great Britain would be regarded as a congested area, and that the necessary distance for pumping ballast water would be 150 miles. The condition of the small patch of sea around the Dogger Bank, into which would be constantly pumped the ballast water from the ships entering Newcastle, Hull, Tilbury and the Thames, Gothenburg, Oslo, Esbjerg, Kiel, Antwerp, Rotterdam, can well be imagined. The pumping of ballast tanks 50 or 150 miles from shore, while in itself a dangerous proceeding, in no way ameliorates the evils of oil pollution, but, on the contrary, would tend to aggravate these, for instead of the oil being spread over a long seaboard, the action of wind and tide would carry it in bulk now to one and now to

was fully discussed by the U.S. Shipping Board in its report to Washington, and it concluded that the balance of advantage was enormously in favour of fitting the separator to the ship as soon as a satisfactory and efficient separator of reasonable size and capacity was available. The illustrations show typical installations, Fig. 10, of a barge plant of 200 tons per hour in use by H.M. Admiralty; Fig. 11, the plant of 150 tons per hour installed in S.S. "Majestic"; Fig. 12, of a standard 50-ton plant fitted to one of a number of vessels of the Grace Line, built by the Furness Shipbuilding Co.; Fig. 13 shows the Admiralty plant in course of construction, and Fig. 14 two 50 tons per hour separators ready for shipment.

Some interesting points arose in the two-day acceptance trials of the Admiralty barge, which took place on June 8 and 9 last, when two lots, each of 1000 tons of water, contained in four tanks of the R.F.A. tanker

"Linol," were pumped through the plant in a total period of 10 hrs. During the first 5 hrs., the mixture to be dealt with was tank washings, containing from 1 to 2% of oil, while during the second period mixtures of sea water with 5%, 10%, and 15% of Navy fuel oil was separated. Owing to the viscous nature of the oil and the large quantities of air pumped with it at the end of each tank, it was found necessary to run the plant at a rate exceeding 300 tons per hour, in order to obtain the necessary average of 200 over the period. Fig. 15 gives the curve of output during the 5 hr. runs.

It has been alleged as an objection to the compulsory fitting of separators that they would add another and

three weeks as the period between bunkerings, a minimum of £500 per annum. These figures take no account of exceptional circumstances such as contamination of oil through accident or leaky tanks and the recovering of the sludges which settle out from certain crude oils, in which the separator offers very large economies.

The plant installed in s.s. "Majestic," already mentioned, owing to exceptional circumstances, recovered upwards of 200 tons of oil on its first voyage from tanks in which residues had been accumulated. This oil was burned directly under the boilers. This particular installation also illustrates the facility with which the shape of plant can be adapted to fit into any awkward and

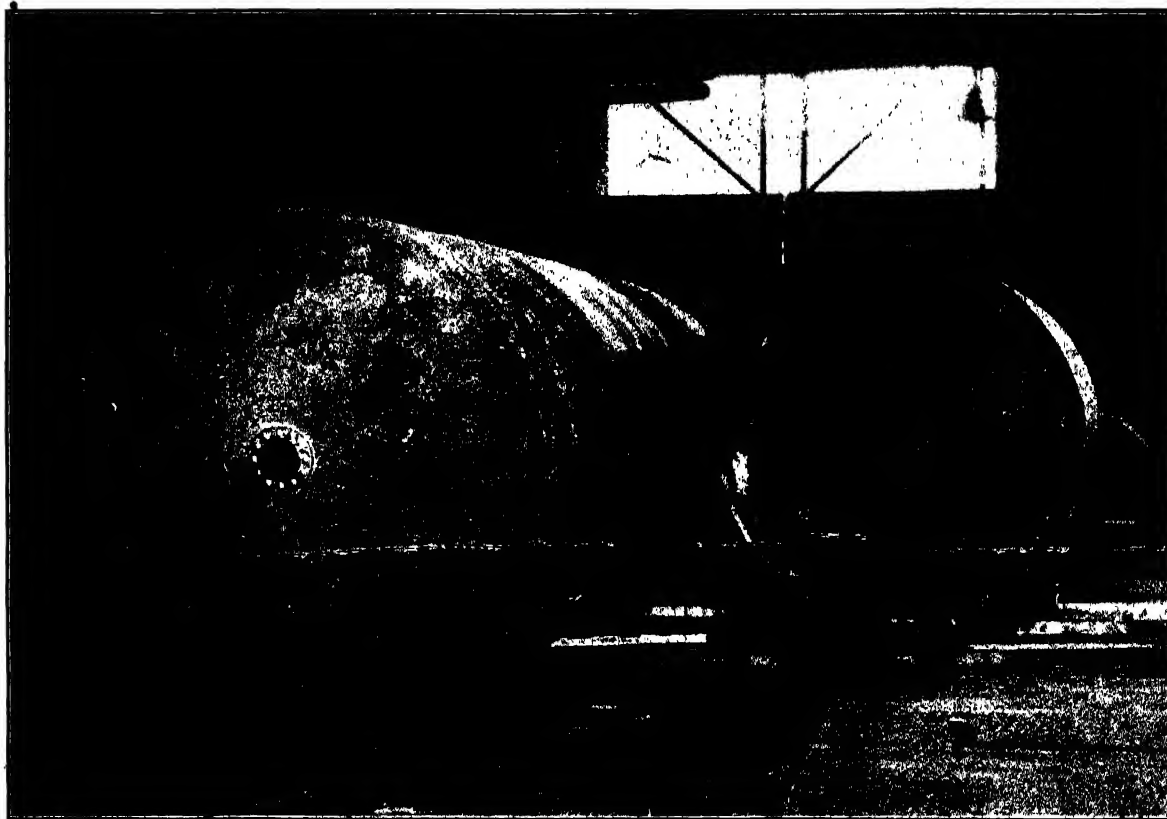


Fig. 13

intolerable burden of expense and waste of valuable cargo space of the shipping industry at a time of serious depression, and when it is still suffering from those difficulties which are an aftermath of the European War. An impartial examination of the facts in conjunction with the figures given by the United States Shipping Board completely disposes of this argument. An oil-burning vessel when in water ballast has from 600 to 1500 tons of water containing at least 1% of oil. This 10 tons or so of oil can be recovered without any additional expense, as the cost of pumping is the same whether the water goes through a separator or directly overboard. A plant of 100 tons per hour capacity, which can be installed for less than £1000, would therefore earn a return at least £30 per voyage, or, taking

otherwise useless space; in this case the corner of the fan room. A part of the double bottom or the cofferdams of oil tankers amongst other positions are equally available without any encroachment on cargo space. The proposal of the Washington Conference that the space occupied should be deducted from the effective tonnage for the calculation of port, canal and similar dues offers a further economy.

The analysis of samples of effluent containing quantities of oil of the order of 0.0001 to 0.0005% presents considerable difficulty; in fact, the United States Bureau of Mines, in its report, states "that the quantity of oil is hardly sufficient to permit of analytical determination in a sample of moderate size."

A comparative study of three of the recognised methods

of analysis was, therefore, made on samples which were carefully made up from a standard solution of fuel oil in ether, and from which the ether was allowed to

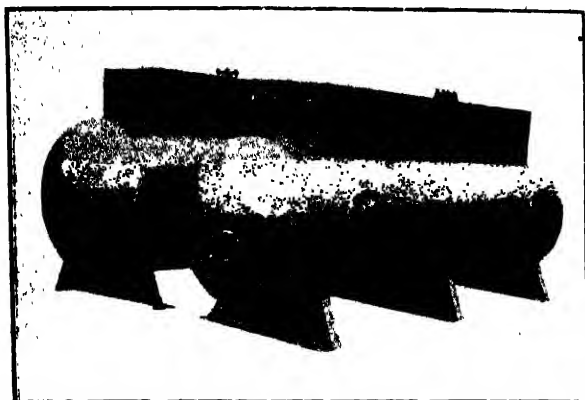


Fig. 14

evaporate after thorough shaking with the sea water. The methods used were:

(1) Extraction, with careful washing of the bottle also, with pure benzene, filtration of the benzene after

(3) A thorough mixing of the sample with a solution containing 0.5 gr. of aluminium sulphate, precipitation with excess of ammonia, filtration of the alumina, drying at 100°, and Soxhlet extraction of the dried precipitate, evaporation of the benzene from the extract at a low temperature, and drying to constant weight of the residue of oil.

Comparative analyses of oily mixtures

Average of five determinations

Standard oil content	I Benzene	II Chloroform	III Alumina
0.0001%	0.00013	0.00012	0.00010
0.0002%	0.00025	0.00026	0.00023
0.0003%	0.00034	0.00033	0.00031
0.0004%	0.00045	0.00042	0.00039
0.0005%	0.00058	0.00057	0.00048
0.0010%	0.00132	0.00118	0.00097

It was anticipated that all these methods would give low results on account of the expected loss of some part of the fuel oil in the drying process. It was found that, on the contrary, nearly all the results were higher than the standard, while where the filtration of the extract was omitted, the results were 30% to 70% high, probably because the oil had taken up particles of solid matter floating in the water.

The separator has also been applied on land to the recovery of oil from the rain water and washings from

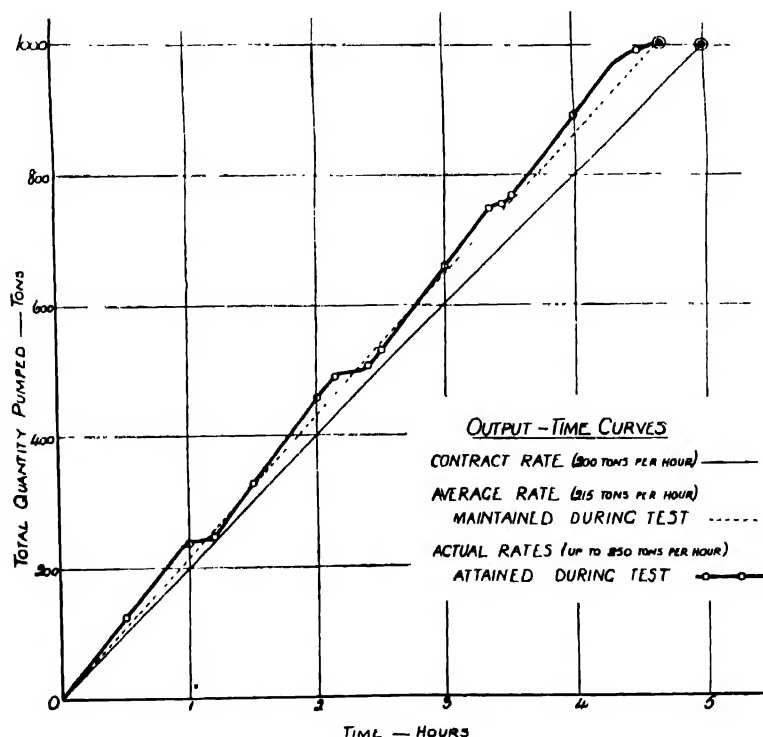


Fig. 15

separation with an ordinary separating funnel, and evaporation at a low temperature with subsequent drying to constant weight at 100° C.

(2) A similar extraction with chloroform and drying to constant weight at 100° after filtration.

oil storage yards—for dealing with the oily and tarry effluents from gas works and water-gas plants, and similar industrial wastes. The special form of filter is of service for the de-oiling of condenser water for boiler feed.

OUR DELIGHT IN BAD LANGUAGE

J'ai cherché, autant que possible, à joindre, dans l'explication des phénomènes, la précision à la clarté, prenant en cela pour modèle les mathématiciens qui ne se servent jamais d'un terme sans en avoir préalablement établi le sens. Il faudra bien un jour arriver à écrire les livres de la chimie comme on écrit une géométrie ou une algèbre : c'est alors seulement que la chimie se répandra davantage dans les masses.

GERHARDT : *Introduction à l'étude de la chimie*. 1848.

One Paul gave the same message to the Corinthians : whether chemists were among them is not known.

"Except ye utter by the tongue words easy to be understood, how shall it be known what is spoken? for ye shall speak into the air. There are, it may be, so many kinds of voices in the world and none of them without signification. Therefore, if I know not the meaning of the voice, I shall be unto him that speaketh a barbarian, and he that speaketh a barbarian unto me."

Our leader-master takes the fly very easily. He is caught by Calorifer's first cast - by no mere Brown Dun but by a Neogrecian. Perhaps there was art behind the use of such fly - at least, the desire to give an opportunity, possibly to pull-the-leg. The editorial trout is ever an inconsequent feeder - still, the rise was natural. "Epipedonic!" How superlatively superior to Road-hog! The "literary gent" must react to such offer, particularly when he is a young and cautious driver himself. Calorifer's challenge to him to discuss the relation of action to reaction at the angle of the green cushion seems to have fallen flat - he is as unresponsive as Wilder D. himself, *pace* Prof. Bone, though not unaccustomed, we fancy, to leave the editorial armchair for savage lands and follow the lure of rolling ivory - or is it celluloid? If the chessboard or even the bath-mat can be used in displaying the nature of common salt, the character of chemical change may well be demonstrated upon the green cloth. Instead of the desired discussion, however, we have a learned dissertation upon "theory": it seems that the hook must be baited with Greek.

Calorifer has asked that the word may be standardised. *Theory* is now one of those terms, as our Editor succinctly states, used in science "to explain briefly that the writer is not clear in his mind what he does mean" - perhaps a condition not infrequent in the scientific writer. Examples are quoted of its use by all sorts of men in all sorts of ways. He would allow it to have "One Dam Meaning After Another" and deprecates its use with a single meaning. Calorifer should crumple up under such criticism but I fancy he has some element of courage in him and will not easily be put down even by the editorial "We." He seems to have one of those nasty, inquisitive, irreverent minds which leads its owner to say: "Yes! but what's the guy's opinion worth anyway? What are his idiosyncrasies?" The fellow, it is clear, writes as an Editor, not as a chemist. He is known to be a lawyer. Nominally, the lawyer is judicial - in itself a term difficult to define. More often than not the judicial is the synonym of the partial, at least of prejudice - the prejudice of precedent.

The ultimate object of the scientific writer should be to express himself in immutable terms. The lawyer, on the other hand, may favour a multiplicity of meanings, so that there may be room left for dispute - consequently, for fees. The two have interests at opposite poles - witness the struggle over the word *synthesis*. It was worth a lot to all parties concerned, except to the unfortunate people who meant business and wished to synthesise calcium carbide.

Our Editor cannot have it both ways. Either he must be a mere editor and an opportunist or put on the toga scientific and advocate the definite. Herein lies his opportunity. We by no means object to be told that the theorist is the equivalent of the man who watches a football match. The man has a definite game, with clearly defined rules, in his head; also he is a close observer and goes upon facts; he never thinks of the game as played merely by moving arms and legs but has the complete man in mind. Theory must be reserved for high table use, on state occasions, as a vintage word of special import and highest degree, to be carefully cuddled and warmed before use, so that it may fit the precise meaning of the situation. The practice of the best writers justifies such exclusive use. As witness, we give the following from a well-known dictionary:

"*Theory* is distinguished from *hypothesis* thus: a *theory* is founded on inferences drawn from principles which have been established on independent evidence; a *hypothesis* is a proposition assumed to account for certain phenomena etc. It is necessary to keep this distinction in view, as the terms *theory* and *hypothesis* are very frequently confounded, both in speaking and writing."

We have to note that there is a growing demand for technical books written in the English language - not in terms of a thoughtless and offensive laboratory patter. We cannot complain that our science makes little headway in society, when the jargon of the young Royal Society hunters, its Lewisisms, Lowryisms, Morganisms, Ridealisms, Rutherford-malapropisms, etc., makes our writings misleading and unreadable, almost nauseous to educated ears. All our leading words need precise definition. To-day no one can say what is or is not implied by master terms such as catalysis and ionisation, for example: Cambridge, Princeton and Johns Hopkins alike fail to use the former in any rational way. Our minds are muddled, so we muddle our words. Mr. Baldwin has recently been elected into the body scientific under the proviso of the Royal Society's statutes admitting persons who have rendered conspicuous service to the cause of science or are such that their election would be of signal benefit to the Society. It is not known that he ranks in the former category even in connexion with his studies of combustion. His service must, therefore, be prospective. Here we must have fallen asleep and dreamed a dream.

We seem to remember hearing a voice

All was not as it should be in
Our body scientific thin,
So they inducted the Prime Min.
He said they were a priesthood who
Supposedly ver-it-ies 'noo;
But why express them so - pooh, pooh!

Next we heard the question :

Say, Ed., will Baldwin, F.R.S., read Society's stodge ?

No, Sir ! See, here ! New Broom sweeps clean.

Then came pictures upon the wall.

1. Baldwin, P.M., handing file of R.S. Proc. to Cook

2. Cook selling same to Chemistry House grocer.

3. Excited buyers of pounds of butter upon which printing has come off.

We will not buy such But. to-day !

Oh, take this chelate grease away.

This activated fat agley !

4. Grocer, reactant, in dilapidated shop, ruined by selling R.S. bad language as butter.

5. Repentant R.S. on St. Andrew's Day.

And everybody saw with joy

The look upon that Lowry boy :

How thought of Hell him made repent,

And Rid-e-al and Morgan too

Began to feel a little blue,

So up they all their errors threw

6. P.R.S. in Pilgrim's garb, wearing cap bearing La Fontaine's moral : " Les voleurs sont tel ou tel prince." He is hung around with full ballistic kit, Lewis gun, etc. for knocking spots off atom. P.R.S. does penance before Baldwin, P.M., F.R.S., for his rape of the chemist's Ion. He is let off with a warning, on promise to misuse her no longer and to stay all further improper use of such stolen goods by electricians, Fowlers, etc., etc.

In P.R.S. the fear outgrew

That he had put his foot in too,

That he dam well should serve his Lent.,

That he no more should let in those

Who never did with sense compose.

Should make his soc. fit only coves

Who might with credit all be chose.

Who clearly could wear well their clo'es,

And ultimately rise to Joves.

Here Baldwin said : It will be right

If you your thoughts in English write.

And bowed he then to them : Goodnight !

Now all was as it should be in

A body scientific thin.

Give we our thanks to the Prime Min.

Our Editor will perhaps play the Daniel to our dream with its writing upon the wall and interpret its import. At least, we hope that he will make his organ a laundry in which words may be starched and ironed into forms fit for wear in polite society. " *Il faudra bien un jour arriver à écrire les livres de la chimie comme on écrit une géométrie ou une algèbre* "

A few words as to Lucifer's remarks upon my friend Calorifier. The latter, I am sure, is pained, though not surprised, that his friendly efforts to illuminate Darkest Bigdrumbonia are declared a failure. The field of missionary enterprise is strewn with failures—material collected from "Somewhere in Lancashire" is not likely to be plastic. Why Lucifer should be called upon the scene is not clear. He has long been declared out,

both by Prof. Bone and a majority of the bench of Bishops, so the pseudonym is an obvious fake. Moreover, the heading to such diatribe should have been "Ye potte calleth ye kettel blacke."

Say, Bone, where do you get off on Calorifer ?*

The "Tu quoque" argument carries us no further in the analysis of flame. Eggs are often broken over bacon in our isles but Bacon's words break no eggs over the big-drum problem raised by the Verulam Resonator.

Bacon won't do any good to your S.A.

Our friend ever sits upon his experimental basis, as the Mississippi pilot in Artemus Ward's day sat, upon the safety valve while below the boiler was fed with hams. The valve has been known to blow up. He shows pronounced symptoms of *cephalitis enlargica*. We suggest a course of mediavalism that at least he think back to Priestley, probably the greatest experimenter the world has known, yet unable to grasp the special significance of his discoveries. If the effort be too great for a Modernist, he may consider Crookes. Crookes did not understand his radiometer, his reading of his rare-earth work was wrong and he had but faint understanding of the high vacua he created. The one needed a Lavoisier, the other a J. J., to make his work of avail to the world. It is a well-known maxim that "lookers-on see most of the game." The Drybonians have yet to show that they have grasp of the complex geography of the territory which they are surveying.

Anyway, who and what is the experimenter ? Is he so superior a person that he may arrogate to himself the sole right to assess the value of his observations and to jibe at those who modestly offer their criticism ? The experimenter usually works with borrowed ideas and borrowed tools. Those from whom he borrows may at least be allowed to display an affectionate interest in his doings, without being accused of any form of *ism*. Are not our particular friend's wanderings in Drybonia directed by suggestions he has received from others, whether he knew this or not ? Are not they too experimenting but with his vile body, and may not they honestly claim the right to a share in his reappings from their sowings ?

STRUWELPETER REDIVIVUS

THE WASTES OF THE PAPER PULP AND PAPER MILL INDUSTRIES

By J. B. C. KERSHAW

The wastes of the paper manufacturing industry occur chiefly in the production of wood pulp—that is, in the mills which are situated abroad. Attention will be directed, however, in this article to the prevention of waste in all branches of the paper manufacturing industry, for most of the large paper mills in this country depend for their supplies of wood pulp upon subsidiary works or mills in Canada or Scandinavia.

It is over fifty years since the chemical method of preparing cellulose for the manufacture of paper was first introduced, and this branch of the industry has

* See *Punch*, Nov. 9, p. 510.

undergone very remarkable developments during the past half century. Esparto grass in recent years has become a very important raw material, and the original soda process for disintegration of the ligneous fibre of the wood has been to some extent supplanted by the acid sulphite and sulphate processes, since these produce, without the aid of any bleaching material, a much whiter pulp. By skilful manipulation of the acid sulphite process it is possible, in fact, to obtain a cellulose material with long fibres, which can be used for the production of a strong paper, without the help of any sizing or weighting materials. This feature is tending to increase the use of the acid sulphite process for the supply of raw material to British and American paper-making mills. The latest method of preparing cellulosic material is based upon the use of chlorine gas, and one of the

of these materials is not based entirely on their intrinsic value, for it is absolutely necessary, in most cases, that the waste liquors should be purified before they are turned into streams and water-courses, since in their unpurified state they may cause great destruction of fish life and vegetation.

The difficulties in dealing with these waste liquors are due partly to their dilution, and partly to the large number of different chemical compounds which they contain. An immense amount of research and experimental work is now being devoted to the treatment of the waste liquors from the sulphite and sulphate processes, and although up to the present no method of treatment has gained general acceptance, considerable progress has been made, and there is no doubt that in time the problem will be solved. Before giving details

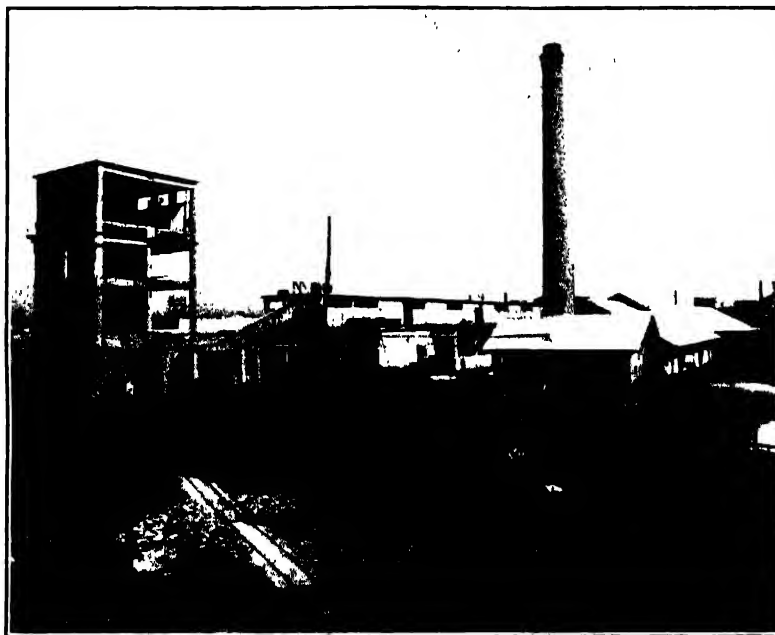


FIG. 1

Soda, chlorine and pulp works of the "Electrochimica Pomilio" Co., Ltd., at Naples. Pulp department and boiler house

leading Italian mills is now producing a high-class pulp from esparto grass by this method of treatment.

None of the chemical methods yield, however, more than 50% of the wood or vegetable material in the form of cellulose, and quite one-half of the weight of the raw wood, consisting of the lignin, carbohydrates, resins and albuminates is carried away in the waste liquors.

Signor Pomilio, one of the leading Italian paper manufacturers, has calculated that 672,000,000 cb. ft. of wood is employed annually for paper manufacture in America alone,¹ and when one adds to this huge total the wood consumed in Canada, Norway, and the other timber-producing countries of Europe for the production of chemical pulp, it will be realised that many millions of pounds of valuable organic substances are being lost each year in the waste liquors of the wood-pulp industry. The argument for the recovery

of these investigations, however, it will be advisable to outline the present methods of wood-pulp manufacture and the present methods of dealing with the waste liquors.

Mechanical wood pulp

This process is employed for non-resinous long-fibred woods, such as spruce and balsam. The wood is cut into 2-ft. lengths after removal of the bark, and is then pressed against the side of a grinding stone which has been roughened so as to produce a cutting action. The yield of pulp based on the weight of the dry wood is 90%, but it is of inferior quality and is only employed, with longer and stronger fibred stock, in the manufacture of papers of the cheaper type, such as newspaper, cheap catalogues and cheap magazines, for which paper with good durability is not required. The waste from this method of reducing wood consists principally of "slivvers" of wood about the size of match sticks,

and amounts to about 5% of the weight of wood passed through the mill. In many mills the "slivers" are re-worked, in order to produce a cheaper grade of paper.

The sulphite process

This process is used for the pulping of long-fibred non-resinous coniferous woods, such as spruce, poplar, balsam and hemlock, and, based on the dry weight of the original wood, a yield of less than 45% is generally obtained. The chemical employed is calcium bisulphite, produced by the action of sulphur dioxide upon lime. The pulp produced can be obtained in a high degree of whiteness, and is used both bleached and unbleached for the manufacture of book, news, wrapping, bond and tissue paper. One gallon of undiluted sulphite waste liquor, which carries in solution one pound of dissolved lignin and resins, is produced as waste for every pound of cellulose by this process, and as only 60% of the concentrated liquor can be drained from the pulp after its discharge into the blow-pit, it is usual to wash the pulp and thus to add another 3 gals. of waste water to that already produced.

The sulphate or "Kraft" process

This process is employed with either resinous or non-resinous woods such as pine, spruce, hemlock, poplar and fir, and is based upon the use of a mixture of sodium hydrate and sodium sulphide for opening up the wood. The yield of cellulose obtained is generally less than 45%. Kraft pulp is usually left unbleached, and on account of its strength is employed chiefly for the manufacture of wrapping paper, or to produce the board employed in the manufacture of food containers.

The waste from the Kraft process is much smaller in volume than that from the sulphite mills, since the spent liquor from the digesters and all of the wash water is evaporated and incinerated, in order to recover the soda. The chief waste material, therefore, is the lime sludge which is produced by the causticising of the liquor for further use; and in most cases this is disposed of, either by discharging it into streams, dumping it on the land, or selling it as a fertiliser.

The soda process

The soda process of manufacturing wood pulp, although the oldest, is restricted to the treatment of short-fibred deciduous wood, such as aspen, cotton-wood, willow, and gum; in most cases a yield of less than 45% is obtained. The chemical employed is commercial caustic soda, and the resulting pulp is always bleached to a high degree of whiteness. It is employed with the longer and stronger fibred pulp stock, such as spruce sulphite, for the manufacture of book, lithographic, and envelope papers. The methods of dealing with the wastes from the soda process are the same as those employed for the Kraft wastes; but appreciable quantities of carbon are found in the wash-water from the recovery plant of the soda process.

"White-water" wastes

"White-water" is the technical name given to the waste from pulp-paper mills carrying the finer particles of cellulose, and it is imperative for the profitable working of a wood-pulp or paper mill that this source of waste

should be stopped. In recent years a considerable development of more efficient types of equipment for this purpose has occurred on both sides of the Atlantic. The improved plant has been either of the *filtering* type, in which the solids suspended in the white-water are filtered through a mat, which may be a paper-making fibre or cloth; or it is of the *sedimentation* type, which allows the solid material to settle to the bottom of the container, where it can be removed by scrapers and returned to the paper-making machines.

The filtering type is the best for the treatment of fibrous wastes containing little or no clay, whilst the sedimentation type is adapted for wastes in which clay is present. The efficiencies obtained from these types of pulp-saver, when intelligently used, are estimated to be over 90%, and the operating costs are low, since very little power is required for running the plant. The capital costs vary from 200 dollars to 500 dollars per ton of paper produced per day, the exact amount depending upon the local conditions and the type of paper made.

One of the preliminary difficulties in all recovery processes is the cost of concentration, for the presence of albumens, fats, waxes and resins adds considerably to the cost of evaporation; and waste sulphite liquors, as a rule, contain only 10% to 12% of solid matter, with a high percentage of organic compounds. The waste liquors from the soda process are much more concentrated, and the cost of evaporation is thus much lower than for sulphite liquors. These alkaline "black liquors," as they are termed, are very destructive to marine and vegetable life; and therefore, wherever the older process is still in use, it is customary to evaporate the liquors to dryness, and to burn the residue, containing all the organic matters, for steam generation.

The solution of soda obtained by lixiviating the ash is then causticised with lime in the usual manner, and the sodium hydrate solution is used again in the process. This may be considered the standard method of treatment of the "black liquors" obtained by the older process of cellulose manufacture, and any improvements recently proposed are simply in the details of the plant by which it is carried out.

For the disposal of sulphite mill wastes no method of treatment has secured general adoption, and the production of ethyl alcohol by fermentation of this liquor has been abandoned in all countries except in Sweden, on account of its prohibitive cost. The production of core-binders, adhesives, turpentine, resins, and tanning extracts has not become general for various reasons, one being that the demand for some of these products is so small, and the supply of raw material so great, that a few plants are able to supply the whole market.

The waste from the sulphate mills, which produce "Kraft" pulp, consists chiefly of lime sludge, and many of the mills now use rotary kilns for burning this lime, and also for the lime sludge obtained from the soda process.

• (To be continued)

The late Mr. J. W. Goddard, of Leicester, head of J. Goddard & Sons, plate powder manufacturers and manufacturing chemists, left estate valued at £202,184.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

BUREAU OF CHEMICAL ABSTRACTS

The following have been appointed by the Council as the Society's representatives for 1927-28 on the Bureau of Chemical Abstracts:—

Mr. J. L. Baker, Mr. F. H. Carr, Mr. E. V. Evans, Sir Wm. J. Pope, K.B.E., and the Honorary Treasurer, Dr. E. W. Smith (*ex-officio*).

BINDING CASES FOR BRITISH CHEMICAL ABSTRACTS AND JOINT INDEX

Abstracts "B" and Index to "A" and "B"

Binding cases for the above publications, in dark blue cloth, will be available, commencing with the 1927 issues.

The price will be 3s. 9d. per set of two cases, postage 6d. extra, or, separately, 2s., postage 3d. extra.

Abstracts "A" and Index to "A" and "B"

Cases are also available in maroon or blue cloth, price 3s. 9d. per set of two cases, postage 6d. extra.

Orders, accompanied with remittance, should be forwarded to Messrs. Gurney & Jackson, 33, Paternoster Row, London, E.C.4.

LIST OF MEMBERS ELECTED

December 9, 1927

- Andrews, Albert E., c/o The Marmite Food Extract Co., Ltd., 52, Camberwell Green, London, S.E.5. Research and Analytical Chemist.
- Briggs, Wm. A., 23, Brighton Gardens, Gateshead, Co. Durham. Works Chemist.
- Clark, K. Lanphier, "The Haven," 94, Wallscote Road, Weston-super-Mare. Works Chemist.
- Clark, Wm. H. D., Houdley, Hadley Wood, Barnet. Patent Expert.
- Guertin, Henry E., The St. Lawrence Flour Mills Co., Ltd., 1110 Notre Dame W., Montreal, Canada. Chemist.
- Hacking, B. Ian, c/o East Lancashire Soap Co., Ltd., Clayton le Moors, nr. Accrington. Soap Manufacturer.
- McCloud, John L., Ford Motor Co. Library, Dearborn, Michigan, U.S.A. Metallurgical Chemist.
- MacCulloch, Nigel J. H., The Rectory, Bridge of Allan, Stirlingshire. Works Chemist.
- Marsden, Wm., 2, West Riding Terrace, Mickley, Stocksfield-on-Tyne. Assistant Analytical Chemist.
- Morse, Wm. M., 400, Graybar Building, 420, Lexington Avenue, New York, N.Y. U.S.A. Editor.
- Nicolls, Jasper H., Fuel Testing Station, 552, Booth Street, Ottawa, Canada. Chemist.
- Nyrop, Johan E., Bel Colle, Hørsholm, Copenhagen, Denmark. Consulting Engineer.
- Reddie, J. Alexander, Bank House, Apperley Bridge, nr. Bradford, Yorks. Chemist.
- Rheinlander, Arthur H., Government Laboratory, Clement's Inn Passage, Strand, London, W.C.2. Chemist.
- Rose, Harry C., c/o Messrs. Jones Bros. (West Bromwich), Ltd., Eagle Oil Works, Albion, West Bromwich, Staffs. Analytical Chemist.
- Saklatwalla, Beran D., c/o Vanadium Corporation of America, Bridgeville, Penna, U.S.A. Vice-President.
- Sera, S., Central Laboratory, South Manchuria Railway Co., Dairen, Manchuria. Superintendent.

Smart, Brig.-Gen. Chas. A., C.M.G., Canadian International Corporation, Ltd., 718, Sherbrooke Street West, Montreal, Canada. Director.

Soff, Le Roy D., 131, East Fordham Road, New York, N.Y., U.S.A. Chemical Engineer.

Suggden, John A., 6, Glebe Terrace, Far Headingley, Leeds. Assistant Lecturer.

Taylor, Austin J., 222, Highfield Street, Moreton, N.B., Canada. President and Manager.

Walls, Ernest, Riversley, Littlefield Place, Clifton Down, Bristol. Manufacturer.

Weir, John, c/o Nobel's Explosives Co., Ardeer Factory, Stevenston, Ayrshire. Research Chemist.

EDINBURGH SECTION

The third meeting was held jointly with the local branch of the Institute of Chemistry on December 6, in the Pharmaceutical Hall, Edinburgh. Mr. J. Adam Watson presiding.

Prof. Sir James Walker, F.R.S., in a lecture on "Electro-synthesis" said that since Kolbe's time the process of electrolysis of solutions of salts of fatty acids had been applied to the preparation of hydrocarbons with straight chains of carbon atoms of over 60 links in length. This he would define as true synthesis. In addition to the saturated hydrocarbon, in some cases the reactions gave other products, particularly the unsaturated hydrocarbon of half the length of chain, and the ester of the acid used.

The lecturer said that whilst working as the assistant of Prof. Crum-Brown, following up a suggestion, he adapted the method to the synthesis of dibasic acids, the product of each step being used as the starting point of the next. Thus starting from sodium ethyl malonate he prepared diethyl succinate and so in turn the esters with 4, 8 and 16 carbon chains between the end groups. Other preparations gave the other members of the even series, the method being quite general. Branched chain compounds were also used. Since the higher members of the various series tended to have a soapy nature, some difficulties were here encountered, but later on his pupils had overcome these by using solvents other than water.

The lecturer pointed out the importance of the methods for the preparation of long chain compounds of known constitution which could be directly compared with similar substances of natural origin with a view to elucidating the structures of the latter. A point of special interest was that the syntheses could be carried out in the cold, thus minimising the risk of intramolecular and other abnormal changes. The methods were not necessarily restricted to unsubstituted acids, but if active groups were present they could be blocked by alkylation. Nevertheless some experiments on these lines had not met with complete success.

Discussing the mechanism of the reactions the lecturer said that three theories had been suggested. Kolbe attributed the reactions to anodic oxidation, later the union of the discharged anions with simultaneous elimination of carbon dioxide was suggested and still later the peroxide theory, introducing the intermediate formation of the peroxide, such as acetyl peroxide, which subsequently decomposed. A variation of the peroxide theory in which nascent oxygen, produced by the action of

discharged anions and water, reacted with acid anhydride to give the peroxide, had also been put forward. He could see no reason for complicating the theory in this way; there was not sufficient experimental evidence to determine the true mechanism. In his own laboratories there were two schools of thought, the theory of direct union and the theory of anodic oxidation sharing the support of his assistants. Attempts to solve the problems of the anode mechanism by the direct study of electrode potential measurements had not so far been very successful.

After the lecture a number of members spoke in appreciation, and questions were asked by Major Bruce Dr. Kermack, and Messrs. Coyne, Ingham, Robertson and Cameron.

In reply, Prof. Walker said that so far as he knew experiments of a similar nature with aromatic substances, proteins and halogen derivatives of fatty acids had not been successful. The benzene ring, even at the end of a fatty chain, in some way prevented the normal reaction from taking place. Similarly, halogen compounds gave no oily synthetic products, complete breakdown resulting or else the ester formation without synthesis. Dr. Gibson believed he obtained a minute trace of hexachloroethane from trichloroacetic acid. Ring closure was another thing which had not been observed in these experiments. On the other hand, interesting reactions with cyclic compounds were possible, and he quoted the case of sodium ethyl camphorate from which unsaturated synthetic products could be obtained in good yield. Dealing further with the constitutions of the products and comparisons with natural substances he showed how melting-point determinations could be successfully used, and if the acids themselves gave ambiguous results the esters could be substituted. He thought that the method of synthesis could be relied upon to give a compound of known constitution. Although the compounds of high molecular weight were either soaps or like soaps, these studies did not appear to have thrown any light upon the colloidal properties of the soaps.

GLASGOW SECTION

A meeting of the Glasgow and Edinburgh Sections of the Society of Chemical Industry and the Institute of Chemistry was held, jointly with the Scottish Section of the Institution of the Rubber Industry, in the Cadoro Restaurant, Glasgow, on December 7.

Mr. S. H. B. Langlands, Chairman of the Glasgow Section of the Society of Chemical Industry, presided and welcomed the visitors. He said that he hoped more joint meetings of the various societies and local sections of the same society would be held in the future. Such meetings would foster a better spirit of understanding between those engaged in the various branches of chemical industry, and would tend to an increased efficiency.

Two papers were read, the first being "Sulphur in rubber manufacture," by Dr. D. F. Twiss, the second being "Naphthas and their uses," by Mr. C. Chapman, F.I.C., A.M.I.Chem.E.

Dr. Twiss discussed the part played by sulphur in the vulcanisation of rubber. By the term "vulcanisation" was meant the changes induced in raw rubber by the

addition of a small quantity of a substance which combined with the rubber to form another substance which was then dispersed. Sulphur had been found useful in producing the desired changes in the character of raw rubber. The fineness of division of the sulphur was very important, but the degree of fineness was limited by incipient melting of the sulphur in the hot process. The partition of rubber and the contained sulphur in a common solvent was discussed, and attention was directed to the different allotropic forms of sulphur. The transformations of the various forms was then discussed with a view to arriving at the conditions upon which vulcanisation proceeded. Stress was laid upon the fact that the desired changes could be produced by adding carbon black in place of sulphur, although the amount necessary was much greater.

The lecturer illustrated his remarks by experiment and by an exhibition of various samples.

A good discussion followed, which brought out the fact that the present view of vulcanisation seemed to be a compromise between the chemical theory on the one hand and the adsorption theory on the other.

Mr. Chapman outlined the various stages in the refining of naphthas, including the removal of the phenolic bodies or tar acids and the distillations of the washed naphthas. He dealt with the production of pure benzene etc. and the "semi-pure" substances, and the isolation of such substances as pyridene, carbon disulphide, and coumarone. It was strongly stressed that while dyestuffs and explosives were certainly produced from benzene etc., yet the naphthas were utilised for many other purposes. The chief uses to which the naphthas were put were the production of motor spirit, dry-cleaning processes, and paint and varnish preparations.

On the call of the Chairman, hearty votes of thanks were accorded to the lecturers.

The Chairman then called upon the Convener of the Ramsay Chemical Dinner Committee to address the meeting.

Dr. Dow said that the Committee was exceedingly anxious that the Ramsay Dinner should be as successful on this occasion as it previously had been.

This year the Ramsay Dinner had been sub-titled "The Institute of Chemistry Jubilee" to enable the event to be celebrated locally.

The dinner was to be held in the Trades House, Glasgow, on Wednesday, December 21, at 6 p.m., when the chair would be occupied by Prof. Smithells, President of the Institute of Chemistry.

MANCHESTER SECTION AND FUEL SECTION

At a joint meeting of the Manchester Section and Fuel Section held in the Engineers' Club, Manchester, on December 2, Dr. James A. Bowie (Director of the Department of Industrial Administration of the Manchester College of Technology) read a paper entitled "A new diagnosis of the coal trouble." Mr. C. J. T. Cronshaw, chairman of the Manchester Section, presided over a good attendance.

Dr. Bowie said that in 1870 the British production of coal was over 50% of the world's production, in the period 1909-1913 it was 25%, and in 1925 only 20.9%. The position of the British coal industry,

therefore, was that we were producing a smaller proportion of the world's coal supplies, a reduced absolute total, and even this total tended to decline, although we were now selling it at a figure in real value well under its 1913 price. From this the conclusion seemed inevitable that the British coal industry was faced with a shrinking demand which would not yield to the stimulus of price reduction.

If that was so, it was not true to say that the present plight of the industry was due to the heavy burdens it had to carry in capital charges, local and national taxation, and high costs of transport. All these certainly increased costs, but their reduction, even if possible, would do no more to assist the industry than had the great reduction—averaging over 2s. per ton—recently effected through wage rates and increased hours. If further disproof of "the heavy burden theory" was needed, one had only to consider the situation of the coal industry in other countries. Throughout the world the coal industry had grown up under conditions which inevitably meant over-expansion, leading to over-manning, low wage rates, and lack of profitability. For a time this congenital vice of the industry might be veiled by a continually growing demand, as up to 1913, by the gradual operation of diminishing returns, or by a reduction in hours, as in Britain in 1919, but under static conditions it was certain to assert itself.

Rich prizes had been offered to entrants into the industry over short periods of relative scarcity. Those "gleaners of the coalfields," easily able to start operations in times of high prices, swelled the productive capacity and increased the personnel of the industry. In 1926 over 200 new pits and drifts were opened in Britain. But it was neither the numbers nor the output of those pits that was important, it was their potentiality for growth. Although there was undoubtedly a heavy infantile mortality among them, a significant proportion of them seemed to pay their way, and thus to struggle to maturity. If a small pit paid, it was not difficult to borrow capital, and so the infant grew up to increase the overcrowding.

The penalties of permanently shutting down were heavy. A pit had practically no scrap value. The capital sunk in its lay-out was irredeemable, machinery hardly paid for its removal, there was no property in patents, colliery housing was immobile, and there was seldom even any item for goodwill to be carried off from the wreck. A coal mine, with its specialised equipment, could not be converted into any other type of business. Even if the hard-pressed colliery owner succeeded in selling his pit as a "going concern," all that happened was that a new concern arose out of the ashes of the old, with reduced capital charges and losses written off, and went on dumping its output on an already surcharged market.

The opening of the new coalfields in South Yorkshire and Nottinghamshire, with their promised output of about 20,000,000 tons per annum, and the application of coal-cutting and conveying machinery to the industry, might solve the problem as far as particular units were concerned, but they aggravated it for the industry as a whole by further adding to its excess mine capacity. For the 20 years before the war the industry earned

"extraordinarily low" profits, and for the four years 1922—25 it earned, in real value, only a little over half its pre-war figure. The two things necessary were the elimination of the uneconomic producers and the increased efficiency of the remainder.

The ideal was so to set the stage that the unfits discovered themselves, and were thereafter automatically eliminated. At present competition in the coal industry was neither fair nor free. Dr. Bowie suggested, therefore, that the industry be required to adopt the usual practice of paying its different grades an irreducible money wage. That would mean that depression would be felt first by the weakest units, not as now broadcast throughout the whole industry, and falling with special weight on the young, modern and well-equipped pits.

Secondly, it was necessary to prevent the indiscriminate entrance of weak sellers into the industry. The mineral resources of the country should be administered with more regard to the interests of the nation and the industry, and less to that of the fortuitous owners of those resources. It could not be in the national interests that some 8000 independent persons should own the country's minerals, and that some collieries should have as many as over 50 royalty and wayleave owners to deal with.

The greatest possibilities of efficiency lay in the realm of industrial relations. The miner had for long been the doughtiest fighter in the industrial field, and the losses he had inflicted on himself, the industry and the community had been immense. As far as calculations could be made, it could be safely said that the miners, through industrial disputes since 1900, had lost in wages a sum which would have enabled them to buy up, lock, stock and barrel, the whole of the collieries of this country; in voluntary absenteeism they had during the same period lost another sum of equal amount; while the community had lost at least four times the total present-day capital value of the collieries. Output depended in the coal industry to an unusual degree on the workers' free will and choice. The problem was how to reduce the enormous wastes of industrial strife, of absenteeism, of a heavy labour turnover, and to give the worker a new incentive.

The unique wage agreement of 1921 was meant to deal with that, but was never at any time adequate to do it. Although its principles represented the most scientific method of wage adjustment yet evolved, and were likely to be more generally imitated in the future, they did nothing to provide that new interest in work which was the general need to-day. That could be best achieved at the pit where men met and worked together, and it must imply some relationship between the parties other than that of mere bargainners; it meant some degree of exchange of function. Control sharing, through pit committees, would by itself be no more adequate than works committees had been in industry in general; cash profit-sharing would merely introduce a fresh set of frictional contacts. The most promising solution would seem to lie in some form of ownership-sharing, freely introduced where conditions were suitable, and not, as advocated by the Samuel Commission, by any method of legal compulsion.

MONTREAL SECTION

The regular monthly meeting was held on November 16 at the Windsor Hotel, preceded by the usual dinner. About fifty members and guests were present to hear Mr. Charles O. Brown, consulting chemical engineer to the Nitrogen Engineering Corporation, give a highly interesting address on "Synthetic nitric acid." The Chairman of the Section, Dr. J. F. Snell, presided.

Mr. Brown described in great detail the manufacture of synthetic nitric acid according to the current American practice. The catalyst is platinum, and the temperature of the reaction is unique in that it is at least twice as high as in other similar reactions, *i.e.*, about 950–1000 °C. The raw materials are ammonia, water and air, and all grades of ammonia are equally suitable. The mixed gases, containing 10–11% of ammonia, are introduced into the converter, where the ammonia is converted into nitric oxide; they then pass into a cooler, after which the nitric oxide is oxidised to the dioxide. It is preferable to have all the nitric oxide oxidised before absorption is begun. The oxidation of nitric oxide to the peroxide is not reversible under 150 °C., and is one of the very few reactions whose rate is increased by a drop in temperature. Absorption takes place in chrome-alloy towers, generally arranged in series. Refrigeration is important, as a tower space of 3000 cb. ft. per daily ton may be reduced to 800 cb. ft. when ammonia refrigeration is used. In conclusion, the speaker compared the cost of nitric acid produced from Chile saltpetre and from synthetic ammonia, a comparison which seemed to favour the synthetic product.

In the discussion which followed the lecture, Dr. L. F. Goodwin made some comparison between the British and Continental practice and the American practice so well described by Mr. Brown. He also discussed the advantages and disadvantages of welded absorption towers as compared with riveted towers, both from the point of view of cost and of maintenance. Dr. H. Hibbert spoke of the possibilities of the process, with particular reference to Canadian conditions.

CALENDAR OF FORTHCOMING EVENTS

Dec. 16.—Society of Chemical Industry, *Birmingham and Midland Section*. Jointly with the Midland Section of the Institute of Chemistry. University Buildings, Edgbaston, Birmingham, at 6.30 p.m. "Recent work in the University biochemical laboratories," by Prof. A. R. Lang. The lecture will be followed by an inspection of the new laboratories.

Dec. 16.—Society of Chemical Industry, *Liverpool Section*. Joint meeting with the Chemical Engineering Group. The University, Liverpool, at 6 p.m. "Oil pollution of seas and harbours—and a remedy," by C. S. Garland. (*See Chem. and Ind.*, Dec. 9, p. 1152.)

Dec. 21.—Ramsay Chemical Dinner, held under the joint auspices of Society of Chemical Industry, Institute of Chemistry, Society of Dyers and Colourists, Glasgow University Alchemists' Club, Andersonian Chemical Society, Ardeer Chemical Club, and the Royal Philosophical Society of Glasgow, in the Trades House, Glassford Street, Glasgow, at 6 for 6.30 p.m. This year the Dinner has been subtitled "The Institute of Chemistry Jubilee," and the Chairman will be Prof. A. Smithells.

Jan. 2.—Society of Chemical Industry, *London Section*. Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. "Future of biochemical research," by Dr. J. C. Drummond.

INSTITUTION OF CHEMICAL ENGINEERS

The Autumnal Conference opened on December 7 at Burlington House, Piccadilly. Sir Alex. Gibb, president of the Institution, occupied the chair, and Mr. Norman Swindon delivered a paper on "Submerged flame combustion."

After enumerating the conditions necessary for submerged flame combustion, the author gave a brief outline of the development of this subject from Collier's burner patented in 1887. During this portion of the paper the author dealt with certain difficulties which militated against success and emphasised the steps taken in modern design to eliminate these defects. The author then discussed in detail the effect of partial pressure on vapour produced, the lighting of the burner, the presence of sulphur in the fuel, and the importance of the intimate mixing of gas and air. The speed of flame propagation and its bearing on burner design was also touched upon as well as the mechanical means at present employed for apportioning the air and the fuel—a very important feature in the success of submerged flame combustion. Of equal importance, too, were the materials employed in the construction of such burners and the vessels in which these burners were placed, and a strong plea was raised for the development of materials, especially refractories, which could be used in the construction of these burners.

Passing to the employment of the submerged flame burner in chemical industry, the author divided its use into two sections, namely, for heating and for evaporation. He considered that whilst its usefulness as a steam generator for power purposes was limited, a large field would probably be available, especially in the chemical industry, for a burner of this type for heating or concentrating chemical solutions. The presence of the products of combustion in the vapour produced, whilst forming an efficient agitating device in some cases, is detrimental in others, and is obviated by the employment of a lead bath heated by the submerged flame and transmitting this heat to another chamber in which the liquid to be heated is contained, thus producing a vapour free from the products of combustion.

The burner could be easily employed in vessels constructed of fragile material, as the conditions under which it operated prevented local heating or high temperatures reaching the fragile wall of the container. After developing an entropy temperature chart for a steam-gas mixture, the author showed how such a chart was necessary in the determination of the efficiency of one of those boilers, and pointed out that in determining such an efficiency one had to take into consideration not only the calorific value of the fuel used, but also the heat and pressure energy stored in the fuel and in the air necessary for its combustion by the compression required to eject them into the burner. He stated that from his experience an efficiency of about 97% would be obtained with such a boiler.

The discussion was opened by Mr. J. Arthur Reavell, who agreed with the author in the unsuitability of such a boiler for generating steam for power purposes, but thought that in the chemical industry application for such a boiler could be found, and that in some applications its position would be unrivalled.

Dr. Ormandy referred to the amount of work that had been done on this subject by Mr. Brunler, and stated that still more work remained. Some of the work was being carried out in this country, and until the results were available he desired to retain an open mind on the efficiency of such a boiler.

Mr. Oscar Brunler pointed out that whilst the heating of a liquid by a submerged flame was a comparatively simple matter if the pressure on the surface of the liquid was at or about atmospheric, with higher pressures on this free surface the problem became much more complex and the difficulties of submerged combustion greatly increased.

Mr. Featherstone Hammond dealt with the very large area of the boundary surfaces between the liquid and the products of combustion thereby producing efficient cooling of the latter and the prevention of local heating.

Mr. Heastie raised several questions relating to heat transference, while Dr. Scholtz discussed the chemical effects which might arise when the burner is used, as was suggested, for the melting of metals either when too little air was present or when the air was more than sufficient for complete combustion.

In view of the statement in the paper that the heat developed in a submerged flame burner was many times greater per cb. ft. per hour than the heat developed in the new water-walled boiler furnaces, Prof. Holman asked it in consequence the submerged boiler was much lighter than the other types, and pointed out the great advantages that this would be in the cases where boiler plants were required in out-of-the-way places where transport became abnormal.

Prof. J. W. Hinchley also discussed the utility of the boiler as an evaporating and heating medium, and gave some interesting figures relating to heat transference across metal walls which had been subjected to different surface treatment as results of experiments carried out at the Imperial College of Science.

Mr. Bailey asked how small burners of this type could be made, as it seemed to him that cases would arise in which a number of small burners would be more suitable than some of the large burners which had been described by the author.

Mr. Featherstone Hammond, in replying to Mr. Bailey's question, said that burners had already been made which consumed about 60 cb. ft. of gas per hour, and that more specific information would have to be given before he could state if it were possible to go below this figure.

Sir Alex. Gibb, in proposing a vote of thanks, complimented the author on the clarity of the diagrams which he had shown, and stated that this was the first occasion in which an attempt had been made to discuss submerged-flame combustion in a sound analytical manner.

The Conference was resumed on December 8, when Mr. Macnab occupied the chair in the unavoidable absence of Mr. J. Arthur Reavell. Three papers dealing with refrigeration were presented.

In the first paper Mr. G. W. Daniells dealt with the design of refrigerating plants, and showed how the entropy temperature chart could be employed to determine the heat content of the refrigerant at various stages

in the cycle. On these charts was shown how expansion through a regulating valve carried out so that the total heat remains constant, affects the dryness of the liquid vapour mixture, and the effect of precooling the liquid refrigerant. Multiple effect compression was also discussed, and diagrams were shown of multi-pressure systems of working. The author pointed out that a successful refrigerant should not require excessively high pressures in the plant or a bulky compressor to handle it, but that it should be chemically inert to the materials employed in the construction of the compressor and chemically stable under operating conditions. These conditions limited the choice of refrigerants to such substances as ammonia, sulphur dioxide, methyl chloride, and one or two other hydrocarbons. The question of supercharging as a means of increasing the output of an existing plant was also treated. The latter portion of the paper dealt with heat transmission, and slides were projected illustrating types of coil heaters in which the flow of both refrigerant and the liquid being evolved was very poorly controlled, and showing how a very slight modification of such a design enabled much better control to be obtained in the coolers.

This paper was followed by another on the "Practical aspect of mechanical refrigeration as applied to chemical industry," by Mr. L. Chew. Dealing with compressor design, the author pointed out that the most notable change in the development of ammonia compressors consisted in raising the speed of rotation. Formerly the machines ran between 60 and 100 revolutions per minute, but now speeds varying from 300 r.p.m. for large machines to 500 r.p.m. for smaller machines are quite common. After discussing such factors in the design of ammonia compressors as effect of clearance, volumetric efficiency, coefficient of performance, ratios of compression, the author described modern compressor plant both of the high speed reciprocating and turbine types, and stated approximately the lowest capacity at which it was economical to instal the turbine compressor. Mention was made of a reciprocating machine upon the crank case of which could be fitted three different types of cylinders, thus permitting the machine first to operate through other refrigerating cycles; secondly, to deal economically with higher compression ratios, and, thirdly, to vary the refrigerating capacity. An interesting diagram was shown giving the relative sizes of turbo-compressors using different refrigerants but having the same capacity. In the latter portion of his paper Mr. Chew considered the vital question of heat transfer, and described a number of experiments which had been made to determine how the heat transmission coefficient was affected by different arrangements of coils and pipes. Reference was made to various forms of evaporators and condensers employed in refrigerating works, and the economic aspect of the subject was not forgotten.

On resumption of the meeting at eight o'clock, Mr. R. J. Mitchell gave his paper on "Electric automatic refrigerators for domestic use." The author dealt with the importance of refrigeration in the preservation of food-stuffs, and then considered the problem which faced the designer of a small machine for household use. In large plants the operation of refrigerating machines is

under the control of a skilled engineer, but household machines must be so constructed that they do not need expert or skilled supervision. The public expects to get a perfect machine of this type for about £50. A large amount of experimental work had therefore to be done before such machines could become a commercial proposition. Nearly all compression machines of this type used sulphur dioxide as the refrigerant since this material has a high latent heat, is not explosive, and when anhydrous does not attack the metal parts. Moreover, the cycle is a low pressure one and the material can be obtained in a pure state cheaply. The factors governing the design of the compressor are reliability and simplicity. For this purpose the reciprocating compressor is extensively employed. The automatic control of these household plants is also essential, and the author described a means whereby the motor driving the compressor and the supply of cooling water could be controlled by the temperature existing in the cold chamber. The construction of the cold chamber itself was also dealt with, the main features being the provision of an internal surface which could be readily cleaned, the insulation of that surface to prevent the ingress of heat to the contents of the chamber, and the provision of a door or doors of such a size that the contents of the chamber could be easily removed and which would fit in such a way as to inhibit the inflow of heat. Slides showing the general arrangement and details of several of those well-known machines were projected, and then the author proceeded to describe the principles upon which an adsorption machine works. After the description a number of diagrams were shown illustrating small refrigerators working on this system.

Mr. Willcocks, in opening the discussion, emphasised the necessity for the chemist to know something about refrigeration as well as for the engineer to know something about the chemical problems to which refrigeration could be applied. He mentioned the position of the refrigerating industry in America and how the problem of cooling an oil for the extraction of wax in which there had to be a temperature drop of 10° between the liquid being cooled and the cooling material at every stage in the cooling had been accomplished. Mr. Willcox also thought that the icebox formed a useful adjunct in the household preservation of food.

Dr. Seligmann mentioned some experiences which he had in connexion with the cooling of milk, and stated that in one form of evaporator he had obtained a very high coefficient of heat transfer at points where the film changed direction. He disagreed with the previous speaker on the subject of iceboxes, and contended that in such an apparatus whilst a temperature of 50° F. might be attained under suitable conditions a temperature of 56° F. was much more likely: 50° F., however, seemed to be a critical temperature, and in the milk industry the uniformity of temperature in an icebox was lacking. Other speakers referred to Mr. Mitchell's unbiassed descriptions of the machines which he had reviewed.

Mr. W. A. S. Calder, Vice-President of the Institution, occupied the chair at the first session on Friday, when Mr. W. J. Jones delivered his paper on "The problem of industrial lighting with some reference to chemical in-

dustry." The author pointed out that industrial lighting was a problem of great complexity since innumerable classes of work had to be considered. In such a problem visibility was an extremely important factor, and brought the experimenter face to face with the physiological problems of the eye. The brightness of an object, too, is dependent upon the amount of illumination allowed to fall on it and its reflectivity. The author then carried out some interesting experiments to show how the shape of an object seemed to be affected by various forms of lighting, and how the ability to perceive detail is dependent upon the intensity of illumination. The present method of replacing low candle power lamps by lamps of much higher candle power in reflectors, designed primarily for the former type of lamp, has negatived the greater illumination by the introduction of glare. The effect of glare was forcibly demonstrated by other experiments which the author made.

Proceeding from these technical points the author then considered the effect of lighting on production, and showed that, although tests of this nature were difficult to make, in every case where they had been made increase in lighting had resulted in increased output and better workmanship, and that this increase more than counterbalanced the additional expense entailed in lighting. The next question which naturally arose was the economics of light production. The cost of electric light depends upon the efficiency and price of the lamp and the price of electricity. The author showed that when these factors are taken into account, curves can be drawn showing minimum points at which lighting becomes most economical. The author also warned against increasing the life of a lamp by reduction of the voltage for by so doing the resultant light output is reduced to a very great extent. A chart was given to show the accident curve and the curve for the hours of artificial lighting over a period of one year. These possessed remarkable similarity, and certainly showed that these two factors were not independent.

Slides were shown illustrating the illumination of workshops and factories by putting modern high candle power lamps into old fittings and the glare which was produced thereby, and the same factories lit by high candle power lamps in fittings which had been designed for that purpose. The author both by his paper and his demonstrations clearly showed that the subject of factory lighting from the point of view of increased output, safety of operators, etc., was just as important as hygiene and ventilation, and amply repaid the extra cost which it involved.

An interesting discussion followed in which several speakers drew attention to the inadequate and antiquated methods of lighting which are adopted in some factories, and to the fact that the cleaning and attention to lights in factories is regarded as an unnecessary expense.

The first paper of the evening meeting, when Mr. H. J. Pooley occupied the chair, was by Messrs. Parker, Jackman and Vowler on "An apparatus for measuring the weight and volume of the contents of receptacles." The authors stated that they had been led to the development of this apparatus by the necessity of obtaining a simple and accurate method of weighing the charge

of goods to be cleaned and the solutions used for cleaning these goods in a laundry washing machine. Investigation of the problem led them to adopt a pressure cell formed of a metal casing provided with a thick rubber diaphragm and filled with glycerin. One or more of these cells were placed under the feet at one end of the washing machine and connected to a gauge graduated to read weights. The feet of the other end of the washing machine rest on knife edges, and provision is made for adjusting the pull exercised by the belts driving the machine. Flexible tubes connect the inlet and outlet pipes of the machine. The fluid employed to transmit the pressure from the cell to the gauge is glycerin, as it was found that this material was sufficiently viscous to damp down fluctuations set up at the reversal of the machine.

In the discussion Mr. F. H. Pooley asked several questions relating to the fluid used, the prevention of back lash in the gauge, etc.

The last paper was presented by Mr. A. J. Green on "The properties of silica and fireclay products in their relation to industrial usage." In his paper the author pointed out that fireclay is a comprehensive term embracing a variety of substances which differ considerably, both in constitution and physical properties. In the reduction of fireclay products, varying quantities of graded grog are worked into the clay to give homogeneous mixture, and after shaping the object is dried and fired according to a predetermined schedule. The next portion of the paper dealt with the texture of the fireclay products and the importance of grog in this respect. The constitution of silica products is determined in the main by the nature of the raw materials, the manufacturing procedure embodying the grading of the raw materials and the amount of flux used, and the control and extent of the firing operations. Under each of these headings considerable variation can occur, so that it will be evident that discrepancies in the resulting products are easily produced. Specific gravity, as a means of determining the grade of the product produced, was not an infallible test, since bricks of a specific gravity, varying from 2.32 to 2.37, a high grade article, contained varying quantities of tridymite and cristobalite, which play a conspicuous part in low-temperature spalling.

The next section of the paper dealt with the structural stability of silica and fireclay and refractories under load. Graphs were shown illustrating the behaviour of various specimens under loads of from 4 to 75 lb. per sq. in. when subjected to heat treatment. Naturally the behaviour of these materials under test depends upon the composition of the refractory, the firing treatment and its physical nature. After a consideration of the resistance to spalling of refractories, the author discussed their thermal properties and the temperature diffusivity and thermal conductivity of fireclay and silica products. It was pointed out that the temperature diffusivity of fireclay and silica products increases with temperature. The coefficient of diffusivity of both products is raised by increased firing treatment, and a high porosity is not hostile to low diffusivity. Under the heading of corrosion, erosion, and physico-chemical disintegration, the author discussed the

influence of iron compounds, the corrosion of silica bricks in the roof of an open-hearth steel furnace, and the influence of salty coals.

The paper was of a general nature, and covered such a wide field that very little time was left for discussion. Mr. Trost mentioned the development of an apparatus for testing firebrick and silica products under load, in which the readings were recorded automatically. In his opinion the standard laid down by the gas engineers of 50 lb. per sq. in. was excessive, a figure of 20 lb. per sq. in. being more suitable. Messrs. Hussey and Miers also spoke, but in view of the shortness of time available, they agreed together with other gentlemen to communicate their remarks in writing, and that these, together with the author's reply, would appear in the Transactions of the Institution.

BIOCHEMICAL SOCIETY

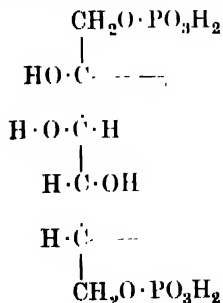
A meeting was held in the Imperial College of Science and Technology, on December 9, when the following papers were read:—

"The evaluation of yeast fat for vitamins A and D and of irradiated yeast fat for vitamin D," by E. M. Hume, I. Smedley-Maclean and H. Henderson Smith. Yeast fat was examined for its content of vitamin A and of vitamin D, the latter both before and after irradiation of the fat. A sample of total fat, derived from pressed brewer's yeast, showed no activity for vitamin A, when a daily dose of 0.18 g. was given to rats on a diet deficient only in vitamin A. A sample of acetone-soluble fat, prepared from yeast, which had been incubated in carbohydrate phosphate solution, was found neither to promote the growth nor the bone formation of rats on a diet deficient only in fat soluble vitamins, when a dose of 0.14 g. was given daily. It was, therefore, concluded that such a sample of yeast fat was devoid of vitamin D. Smedley-Maclean and Luce had previously found that a sample of total yeast fat, derived directly from pressed brewer's yeast, did promote growth and calcification of rats. The explanation of the discrepancy probably lay in the different kinds of yeast fat used, and the matter was being further investigated. The same two kinds of yeast fat, together with samples of fat prepared from yeast after a preliminary boiling with normal acid, were irradiated with the mercury vapour quartz lamp, and fed to rats on a diet deficient in fat-soluble vitamins, in very small daily doses. The best results were given by the acetone-soluble fat derived from incubated yeast, which promoted growth and bone formation in a daily dose of 0.005 mg. The quantitative relationship of the vitamin D in the irradiated fat to the two sterols, ergosterol and zymosterol, in the fat before irradiation are not yet worked out.

"Organic phosphates from rabbits' muscle," by J. Pryde and E. T. Waters. In confirmation of Embden and Zimmermann, hexose diphosphoric acid has been isolated as the brucine salt from muscle press juice prepared from rabbits, to which glycogen and sodium fluoride had been added. It has $[\alpha]_{5461}^{15} = -30.7^\circ$ in dry methyl alcohol, identical with that of the brucine hexose diphosphate formed during yeast fermentation. From 500 c.c. of juice obtained from the muscles of two medium-sized

rabbits 3.5 g. of the crystalline salt was obtained. In further confirmation of Embden and Zimmermann, when the fermentative resynthesis using added glycogen and fluoride is omitted a hexose monophosphoric acid only is obtained. 12 g. of the brucine salt was obtained from 5 kg. of muscle removed from 12 rabbits. In more recent work higher yields have been secured. The possibility has not been excluded that this monophosphate may consist of a mixture of two monophosphates. Adenylic acid, as reported by Embden and Zimmermann, has also been isolated from muscle pulp. From 12 rabbits approximately 1 g. was obtained. It has $[\alpha]_{5461}^{18} - 51.1^\circ$ in water, and m.p. 191° (decomp.). Heated at 100° in a sealed tube in anhydrous methyl alcohol containing 1% hydrogen chloride, it is decomposed with formation of a methyl pentoside free from phosphorus. From the hydrolysis products adenine was isolated as the picrate (m.p. 293° , with decomp.).

"Dephosphorylated methylhexosides derived from hexosediphosphoric acid," by W. T. J. Morgan and R. Robson. By the action of the bone phosphatase on the α - and β -methylhexosidediphosphoric acids both phosphoric acid groups have been removed and the corresponding α - and β -methylhexosides obtained as non-reducing syrups. The specific rotations, $[\alpha]_{\text{H}_2\text{O green}}^{20}$ $+ 60^\circ$ and $- 45^\circ$ respectively, showed that these compounds were not α - and β -methylfructosides. On hydrolysis with 0.01N HCl at room temperature both hexosides yielded a levorotatory sugar corresponding to $\alpha\beta$ -fructose. The ease of hydrolysis suggested that the compounds were α - and β -methyl- γ -fructosides, and the observed rotations are consistent with this view. Further evidence was obtained by converting the β -methylhexoside into tetramethyl- β -methylhexoside, $[\alpha]_{\text{H}_2\text{O green}}^{20} - 6.8$, which on acid hydrolysis yielded $\alpha\beta$ -tetramethylhexose, $[\alpha]_{\text{H}_2\text{O green}}^{20} + 30^\circ$. This specific rotation is close to that given by Irvine, Howarth, and others for $\alpha\beta$ -tetramethyl- γ -fructose, but differs widely from the value ($- 142^\circ$) for the corresponding derivative of normal (amylenic oxide) fructose. It is concluded that hexosediphosphoric acid is a derivative of γ -fructose. The existence of the unstable butylene oxide ring in conjunction with an unsubstituted reducing group makes it very probable that the second phosphoric acid group occupies position 6, and the following formula is therefore put forward as representing the structure of hexosediphosphoric acid:—



"Chemical changes taking place in muscular tissue when passing into rigor," by H. R. Hewer, H. Jairam and S. B. Schryver. Gelatin, if previously treated

with relatively dilute acids, yields a larger basic fraction (precipitable by phototungstic acid) of the hydrolysis products than does the untreated gelatin. Other animal proteins have been found to act in the same way. It is now shown that the muscular tissues of frogs, when in a state of rigor, yield on hydrolysis appreciably larger amounts of the basic fraction than do muscles in a state of rest.

"The relationship of pectin to hemicellulose," by E. J. Candlin and S. B. Schryver. The insoluble pectic acid, prepared from non-lignified cell wall substances of plants, readily undergoes decarboxylation on treatment with weak alkali at relatively low temperatures, to yield products similar in character to the hemicelluloses. Reasons are given for supposing that the pectins and hemicelluloses belong to a definite class of chemical compounds, for which the name polyuronide is suggested.

"Studies in the nutrition of birds," by Egerton Charles Grey. The resistance of Egyptian pigeons was found to vary with the breed, the black being more resistant than the white or brown. The wild pigeons are mostly black. These facts led to the choice of black pigeons for experiments, and a comparison of the tame and wild bird. The former were found to put on weight and lose weight rapidly, the latter slowly, which facts were correlated with the better development of the digestive system in the former and neuromuscular system in the latter. On a diet of polished rice the tame birds showed alimentary dystrophy, oedema, congestion, hemorrhage, death by general inanition or heart failure, but not neuritic symptoms; while the wild birds, which showed less of these symptoms, and which lived longer, developed convulsions and other neuritic symptoms. The brain was found not to lose weight. The nervous system is thus evidently only slowly involved, and only the hardy type will show the neuritic symptoms. These facts appear to have an obvious bearing on the aetiology of beri-beri. Early administration of cod-liver oil prepared the pigeon to resist the effects of a diet of polished rice, and certain nitrogenous substances, as well as radiation of the rice, appeared beneficial. Washing out the crop, and withholding food, act as a partial cure, while administration of sugar hastens death. Starvation does not therefore adequately account for the condition—rather, there is evidence of intoxication. One of the most remarkable changes in the body is the atrophy of the pancreas. It may diminish to a sixth of its weight and become almost liquid. When young pigeons are fed on whole rice they do not thrive; the organs are less developed, notably the pancreas. The facts indicate that the rice disease is due partly to the absence of the vitamin B complex and partly to the inadequacy of the rice as a diet. The vitamin B complex is considered as having two functions, firstly in catalysing the combustion of material in the tissues, whether of fat, carbohydrate, or protein origin; and secondly, in maintaining tissue tone. The various symptoms, it is claimed, can be interpreted in terms of the breakdown of one or both of these mechanisms.

"The estimation of chlorides on biological fluids," by R. K. Christy and W. Robson. A series of investigations on sodium chloride and water equilibria between

blood and tissues in laboratory animals necessitated a micro-method of estimating chlorides. Preliminary investigations, using the technique of the Volhard method, or its modifications, as well as that of the Van Slyke method, showed that from the point of view either of accuracy or of carrying out estimations by artificial light these methods were unsuitable for the purpose. The substitution of KIO_3 for KNO_3 in the KI-starch-nitrous acid method of Van Slyke did not yield accurate results. If, however, the bi-iodate $\text{KH}(\text{IO}_3)_2$ is used results are obtained within 1% of the true values. An additional advantage is that the end point is true over a wider range of p_{H} than that of the nitrous acid method, and does not require a buffered solution. It is applicable to fluids containing that quantity of HNO_3 usually added for the complete precipitation of chlorides by AgNO_3 . The reaction involved is $\text{KH}(\text{IO}_3)_2 + 10\text{KI} + 11\text{HNO}_3 \rightarrow 11\text{KNO}_3 + 6\text{H}_2\text{O} + 6\text{I}_2$.

SOCIETY OF GLASS TECHNOLOGY

The meetings at Stourbridge began on the evening of Tuesday, November 22 (when Prof. W. E. S. Turner gave a popular lecture on "Modern artistic glass"), and extended over Wednesday, November 23, when the following papers were presented:

"Modern artistic glass," by Prof. W. E. S. Turner. After referring to the properties which glass possessed as a medium for artistic expression, Prof. Turner stated that the two requisites for permanence in art were (1) beauty of form and (2) a knowledge of technique. With regard to form, this was exemplified in the high standards of later Egyptian, Roman, and Venetian glass. Elegance survived in a few modern factories, but it was not general. In decoration there was a wonderful field open to the glass craftsman. The question for the artist was how best to reconcile the treatment with the natural properties of the glass. Thus, enamelling, or even casing, might be carried too far, if it obscured entirely the transparency or translucence of the glass. The brilliance of cutting should have relation to the nature of the subject. Deep breaking or cutting of the surface might be bad artistically. Prof. Turner then gave a detailed study and review of artistic glassware in different countries. In America the man who had done most to develop artistic glass in the United States was an old friend of the Stourbridge neighbourhood, Frederick Carder, who was regarded as America's master glass maker. References were next made to modern glass production in Belgium, Austria, Germany, Czechoslovakia, and Sweden, as well as to two British firms, Messrs. James Powell & Sons (Whitefriars), Ltd., and to Messrs. John Moncrieff, Ltd., Perth (*Monart* ware). With regard to France, developments there had come through strength of personality. In no country had there been so marked a departure from the orthodox in form and decoration as in France.

The chairman, Mr. Walter Butterworth, senr., M.A. (President of the Society), commented on Prof. Turner's remarks so felicitously that he was invited to give a lecture himself, to deal more particularly with stained glass.

"Stourbridge fireclays and the manufacture of glass

house pots," by M. H. Edwards. According to local tradition the fireclay industry was introduced into the Stourbridge district about 1556, by some refugee Hungarian glass-workers, who found that the fireclays in the local coal measures were such as they needed for their melting pots. The bed of clay originally used was the Old Mine clay, which appears to have been first exploited in the Hungary Hill district. Later, other beds below this, the New Mine clays, were used, though none was so good as the Old Mine clay for glass house pots. The clays on being raised from the pit are tipped on the surface into separate banks for weathering, the time allowed being from 6 to 12 months, or longer. The pot clay is then broken, spread on a concrete floor in the open air and watered daily. When fit, it is conveyed to the mill, where it is ground and passed through a No. 12 mesh sieve. The grog used is lump for pot-clay, burnt to 1410°C . The important period of maturing follows. This consists of tempering and lying in bulk for from 4 to 6 weeks. Further tempering, usually by hand and foot, is necessary. In the construction of the pots the best method was that of "cross graining" the clay. A good pressure should always be exerted on the clay between the hands.

"Glass pot manufacture in Great Britain," by Prof. W. E. S. Turner. Six lengthy tables were presented, giving the results of a survey of the conditions of pot-making in this country. These tables dealt with: (1) General particulars concerning the pots; (2) the clay and its preparation; (3) the drying and storage of pots; (4) the treatment of pots in the arch; (5) conditions of pot use in relation to life; and (6) life of pots. The lecturer discussed the mass of details given in each table, the information for which was obtained as the result of a questionnaire circulated to representative firms in England and Scotland.

CANADIAN INDUSTRIAL NOTES

The Paispearl Products, Inc., of New York, the oldest and one of the largest manufacturers of artificial pearls in the world, has established a plant at Nanaimo, Vancouver Island, B.C. The product of the new industry will consist of pearl essence, known as "Essence d'Orient," which is extracted from fish scales by a chemical process. The essence will be shipped east to be converted into the so-called pearls. The company intends to handle all the fish-scales which the curing and canning establishments of the island produce.

It is intimated that the Laurentide Pulp & Paper Co., of Montreal, has acquired the properties of the Hawkesbury Lumber Co., W. C. Edwards Pulp & Lumber Co., and Pembroke Lumber Co. These large properties, on the Ottawa River and its tributaries, embrace one of the most extensive lumbering operations on the American continent. In financial circles it is considered to be a move to combat the continued expansion, in the Ottawa Valley, of the Canadian International Paper Co. The significance of this transaction can be comprehended in view of the prevalent report that the International Paper Co., along with the Backus interests, were negotiating a proposition whereby these concerns would control, to a large extent, the major portion of the pulp-wood of the province of Quebec.

CORRESPONDENCE

RESEARCH AT THE UNIVERSITIES

SIR.—I accept the statement in your recent article on "Research" that you wrote without "really reliable data to go upon." May I be allowed to supply you with the same? Students do not, as you suppose, conduct research. They work at problems which are part of the general scheme of research which is, at the moment, occupying the attention of the laboratories in which they work. They are guided in their training by members of staffs of the laboratories which include those of the Universities. The results of the research are usually submitted for publication in the joint names of the student and trainer, and are not published unless a competent body of chemists, acting as a publication committee, regard such a course as desirable. It is clear, therefore, that you cannot withhold your "highest opinion" from the research work of the student and confine it entirely to that of the University!

Perhaps you will tell us what you really mean in a future issue.

Yours faithfully,
JOCELYN THORPE

THE REMUNERATION OF CHEMISTS

SIR.—I think you have performed an excellent piece of work in opening your columns to correspondence on the subject of the salaries paid to chemists. Years ago I should have said that any form of "trades union" for chemists was the most iniquitous idea that could have been suggested, but to-day my views are very considerably modified. It seems scandalous to think that anyone who has taken a good degree in chemistry should be offered the miserable salary which so often is the case. For consider, Sir, what the acquirement of a good degree really entails. It means hard work for at least four years after school days are over, with all its attendant expenses, which have to be found somehow, then another year or so on learning how research is carried out (a total time very little different from that spent by the ordinary medical student), and then to be offered in many cases a "salary" less than that received by the typists in the office.

You, Sir, have published an advertisement for a chemist in to-day's issue of the JOURNAL, who in return for being a chemist, bacteriologist, "medicolegalist," organiser, lecturer, etc., is offered the princely salary of £400 per annum, with an efficiency bar later on. What would the B.M.A. say to a similar offer made to a member of that other profession? Firmly but surely they would "squash" the same and refuse to publish the advertisement. Surely it is time our Institute took similar action and did likewise, insisting that all firms employing chemists should pay them a real salary, not a mere pittance.

It is not that a chemist wants something for nothing, but at least he is entitled to a proper reward for the time and money expended in training himself, and to get this it seems to me that a really efficient organisation run on the lines of the B.M.A. is an absolute necessity. This means some scheme of registration with the non-acceptance of candidates who do not possess certain qualifications, and though such a scheme may seem

to bear hardly on what may be called the "fourth class" man, it would ensure a proper recognition of chemistry as a profession, corresponding with the legal and medical professions.

I am, Sir, etc.,

J. R. H. WHISTON

THE REGISTRATION COMMITTEE'S REPORT AND THE "B" QUALIFICATION

SIR.—Since the publication of this Report the Association has received numerous applications for membership as well as enquiries in regard to the Nomination Committee's requirements in the matter of the "B" qualification.

Having regard to the doubt which appears to exist as to the considerations governing the decision of the Nominations Committee, a fact which seems to have deterred some, probably qualified for full membership, from making application, we would repeat that the most careful consideration is given to every application. If the applicant satisfies the Committee regarding general and scientific education which, though generally does not necessarily include examination evidence, his case is decided strictly on its merits. Such applicants are asked to co-operate with the committee by supplying the fullest possible details, including particulars of any research work and processes devised or improved, since in this way the committee's work is simplified and expedited.

In general, it may be stated that there is no reason why the application of any candidate of proved competency should be rejected.

I am, Sir, etc.,

HENRY T. F. RHODES,
General Secretary.

British Association of Chemists

PERSONAL AND OTHER ITEMS

The Directors of Imperial Chemical Industries, Ltd., announce that M. Ernest John Solvay has been elected a member of the Board. M. Solvay is the son of M. Armand Solvay (Chairman of the well-known Belgian firm of Solvay et Cie) and grandson of M. Ernest Solvay, the inventor of the ammonia soda process and the founder of the firm of Solvay et Cie. It was through the co-operation of M. Ernest Solvay and Dr. Ludwig Mond that the ammonia soda process was introduced into England, and this led to the formation of Brunner Mond & Co., Ltd. Solvay et Cie have been represented on the board of Brunner Mond & Co., Ltd., for many years, and friendly relations have existed between the two companies since the commencement.

Lord Colwyn, president of the Institution of the Rubber Industry, opened the Institution's first public exhibition in the Central Hall, Westminster, on December 14.

Lord Brabourne and Dr. E. P. Andreae have joined the board of the Chemical and Metallurgical Corporation, Ltd.

Colonel J. T. C. Moore Brabazon, M.P., late Parliamentary Secretary to the Ministry of Transport, has joined the board of Kodak, Limited, the British subsidiary of the Eastman Kodak Company, of America.

Mr. F. Napier Sutton, F.I.C., Inspector under the Alkali etc. Works Regulation Act (Ministry of Health) for the Eastern and South Eastern Counties District, retires under the age limit on December 20. He joined the Department (then the Local Government Board) in April, 1885, as assistant to the then Chief Inspector, the late Mr. Alfred E. Fletcher, and was appointed Sub-Inspector in 1892 and Inspector in 1908, and thus completes a service of nearly 43 years.

The late Prof. A. Liversidge, F.R.S., Emeritus Professor of Chemistry in the University of Sydney, left £46,128, with net personalty £39,197. Amongst the bequests are: £1000 to Christ's College, Cambridge, for a scholarship, and £500 for a research lectureship in chemistry and in the English language; £1000 to the Royal School of Mines for a scholarship; £500 to the Chemical Society for a research lectureship in chemistry; £100 and his unpublished papers relating to chemical and scientific matters to the Chemical Society; and various bequests for the advancement of science in Sydney, New South Wales.

Home Office Industrial Museum

On December 3 the King and Queen visited the new Home Office Industrial Museum in Horseferry Road, Westminster, which has been established to demonstrate methods, arrangements, and appliances for promoting the safety, health and welfare of industrial workers. The spacious building which houses the exhibition was ready for occupation in 1914, but during the war and for a considerable time after 1918 it passed into the occupation of the military authorities. The restoration of the building to its original state and the organisation and collection of the exhibits began two years ago. Amongst the exhibits are lathes, drilling machines, grinding wheels, textile machinery, printing machines, laundry equipment and the like, and every machine has a lesson for employers and workers. Transmission machinery, power presses, baking machinery, rubber incorporating rolls, pottery processes, printing machinery, boilers and other steam plant are also installed. An important section is devoted to the chief industrial diseases; included in it are photographs showing methods for the prevention of lead poisoning, silicosis, and dermatitis in various industries. An anthrax section compares disinfected wools and untreated wools at various stages of the manufacturing process. The museum was opened to the public on December 5.

High-Frequency Electric Furnace for Steel Melting

Last week a demonstration was given of the Ajax-Northrup high-frequency furnace which has been installed by Edgar Allen & Co., Ltd., in their Imperial Steel Works, Sheffield, for melting steel. The furnace, which is the first of its kind to be used commercially in the manufacture of high quality tool steel, deals with about 450 lb. of steel an hour, whereas in the crucible process pots containing about 60 lb. of material are heated for 4 hrs. At the luncheon after the demonstration, Prof. C. H. Desch said the process provided a means of making high-class steel under strictly controlled conditions, without the slightest danger of contamination by foreign gases. The current consumption of the furnace was remarkably

low, because the heat was generated exactly where it was wanted, inside the metal and not outside.

Rubber Exhibition at Imperial Institute

The rubber exhibition, showing a wide range of exhibits, which was opened at the Imperial Institute, South Kensington, on December 2, was arranged by the governors of the Institute and the council of the Rubber Growers' Association. The exhibition provides a demonstration of the processes associated with the production and manufacture of rubber, and includes large models of rubber estates, and exhibits showing the uses of rubber in modern life and industry. Admission is free, and the exhibition will be open until December 31.

Ramsay Laboratory of Chemical Engineering

Several big industrial firms which have already obtained valuable recruits from the School of Chemical Engineering at University College, have just undertaken to provide a considerable portion of the money needed to carry on the work of the Ramsay Laboratory of Chemical Engineering for the next ten years. For the remainder of the endowment fund an appeal is being issued, and firms interested in the work of this department are being invited to promise annual subscriptions for the period of ten years. It is not intended to change the policy which has determined the work of the laboratory during the last few years, though it is hoped that sufficient funds will be available to allow certain extensions to be made to the buildings. The committee which has made itself responsible for raising the endowment fund is headed by Sir Alfred Mond, and has a number of other industrial leaders as members.

Reported Franco-German Chemical Agreement

Reports from Paris suggest that an agreement, in relation particularly to the exportation of dyestuffs, has been reached between the I.G. Farbenindustrie and the Kuhlman group and the Société Anonyme des Matières Colorantes in France. Official confirmation is not yet available, but it is reported that the French production quota is fixed at 15,000 metric tons, 10,000 t. for home consumption and 5000 for export.

The I.G. Farbenindustrie

The directors of the I.G. stated at a meeting last week that they propose to seek powers to issue convertible bonds (bearing not more than 6% p.a.) to the extent of 250 million marks (£12,500,000). The new capital will be required for construction and expansion in the coal-liquefaction and the nitrogen-fixation sections of the I.G. The board reports that business is satisfactory, and that it will propose, at the annual meeting on January 14, a dividend of 12% for 1927, compared with 10% in 1926. Progress has been made in coal liquefaction, and by the end of 1928 the production will amount to 200,000 tons of oil. No solution of the problem of the commercial production of synthetic rubber has been reached, but research is proceeding. An agreement is about to be concluded with the French chemical industry, but the negotiations with the British chemical industry have produced no tangible result. The chairman of the board stated emphatically that no agreements would be arrived at which were directed against the industries of other countries.

REVIEWS

THE DYEING OF TEXTILE FIBRES. By R. S. HORSFALL, M.Sc., and L. G. LAWRIE, A.I.C. Pp. x+416. London: Ernest Benn, Ltd., 1927. Price 28s.

"The Dyeing of Textile Fibres" is a welcome attempt to describe the many operations connected with the preparation, dyeing, and finishing of textiles. As the authors state in their short preface, the subject has been treated from the point of view of the material to be dyed, so that about half the book is occupied by consideration of the two most important fibres, cotton and wool. Smaller sections deal with artificial silk, natural silk and linen. In each case the structure and properties of the particular fibre are dealt with, followed by a description of the various treatments it may undergo preparatory to dyeing; next are described methods of dyeing with the different classes of dyestuffs suitable in each case and, finally, the process used in finishing.

The book is primarily intended for dyers who will find therein much valuable information connected with all phases of their art, including large numbers of dyeing recipes which illustrate the use of all the more important dyestuffs. The chemist engaged in the production of dyestuffs will be mainly interested in the stray comments to be found throughout the text which reflect the point of view of the authors towards himself and the fruit of his labours. On the whole, their attitude is at times critical, though much will be forgiven for the admission on page 18 that "The definite need for a dyestuff having certain properties will eventually result in its appearance."

The book is not illustrated, and, on the whole, this is not a serious defect, although occasionally one feels the need of a diagram or drawing to assist in the appreciation of certain of the pieces of machinery described.

The general lay-out and choice of type for chapter headings, sections and paragraphs are, perhaps, not entirely happy, so that at first the reader does not find his way about readily. There are several misprints, which will no doubt be corrected in a future edition; some are unimportant, but the passage on page 33 which talks of "the ratio of length to breadth of the cotton fabric being as high as 1/4000" needs revision.

In addition to the main sections dealing with practical matters connected with dyeing, there is also a short introductory chapter dealing with general points such as theories of dyeing and colour. This also includes a very brief historical survey of the development of synthetic dyestuffs (ending in 1909). The final chapters include notes on the laboratory testing of dyes, a subject that could hardly be adequately treated in the sixteen pages allotted to it. The statement in this section that the degree of fading is "roughly proportional to the amount of colour on the fibre" appears to need qualification in view of the results of modern research.

The authors' remarks on water-softening and the various protecting and dispersing agents used in dyeing will be of interest to many practical workers. No doubt also there may be many who will profit by the short notes on chemicals used in the dyeing industry and the sundry tables, although the necessity for their inclusion

in a book of this type appears doubtful to the reviewer. On the whole, this book is a valuable contribution to the literature of the art of dyeing, and should be read not only by dyers, but also by chemists—since, unfortunately, according to Messrs. Horsfall and Lawrie, this invidious distinction has still to be made.

J. E. G. HARRIS

ENZYMES. PROPERTIES, DISTRIBUTION, METHODS AND APPLICATIONS. By S. A. WAKSMAN, M.Sc., Ph.D., and W. C. DAVISON, M.A., M.D. Pp. xii + 364. London: Baillière, Tindall and Cox, 1926. Price 25s.

It is perhaps unfortunate that the time of publication of this work is so nearly coincident with the completion of the two volumes by Oppenheimer on "Die Fermente," and the abridged "Lehrbuch der Enzyme" of the same author. Comparison with the former is obviously unfair, but the present volume may be legitimately considered side by side with the "Lehrbuch." This being conceded, it has to be admitted that we cannot yet claim a book in the English language, on the important subject of enzymes, which is entirely satisfactory when compared with the best efforts of continental writers.

The book is divided into four unequal sections, the first of which deals with the properties of enzymes. This includes a brief historical survey of the subject, and an account of the rôle of enzymes in the living organism. Succeeding chapters deal adequately with the kinetics of enzymatic reactions and discuss in some detail the various factors which influence the course of such changes.

The second section is devoted to a detailed account of the distribution of enzymes in the human and animal body, in plants and in micro-organisms.

Section C, describing the methods of preparation and study of enzymes, is perhaps the most important in the book. The detail of this section is not, however, always complete: there is a lack of recent references in some cases, as in that of pectase, where statements of doubtful accuracy occur, based on a reference of no more recent date than 1894-5. On the other hand, omission of early fundamental work is sometimes noticeable: the work of Kjeldahl, on which the Lintner method of estimating diastatic power is based, is not mentioned. The chapter on oxidases is not very satisfactory, and one feels, here and elsewhere, that the authors are not quite satisfied with the arguments they defend.

The last section on the practical applications of enzymes is too short to permit of adequate treatment; the specialist in any one branch cannot expect to find detailed information. There is, for example, little more than a page devoted to brewing, and that containing a number of inaccuracies, especially with regard to temperatures.

Nevertheless, the authors have done some considerable service to English-speaking biochemists, particularly in that phase of their work which refers to original sources, the bibliography including over 1300 references.

The publishers have produced a good book, almost entirely free from misprints.

F. W. NORRIS

PARLIAMENTARY NEWS

Tin Ore Supplies

Capt. Hacking informed Sir N. Grattan-Doyle that he was aware that some authorities thought there would be a shortage of the tin ore supplies of the world; he was following closely the discussions which were taking place as to this, and also as to a possible stabilisation of world prices. He did not think that any advantage would be gained at present by the appointment of a special scientific committee to inquire, on behalf of the Government, into the possibilities of conserving the Empire's resources of tin. - November 28.

Home-grown Sugar

In a written reply to Sir J. Power, Mr. Guinness stated that 3,069,757 cwt of home-grown sugar beet was produced in the 1926-27 season. In the present 1927-28 campaign it is estimated that 4,780,000 cwt. will be produced. - November 28.

Foodstuffs (Preservatives)

Mr. Chamberlain informed Mr. Haslam that he had received representations from traders to the effect that since July 1 there had been greater losses on bacon and ham due to decomposition than normally occur, such losses being attributed to the Preservatives Regulations which recently came into force. Mr. Chamberlain stated that one of these representations related to Continental bacon, which had for many years been free from preservatives. The matter was being kept under observation, and he anticipated that these initial difficulties would quickly be overcome. - November 29.

Dead Sea Salts (Concession)

In reply to Colonel Howard-Bury, Mr. Ormsby-Gore said that four applications for the Dead Sea salts concession had been received, and it was decided, in principle, to grant a concession to Major Tulloch and Mr. Novomeysky, based on their offer, provided that suitable terms and conditions could be agreed upon with them, and that they furnished satisfactory financial guarantees. Negotiations on these points were still proceeding, and it was not possible, at present, to state what provisions the concession, if granted, would include. There was no proposal, however, that H.M. Government should obtain a controlling interest by the purchase of shares in the concessionary company. - Nov. 30.

Food and Drugs Acts

Replying to Dr. Vernon Davies, Mr. Chamberlain said he had no record of the number of inspections made or prosecutions undertaken under the Sale of Food and Drugs Acts. In 1924, 1925 and 1926, respectively, the number of samples analysed was 118,000, 118,930, and 120,617. During the same years the number of samples adulterated was 6987, 7714, and 7044, the percentage of samples adulterated for the same years respectively being 5.9, 6.5, and 5.8. - Dec. 1.

Water Pollution (Sugar Beet Factories)

In a written reply to Mr. Haslam, Mr. Guinness stated that the Department of Scientific and Industrial Research was carrying out, under the supervision of the Water Pollution Research Board, working scale experiments on the biological treatment of beet sugar factories' waste

waters at one of the largest factories in the United Kingdom, where facilities were being afforded by the Anglo-Scottish Beet Sugar Corporation. These experiments were being conducted by the staff of the Rothamsted Experimental Station, who also carried out successful preliminary investigation on which the experiments were based. The industry was maintaining close touch with these experiments through the medium of the committee referred to above, and was making a substantial contribution towards their cost. Considerable attention had been and was being devoted to the problem abroad, but no complete solution of the problem had yet been found. - Dec. 5.

Nauru and Ocean Islands (Phosphate Rock)

In answer to Major-General Sir Newton Moore, the Prime Minister said that numerous borings had been made to ascertain the amount of phosphate rock available at Nauru and Ocean Islands, and that it was estimated that these two islands contain together over 100,000,000 tons of phosphate of a quality containing from 85% to 88% tribasic phosphate of lime. Under the existing arrangements, the Governments of Great Britain, Australia and New Zealand were entitled to an allotment of the phosphate produced in each year in the following proportions:—

		United Kingdom Tons	Australia Tons	New Zealand Tons
1920	21	10,781	235,127	17,066
1921	22	10,178	171,881	38,706
1922	23		202,070	51,065
1923	24		318,690	60,687
1924	25		336,800	90,508
1925	26		274,183	98,160
1926	27		(say) 161,825	(say) 130,000
		32,062	2,014,480	190,002

cc. 5.

Blast Furnaces

In a written answer to Mr. Everard, Sir B. Chadwick said he had been informed by the National Federation of Iron and Steel Manufacturers that at the end of November last 160 furnaces were in blast, and 277 were damped down and idle, whereas at the end of November, 1924, 173 were in blast and 302 damped down and idle. - Dec. 7.

COMPANY NEWS

LEEDS FIRECLAY CO., LTD.

The report for the year ended June 30, 1927, shows profits amounting to £42,887 (against £50,209 for the previous year), plus £7155 brought forward. After deducting debenture and loan interest there was a balance of £39,229, from which the directors recommend the payment of a dividend of 8% on the preference shares (against 7½%), 6% on the ordinary shares (against 5½%), and the transfer of £1864 to reserve fund (making that fund £130,000), leaving £7364 to be carried forward.

NON-INFLAMMABLE FILM CO., LTD.

This company has purchased from the War Office a large factory at Lancaster comprising about 34 acres, situated on the banks of the River Lune. The water supply is practically unlimited and of a quality entirely suitable for processes, and railway sidings connected with the London Midland & Scottish Railway run into the factory. Since the purchase was made plans for

development on a considerable scale have been completed, large orders for machinery have been placed, and the equipment of the works is being undertaken with all speed.

CELANESE CORPORATION OF AMERICA

The directors have declared a regular semi annual dividend of $3\frac{1}{2}\%$ on the 7 cumulative first participating preferred stock. This makes dividends, including arrears, paid and declared to be and stock during 1927 amounting to $19\frac{1}{4}\%$.

BRUNNER INVESTMENT TRUST

This Trust has been registered as a public company with a nominal capital of £500,000 in £10 shares. The objects are to acquire and hold shares, debentures, scrip and securities, to act as trustees, etc. The directors are Sir John F. Brunner (director of Madeley Collieries); Mr. R. L. Benson (director of Robert Benson & Co.) and Mr. F. J. M. Brunner (director of Madeley Collieries). The registered office is at 24, Old Broad Street, E.C.2

ALUMINIUM CORPORATION, LTD.

The report for the year 1926 shows a profit of £36,224, compared with £53,743 for 1925. After providing for debenture loan and mortgage interest there was a deficit of £62,163, which, with the balance of £13,731 brought forward, gives a debit balance of £76,347 to be carried forward.

INTERNATIONAL ARTIFICIAL SILK CO., LTD.

This company has been formed with a capital of £660,000, divided into 2,640,000 shares of 5s. each, to acquire from La Soie de Compiègne two large modern mills in France erected for the manufacture of viscose silk, and to provide capital sufficient to increase the present production of three quarters of a ton per day to 4 tons per day during the next 12 months. The chairman is Mr. Andrew Clark, lately managing director of the Clyde Paper Co., Ltd., and the directors are Comte Jean de Nicolay, president of La Soie de Compiègne; Mr. F. R. A. Shortis, lately vice-president of the Guaranty Trust Company, of New York; Lt.-Col. R. Woodruff Cox, managing director of Cox & Edwards, Ltd.; Mr. J. W. Lomax, chairman of the Irwell Bank Spinning Co. (1919), Ltd., and director of Laly Mills (1919), Ltd., and the Manchester Cotton Association; Mr. G. Blay, chairman of Cannon Hill Estates, Ltd.; and Mr. A. N. Harper. The technical consultants are Messrs. Sindall & Bacon and Mr. H. Jentgen.

ELECTROLYTIC ZINC CO., LTD.

The annual meeting was held, in Melbourne, on October 25, at which Mr. W. H. Baillieu, who presided, said that the outstanding events of the past year were the increased efficiency of the operation of the company's undertakings and the developments of the Tasmanian West Coast mines. The decline in base-metal prices was largely offset by the lower prices payable for concentrates in accordance with the sliding-scale agreement, by higher recoveries and lower working costs. The ore reserves in the West Coast mines totalled 1,400,000 tons. An economic method of treating the ores had been evolved, resulting in the establishment of a commercial unit. The gain of over 2000 tons output of zinc was a tribute to the efficiency of the company's technical staff.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

- Acid Acetic, 40% tech.—£19 per ton.
 - Acid Boric, Commercial.—Cryst., £30 per ton; Powder, £32 per ton; Extra fine Powder, £34 per ton.
 - Acid Hydrochloric.—3s. 9d.—4s. per carboy d/d., according to purity, strength and locality.
 - Acid Nitric 80% Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 - Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 - Ammonia Alkal.—£6 15s. per ton f.o.r. Special terms for contracts.
 - Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 - Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 - Borax, Commercial. Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 - Calcium Chloride, Solid.—£5 £5 5s. per ton, carr. paid.
 - Copper Sulphate. £25—£25 10s. per ton.
 - Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 6½ O.P. 1d. extra in all cases. Prices according to quantity.
 - Nickel Sulphate. £38 per ton d/d.
 - Nickel Ammon. Sulphate. £38 per ton d/d.
 - Potash, Caustic. £30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex wharf. Lond. in cwt. kegs.
 - Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 - Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 - Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots, £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 - Soda Crystals. £5—£5 5s. per ton ex railway depots or ports.
 - Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 - Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 - Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 - Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.
- #### RUBBER CHEMICALS
- Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 - Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 - Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 - Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 - Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 - Carbon Black.—5½d. per lb., ex wharf.
 - Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 - Chromium Oxide, Green.—1s. 1d. per lb.
 - Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton, f.o.r.
 London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur
 Precip. B.P.—£47 10s.—£50 per ton, according to
 quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to
 quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £10 5s. per ton. Good demand.
 Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality.
 Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent,
 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carboic.—Crystals.—7½d.—7¾d. per lb. Crude 60's,
 2s. 5d. per gal. prompt; lower for 1928 delivery.
 Acid Cresylic, 99/100.—2s. 11d.—3s. per gal. 97/99.—2s. 4d.
 —2s. 8d. per gal. Pale, 95%, 2s. 3d.—2s. 6d. per gal.
 Dark, 95%, 2s. 1d.—2s. 3d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per
 ton; Anthracene Oil.—Strained, 8d.—8½d. per gal.
 Unstrained, 7¾d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9¾d. per gal., ex works in
 tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal.,
 ex works in tank wagons; Pure, 1s. 5d.—1s. 6d. per gal.,
 ex works in tank wagons.
 Toluene.—90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 6d.—
 2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.
 Creosote.—Cresylic 20/24%,—10d.—11d. per gal. Middle Oil,
 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard
 specification, 7½d.—7¾d. per gal. ex works. Salty, 7d.
 per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.
 —10d. per gal. Solvent 95/160, 1s. 3d.—1s. 4d. per
 gal. Solvent 90/190, 9½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton.
 Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals, £13—£13 10s. per ton. Flaked,
 £14—£15 per ton.
 Pitch, medium soft.—85s.—90s. per ton, f.o.b. according
 to district. Market firm.
 Pyridine.—90/140.—5s. 6d.—6s. 6d. per gal. 90/180.—3s. 6d.—
 5s. per gal. Heavy.—3s.—3s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices
 include packages except where otherwise stated.

Acid Gamma.—4s. 6d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winthor.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—8d. per lb., naked at works.
 Aniline Salts.—8d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb., 100%.
 Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 20/31° C.—5½d. per lb.
 m-Cresol 98/100%.—2s. 3d.—2s. 5d. per lb.
 p-Cresol 32/34° C.—2s. 3d.—2s. 5d. per lb.
 Dichloraniline.—1s. 10d. per lb.
 Dimethylaniline.—1s. 11d. per lb.
 Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—2s. per lb. d/d.
 β-Naphthol.—10d. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb.
 β-Naphthylamine.—3s. per lb.
 o-Nitraniline.—5s. 9d. per lb.
 m-Nitraniline.—3s. per lb. d/d.
 p-Nitraniline.—1s. 8d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb.
 R. Salt.—2s. 2d. per lb.
 Sodium Naphthionate.—1s. 8½d. per lb., 100% basis d/d.
 o-Toluidine.—8½d. per lb.
 p-Toluidine.—2s. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in
 glass containers.
 Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product,
 according to quantity. Solely ex Gum.—1s.—1s. 3d. per
 oz., according to quantity.
 Acid, Boric B.P. Cryst. 36s.—39s. per cwt. Powder
 40s.—43s. per cwt.; Extra Fine Powder, 42s. per cwt.,
 according to quantity. Carriage paid any station in
 Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 6½d.—1s. 7d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d.
 per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 4½d. per lb. Tech-
 nical 11½d.—11¾d. per lb.
 Acid, Tannic, B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Acetanilide.—1s. 6d.—1s. 9d. per lb. for quantity.
 Amidol.—7s. 6d.—9s. per lb. d/d.
 Amidopyrin.—8s.—8s. 3d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 5d. per lb., according to
 quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton. Powder £39
 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—9s. per oz.
 Barbitone.—5s. 9d.—6s. per lb.
 Benzophenol.—3s. 3d. per lb.
 Bismuth Carbonate.—10s. 4d.—10s. 7d. per lb. Bismuth
 Citrate.—9s. 10d.—10s. 1d. per lb. Bismuth Salicylate.—
 9s. 10s.—10s. 1d. per lb. Bismuth Subnitrate.—8s. 4d.—
 8s. 7d. per lb. Bismuth Nitrate.—6s. 1d.—6s. 4d. per lb.
 Bismuth Oxide.—13s. 10d.—14s. 1d. per lb. Bismuth Sub-
 chloride.—13s. 10d.—14s. 1d. per lb. Bismuth Subgallate.
 —8s. 1d.—8s. 4d. per lb. Extra and reduced prices for
 smaller and larger quantities respectively; Liquor
 Bismuthi et Ammon. Cit. B.P. in W. Qts.—1s. 1d. per lb.;
 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal 25s. per cwt. Powder 26s. per cwt.,
 according to quantity, carr. paid any station in Great
 Britain in ton lots.
 Bromides.—Ammonium.—1s. 11½d.—2s. 3d. per lb.

Potassium.—1s. 8½d.—1s. 11½d. per lb. Sodium.—1s. 10½d.—2s. 2d. per lb. Granulated ½d. per lb. less. All spot. Large quantities at lower rates.

Calcium Lactate B.P.—1s. 2d.—1s. 3½d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ethers: S.G. 730, 10½d.—1s. 1½d. drums. Other gravities at proportionate prices.

Formaldehyde.—£39 per ton. Ex wharf in barrels

Guaiacol Carbonate.—4s. 9d.—5s. per lb.

Hexamine.—2s. 3d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.)—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s. 3d. per gal.; 20 vols., 3s. 4d. per gal.

Hydroquinone.—3s. 10d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 6d. per lb.

Iron Perchloride.—18s.—20s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 15s. 6d. January delivery per lb. net. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 5d.—1s. 9d. per lb.

Methyl Sulphonat.—9s.—9s. 3d. per lb.

Metol.—9s.—11s. 6d. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb. Less in quantity.

Phenacetin.—2s. 6d.—2s. 9d. per lb.

Phenazone.—4s.—4s. 3d. per lb.

Phenolphthalein.—6s. 6d.—6s. 9d. per lb.

Potass. Bitartrate.—90/100% (Cream of Tartar) 96s. per cwt., less 2½%.

Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—5½d. per lb. spot.

Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.

Resorcin.—2s. 10d.—3s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—1s. 11d.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—10s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.

Sod. Salicylate.—Powder, 1s. 7d.—1s. 9d. per lb. Crystal, 1s. 8d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.

Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.

Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.

Sulphonat.—6s. 9d.—7s. per lb.

Tartar Emetic B.P. cryst. or powder.—2s.—2s. 1d. per lb.

Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.

Aubepine (ex Anethole).—11s. per lb.

Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.

Anethole (M.P. 21/22° C.).—5s. 6d. per lb.

Benzyl Acetate from Chlorine-free Benzyl Alcohol—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.

Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.

Coumarin.—10s. per lb.

Citronellol.—13s. 3d. per lb.

Citral.—8s. 3d. per lb.

Ethyl Cinnamate.—6s. per lb.

Ethyl Phthalate.—3s. per lb.

Eugenol.—8s. 3d. per lb. Geraniol (Palmarosa).—17s. 9d. per lb. Geraniol.—6s.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. per lb. Linalol.—(ex Bois de Rose) 14s. per lb.—(ex Shui Oil) 9s. 9d. per lb. Linalyl Acetate.—(ex Bois de Rose) 17s. 6d. per lb.—(ex Shui Oil) 13s. 9d. per lb.

Methyl Anthranilate.—8s. 6d. per lb.

Methyl Benzoate.—4s. per lb.

Musk Ketone.—35s. per lb.

Musk Xylol.—8s. per lb.

Nerolin.—4s. 6d. per lb.

Phenyl Ethyl Acetate.—12s. per lb.

Phenyl Ethyl Alcohol.—10s. 6d. per lb.

Rhodinol.—31s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—15s. 3d.—16s. 6d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb. Bergamot.—26s. per lb. Bourbon Geranium.—13s. per lb.

Camphor.—9d. per lb. Cananga, Java, 15s. 9d. per lb. Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java, 1s. 9d. per lb., e.i.f. U.K. port, for shipment over 1928; Ceylon, Pure, 1s. 7d. per lb. Clove, pure 5s. per lb.

Eucalyptus, Australian—2s. 1d. per lb. Lavender.—Mont Blanc, 38/40%, 17s. per lb. Lemon.—8s. 6d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. 3d. per lb. Peppermint.—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Feb. 6th, 1928. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Dec. 22nd, 1927. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Akt. Svenska Flaktfabriken. Increasing capacity of drying installations. 32,021. Nov. 28. (Swed., 29.11.26.)

Bloxam (Geigy A.-G.). Manufacture of emulsifying agents. 32,427. Dec. 1.

Cooper, Mason, and Cooper & Co. Grinding etc. mill. 32,669. Dec. 3.

Frischer. Apparatus for treating solutions. 32,440. Dec. 1. (Ger., 6.12.26.)

General Electric Co., Ltd., and Middleton. Purification of precipitates etc. 32,130. Nov. 29.

Jaubert. Colloidal diaphragms. 32,228. Nov. 30. (Fr., 1.12.26.)

Johnson (I.-G. Farbenind.). Carrying out high-pressure etc. reactions. 32,551. Dec. 2.

Newell, and Newell & Co., Ltd. Rotary kilns. 31,939. Nov. 28.

Pickard. Filters. 32,539. Dec. 2.

• Prétot and Ullmann. Removal of solids from gases. 31,961. Nov. 28. (Fr., 4.12.26.)

Raabe. Leaching etc. materials. 32,377. Dec. 1.

Soc. L'Air Liquide. Separating etc. constituents of gaseous mixtures. 32,289. Nov. 30. (Fr., 4.12.26.)

I.—Complete Specifications

13,642 (1926). Whatmough. Apparatus for dispersing solids in liquids. (280,973.)

20,723 (1926). Schucany. Regenerative gas-fired furnaces. (281,002.)

26,487 (1926). Dorey. Grinding-mills. (281,062.)

2086 (1927). Marks (A.C. Spark Plug Co.). Filters. (281,124.)

*12,124 (1927). I.-G. Farbenind. Manufacture of catalysts. (281,218.)

*31,555 (1927). Studenges. f. Gasind. Adsorption and drying of gases. (281,305.)

*32,021 (1927). Akt Svenska Flaktfabriken. Increasing the capacity of drying installations. (281,339.)

II.—Applications

Allgem. Ges. f. Chem. Industrie. Treatment of hydrocarbons. 32,010. Nov. 28. (Ger., 26.11.26.)

Broughton and Hadlington. Gas producers. 32,691. Dec. 3.

Cooke. Distillation of coal etc. 32,502. Dec. 2.

Gordon, and Imperial Chemical Industries, Ltd. Hydrogenation of carbonaceous materials. 32,543. Dec. 2.

Griven. Treating fuel for internal-combustion engines. 32,542. Dec. 2. (Latvia, 4.12.26.)

Humphrey, and Imperial Chemical Industries. Hydrogenation of carbonaceous materials. 32,237. Nov. 30.

Recovery of oils from carbonaceous materials. 32,238. Nov. 30.

Low-temperature distillation of carbonaceous materials. 32,239. Nov. 30.

Johnson (I.-G. Farbenind.). Production of products analogous to montan wax. 32,685 and 32,686. Dec. 3.

Johnson (I.-G. Farbenind.). 32,548. See VII.

Kelly. Treating oils etc. 31,999. Nov. 28.

Marks (Bernitz Furnace Appliance Co.). Gas generator. 32,505. Dec. 2.

Misch. Apparatus for producing gas. 31,990. Nov. 28.

Pehrson, Pehrson, and Wheeler. Carbonisation of coal. 32,599. Dec. 2.

Sachanen and Tihtscheyew. Cracking petroleum products. 32,566. Dec. 2.

Soc. Anon. La Carbonite. 31,965. See III.

II.—Complete Specifications

32,248 (1926). Nielsen and Laing. Manufacture of gas. (281,105.)

32,862 (1926). Gaertner. Distilling or coking coal. (281,110.)

*14,325 (1927). Koppers Co. Coking retort ovens. (281,221.)

*20,030 (1927). Bates. Hydrogenation of coal. (281,240.)

*29,307 (1927). I.-G. Farbenind. Manufacture of motor fuels. (281,247.)

*31,290 (1927). Ges. f. Linde's Eismaschinen. See VII.

*31,910 (1927). Friedlaender & Co. Preparing and briquetting non-caking fuels. (281,326.)

*32,010 (1927). Allgem. Ges. f. Chem. Industrie. Treatment of hydrocarbons with liquid sulphur dioxide. (281,337.)

III.—Applications

Barrett Co. Distillation of tar etc. 31,951. Nov. 28. (U.S.A., 14.12.26.)

Hübsch and Karpati. Removal of phenols from tars etc. 32,029. Nov. 28. (Hung., 15.1.27.)

Soc. Anon. La Carbonite. Separating-apparatus for tar etc. 31,965. Nov. 28. (Fr., 2.12.26.)

III.—Complete Specification

*31,501 (1927). I.-G. Farbenind. Manufacture of aromatic hydrocarbons. (281,298.)

IV.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of azo dye-stuffs. 32,653. Dec. 2.

I.-G. Farbenind. Production of alkylpyrazolanthrones. 32,684. Dec. 3. (Ger., 14.12.26.)

Johnson (I.-G. Farbenind.). Production of derivatives of phthalic acid. 31,966. Nov. 28.

Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. 32,679. Dec. 3. (Switz., 4.12.26.)

IV.—Complete Specifications

20,992 (1926). British Alizarine Co., Ltd. Dawson, and Beghin. Production of dyestuffs from benzanthrone. (281,016.)

379 and 26,380 (1927). Barnard, and British Alizarine Co., Ltd. Manufacture of dyestuffs and dyeing cellulose esters. (281,114 and 281,213.)

*30,058 (1927). I.-G. Farbenind. Manufacture of hydrogenated naphtho-styriols. (281,257.)

*30,948 (1927). Bensa. Manufacturing chloroperylene quinones. (281,281.)

*31,393 (1927). I.-G. Farbenind. Manufacture of phenylthioglycolic acids. (281,290.)

*31,393 (1927). I.-G. Farbenind. Manufacture of phenylthioglycolic acids. (281,290.)

V.—Applications

British Celanese, Ltd., and Ellis. Treatment of materials containing cellulose derivatives. 31,935. Nov. 28.

British Celanese, Ltd., Ellis, and Olpin. Treatment of cellulose derivatives. 31,936. Nov. 28.

British Vegetable Parchment Mills, and Harrison. Vegetable parchment. 32,643. Dec. 3.

Chem. Fabr. Pott & Co., Pott, and Sapitz. Production of viscose. 32,308. Nov. 30. (Ger., 30.11.26.)

Dreyfus. Treatment of cellulose derivatives. 32,249 and 32,250. Nov. 30.

Eschungen. 32,143. See XI.

Herninghaus & Co., and Wenz. Treating cellulose-containing materials. 32,445. Dec. 1. (Ger., 1.12.26.)

Kuppel. Manufacture of impermeable paper. 32,002. Nov. 28. (Fr., 2.12.26.)

Lucas, and Vickers, Ltd. Manufacture of cellulose. 32,112. Nov. 29. Treatment of vegetable matters. 32,113. Nov. 29.

Marx. Manufacture of paper. 32,459. Dec. 1.

V.—Complete Specifications

18,722-3 (1926). British Celanese, Ltd., and Ellis. Treatment of fabrics. (280,989-90.)

25,280 (1926). Courtaulds, Ltd., Wood, and Turney. Manufacture of artificial silk. (281,058.)

966 (1927). British Dyestuffs Corp., Ltd., and Hailwood. Manufacture of artificial textile fibres. (281,117.)

*31,704 (1927). Seutan Co. Proofed paper. (281,316.)

VI.—Applications

Baechler, Kiser et Cie. Vertical dyeing-apparatus. 32,145. Nov. 29. (Fr., 4.12.26.)

Durand et Huguenin Soc. Anon. Production of printings etc. by vat dyestuffs. 32,010. Nov. 28. (Ger., 26.11.26.)

Imray (I.-G. Farbenind.). Dyeing pelts etc. 32,265 and 32,266. Nov. 30.

Soc. Chem. Ind. in Basle. Production of fast tints on cellulose esters etc. 32,568. Dec. 2. (Switz., 4.12.26.)

Sykes and Sykes & Sons, Ltd. Dyeing-machines. 32,340 Dec. 1.

VI.—Complete Specifications

16,270 (1926). Jones, Kilby, and Standfast Dyers and Printers, Ltd. Dyeing. (280,983.)

26,631 (1926). Durand and Huguenin Soc. Anon. Manufacture of products for dyeing or printing. (260,303.)

379 and 26,380 (1927). Barnard, and British Alizarine Co., Ltd. See IV.

*32,009 (1927). Durand and Huguenin Soc. Anon. Producing dyeings and printings by means of vat dyestuffs (281,336.)

VII.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of nitrates. 32,415. Dec. 1.

Frischer. Concentration of nitric acid. 32,430 Dec. 10 (Ger., 6.12.26.)

I.-G. Farbenind. Production of carbon disulphide. 32,705. Dec. 3. (Ger., 13.12.26.)

Johnson (I.-G. Farbenind.). Production of hydrogen etc. 32,548. Dec. 2. Liquefying oxides of nitrogen. 32,549. Dec. 2. Production of potassium compounds. 32,687. Dec. 3. Eliminating oxygen from gases. 32,688. Dec. 3. Production of cobalt carbonyl. 32,689. Dec. 3

VII.—Complete Specifications

22,576 (1926). Wallace and Gregor. Recovery of soda from solutions. (281,035.)

3946 (1927). Blythe & Co., Bentley, and Cutlow. Purifying sulphur containing bitumen. (281,133.)

7541 and 8300 (1927). Holzverkohlungs-Ind. A.-G. See XX.

14,056 (1927). Frischer. Producing volatile inorganic acids. (271,881.)

*31,290 (1927). Ges. f. Lande's Eismaschinen. Extracting ammonia from gases. (281,288.)

VIII.—Applications

British Thomson-Houston Co., Ltd. Manufacture of abrasive materials. 32,673. Dec. 3. (U.S.A., 3.12.26.)

Lucas. Treatment of articles of burnt clay etc. 32,018. Nov. 28.

VIII.—Complete Specifications

*29,447 (1927). Patent-Treuhand-Ges. Producing a fluid deformable ceramic fused product. (281,249.)

*29,855 (1927). Setterberg. Manufacturing porous refractory bricks. (281,254.)

IX.—Applications

I. G. Farbenind. Manufacture of cementing-compositions. 32,428. Dec. 1. (Ger., 1.12.26.)

Jensen. Rotary cement-burning kilns. 31,970. Nov. 28.

Ratcliffe and Stewart. Manufacture of bricks etc. 32,137. Nov. 29.

IX.—Complete Specifications

21,160 (1926). Doggett. Waterproofing-materials and concrete articles treated therewith. (281,022.)

*29,042 (1927). Rostock. Impregnating and coating surfaces of concrete etc. (281,241.)

X.—Applications

Atkinson and Brearley. Manufacture of stainless iron. 32,189. Nov. 30.

Broken Hill Proprietary Co., Lewis, and Power. Blast furnaces. 32,375. Dec. 1. (Austral., 9.12.26.)

Coles. Rendering iron etc. rustless. 32,048. Nov. 29.

Coles. Sherardizing. 32,620. Dec. 2.

Deuts. Gold- u. Silber-Scheideanstalt, and Schoenbeck. Manufacture of amalgams. 32,167. Nov. 29.

Duffield. Reduction of ores. 32,020. Nov. 28. (U.S.A., 29.11.26.)

Johnson (I.-G. Farbenind.). Production of iron powder. 32,552. Dec. 2.

Talbot. Metallurgical furnaces. 32,564. Dec. 2. (Belg., 30.6.27.)

Wade (Treiberies et Laminiers du Havre). Manufacture of metallic powders. 32,677. Dec. 3.

X.—Complete Specifications

15,591 (1926). Johnson (I.-G. Farbenind.) Reduction of iron ores. (280,976.)

24,591 (1926). Wade (International Nickel Co.). Manufacture of alloys. (281,051.)

3016 (1927). Coley. Manufacture of zinc. (281,129.)

1754 (1927). Jackson (Siemens & Halske A.-G.). Electro-depositing chromium. (266,379.)

7594 (1927). General Motors Corp. Electrolytic deposition of chromium. (273,659.)

9441 (1927). Gustafsson. Producing metals from oxide ores. (269,179.)

16,876 (1927). Metals Protection Corp. Chromium plating. (277,295.)

19,293 (1927). Appel. Electrolytic separation of chromium. (274,882.)

*32,020 (1927). Duffield. Roasting and reduction of ores. (281,338.)

XI.—Applications

Almida Accumulators, Ltd. and Levy. Electric cells. 32,023. Nov. 28.

Campbell and General Electric Co. Manufacture of photo-electric cells. 32,409. Dec. 1.

Eschingen. Increasing electric resistance of films of cellulose esters etc. 32,143. Nov. 29. (Aust., 1.12.26.)

Schmid. Galvanic cells. 32,543. Dec. 1. (Ger., 2.12.26.)

Soc. Franç. des Lampes à Incandescence Luxor. Filaments for incandescent lamps. 32,379. Dec. 1. (Fr., 1.12.26.)

Willeox. Electric induction furnaces. 32,322. Nov. 30.

XI.—Complete Specifications

21,028 (1926). Lewis. Galvanic batteries. (281,018.)

3162 (1927). Sherrin. Secondary batteries. (281,130.)

3227 (1927). Pechkranz. Electrodes for electrolytic cells. (265,606.)

4754 (1927). Jackson (Siemens & Halske A.-G.). See X.

7594 (1927). General Motors Corp. See X.

16,582 (1927). Croad (Jessup & Moore Paper Co.). Electrolytic cells. (281,184.)

16,876 (1927). Metals Protection Corp. See X.

19,293 (1927). Appel. See X.

XII.—Application

Bloxam (Geigy A.-G.). 32,427. See I.

XII.—Complete Specifications

13,138 (1926). Billingham. Emulsification of vegetable and animal oils, fats, etc. (280,762.)

18,194 (1926). Downs and Bellwood. Extraction of oil from the pericarp of palm fruit and like nuts. (280,986.)

*26,573 (1927). Böhme A.-G. Treatment of fats and oils. (281,232.)

XIII.—Applications

Eschingen. 32,143. See XI.

Grindley & Co., and Yeates. Synthetic resins. 32,301. Nov. 30.

Ruppel, and Usines de la Basse-Meuse. Obtaining coloured coatings. 32,000. Nov. 28.

XIII.—Complete Specification

*31,655 (1927). I.-G. Farbenind. Preparing surfaces for the reception of cellulose lacquers. (281,310.)

XV.—Applications

British Glues and Chemicals, Ltd., and Drew. Manufacture of glue. 32,412. Dec. 1.

Nance. Treatment of hides. 32,372. Dec. 1.

Zippermayr. Hardening etc. colloids. 32,473. Dec. 1. (Ger., 2.12.26.)

XV.—Complete Specification

*31,432 (1927). Alealai. Tanning-materials. (281.292.)

XIX.—Application

Heriot. Curing raw meats. 32,579. Dec. 2.

XX.—Applications

Deuts. Gold- u. Silber-Scheideanstalt. Preparing 2-chloro-phyridine. 31,958. Nov. 28. (Ger., 3.12.26.)

Gulbraith, Meynell, and Mounsey. Anti-toxines. 32,711. Dec. 3.

I.-G. Farbenind. Manufacture of arsenobenziminazolones. 32,429. Dec. 1. (Ger., 2.12.26.). Manufacture of benziminazolone-arsinic acids. 32,567. Dec. 2. (Ger., 2.12.26.)

Inray (Goldschmidt). Oxidation of alcohol. 32,264. Nov. 30.

Johnson (I.-G. Farbenind.). Production of alcohols. 32,550. Dec. 2. Production of solid formaldehyde. 32,553. Dec. 2.

Neuscheller and Ohle. Manufacture of ethyl alcohol-gels. 32,142. Nov. 29. (Ger., 30.11.26.)

XX.—Complete Specifications

13,302 (1926). Dreyfus. Manufacture of acetic anhydride. (280.972.)

4074 (1927). Johnson (I.-G. Farbenind.). Production of a calcium formaldehyde sulphonylate. (281.134.)

7541 (1927). Holzverkohlungs-Ind. A.-G. Concentrating volatile aliphatic acids. (271.044.)

8300 (1927). Holzverkohlungs-Ind. A.-G. Concentrating raw pyrolytic acid. (271.828.)

18,924 (1927). Chem. Fabr. vorm. Schering. Manufacture of iodine-substituted benzonitriles. (275.213.)

*31,605 (1927). Selden Co. Catalytic oxidation of organic compounds. (281.307.)

*21,496 (1927). Newport Co. Preparing para-hydroxy-ortho-benzoyl-benzoic acid. (281.227.)

XXIII.—Application

Hartley and Hartley. Sewage purification. 31,933. Nov. 28.

XXIII.—Complete Specification

27,345 (1926). Scholz and Eibes. Adhesive compounds for combating insect pests. (281.068.)

GENERAL NOTES**Official Trade Intelligence**

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number :—*Australia* : Chemical lines (Commercial Officer, Australia House, Strand, W.C.2, No. 498). *Austria* : Leather (470). *British India* : Salt, cement, galvanised sheets, black steel sheets, yellow metal (466). *Canada* : Druggists' supplies (467). *Rumania* : Iron and steel (477).

Draft Alkali etc. Works Order, 1927

By a Draft Order, dated November 25, to be issued under the Smoke Abatement Act, 1927, the Minister of Health proposes to make the following additions to the list of gases and fumes included in the "noxious or offensive gases," the escape or discharge of which must

be prevented :—Sulphuric anhydride, sulphurous anhydride (except that arising solely from the combustion of coal), bromine and iodine and their acid compounds, arsenic and its compounds, ammonia, pyridine and fumes from benzene works and from paraffin oil works. The descriptions of scheduled works are proposed to be extended as follows :—“(5) Nitric acid works,” to include those in which any acid-forming oxide of nitrogen is evolved in the manufacture of any product ; “(13) Arsenic works,” to include works in which any volatile compound of arsenic is evolved in any manufacturing process ; “(18) Paraffin oil works,” to include crude petroleum refineries ; “(19) Bisulphite works,” to include those making liquid sulphur dioxide, sulphurous acid, or any sulphite. “(20) Tar works,” to include any manufacturing operation in which noxious or offensive gas is evolved during the distillation or heating of creosote or other coal-tar product. Other works proposed to be added are benzine, pyridine, bromine and hydrofluoric-acid works. Copies of the Draft Order are obtainable from H.M. Stationary Office, price 1d.

Change of Address

Messrs. L. R. B. Pearce, Ltd., the potash merchants, are moving on January 1, 1928, to more commodious premises at 50, Mark Lane, E.C.3. Their new telephone numbers will be Royal 8742 and 8743, and their telegraphic address "Ellarbecpa Fen, London."

Safeguarding of Key Industries : Exemptions from Duty

The question of renewing Exemption Orders Nos. 1, 2, 3 and 4, which are due to expire on March 6, 1928, is now under consideration of the Board of Trade. The articles covered by these Exemption Orders are as follows :—R Acetone, Acetone fermentation, Acetone synthetic, Acid oxalic, Amidopyrin, Ammonium perchlorate, Barbitone, Dial, Didial, Elbon, Ethylene bromide, Ethylene glycol, Furfural, Glycol ethers, Guaiacol carbonate, Hydroquinone, Integrators planimeter type, R Lead acetate, Lead tetra-ethyl, Lipoidin, Methyl sulphonol, Phenacetin, Phenazone, Phytin, Piperazine, Planimeters, R Potassium hydroxide, Potassium guaiacol sulphonate, Pyramidon-veronal, Salol, Sulphonol, Urea.

Any communications with respect to any of the above-mentioned articles should be addressed, before January 8 next, to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, Westminster, S.W.1.

News from Advertisements

The Senate of the University of London invites applications for the Ramsay Memorial Chair of Chemical Engineering tenable at University College.

Applications are invited from mechanical draughtsmen (p. vi).

A man with practical experience is wanted for the manufacture of nitro-cellulose leather cloths (p. vi).

Two 24-in. electrically-driven centrifugal machines are for sale (p. vi).

Various sets of the JOURNAL etc. are required (p. vi).

There are now 129 firms represented in our Buyers' Guide.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, DECEMBER 23, 1927

No. 51

EDITORIAL

The Institute of Chemistry

THE Institute of Chemistry celebrated in suitable style last week its fiftieth anniversary. The reception on the 14th inst. was brilliant and well-attended; the banquet on the 15th was even more important. The Institute has enjoyed fifty years of usefulness, and many distinguished chemists have guided its destinies and presided over its meetings. For many years it has been fortunate in having as its secretary an able man, really able who has studied its interests and been responsible in no small measure for its present importance and prosperity. Mr. Pilcher has kept the Institute constantly in his mind as the guardian of the professional side of chemistry, and there are few men so well qualified as he to advise on the profession of chemistry, or more willing to help those who apply to him for information. We suppose that we read his book on "The Profession of Chemistry" when it first appeared in 1919; we read the latest edition of it which appeared this year with a good deal of interest. His views agree so closely with our own that we feel sure that we must have learned much from his experience at the Institute and the early edition of his book. On the other hand, many of our present opinions have not been gathered from books but from our own experience, and we were pleased as well as astonished to find so much that he has said, and so much that he has nearly said, in agreement with what we have long thought. He has the advantage of knowing another profession besides that of the chemist, and although his picture of the present state of the profession is not unduly optimistic, it seems to us to be true in fact and sufficiently encouraging to deserve comment.

There are two matters of importance to chemists, frequently discussed in our correspondence columns: title and remuneration. Mr. Pilcher deals with each of these with knowledge and discretion. His statement of the difficulty about the title shows no very obvious

solution, probably the point is not of supreme importance; solicitors were formerly known as attorneys, they are commonly spoken of as lawyers; there are attorneys who are not solicitors and lawyers who are not solicitors. No confusion worth mentioning has ever been caused by these ambiguities. The question of remuneration is much easier to grapple with if only we are prepared to face the facts. Mr. Pilcher tells us, and we are fully in agreement with him, that chemists are not worse paid than other professional men, and he implies that in the majority of cases they are paid as much as they are worth. Those who call attention to the low salaries offered to junior chemists will find the same feature in other professions. We well remember that when we were twenty-three years of age we had attended a provincial university for three years, studied the law for a further four years, and passed in a creditable manner our professional examination, an examination comparable with scientific examinations; we were offered a salary of £100 per annum and accepted it; no Society protested at this inadequate remuneration, and our friends congratulated us on our good fortune: we were probably not worth a higher remuneration; if we had enough brains, industry, sense and luck, to earn more money the world was in front of us. It certainly did not occur to us that because we had studied for several years, and were entitled to write a few initials after our name, we deserved any increase of remuneration; many friends with less learning, but more knowledge of the world and of men and of money, were already earning salaries larger than ours.

It took us several years to realise quite adequately how much more valuable and how much better remunerated is the knowledge of affairs and of men than the knowledge of a science, or of law, or of history or literature. Had we learned this earlier, we should probably have been richer, but not happier, nor in the widest sense more useful. During the last thirty years, or more, there have been many successful efforts to place higher

education within the reach of a much greater proportion of the population. In all classes of society the pen is ousting the sword, the ploughshare, the spanner, and the counter. The supply of the clerk, the book-man, the man educated in schools and universities, exceeds the demand. The supply of the shoemaker, the fitter, the skilled artisan is less than the demand. A man who knows his trade thoroughly, is diligent and business-like, may consort with captains and kings. Why is it that so many thousands of us prefer the learned and poorly paid life to the unlearned and better paid? It is our pride, our knowledge that we belong to the intellectual side of humanity; we know that Milton, who sold the "Paradise Lost" for a fiver or two, was a greater man than some of our present-day men of letters who flood the daily papers with articles and personalia and make handsome incomes. The successful artisan who has made money early in life and much money in middle life would cheerfully give a few thousand pounds to belong to the intellectual or cultured set; it is impossible. The market is flooded, and for fifty or a hundred years has been flooded, with people who wish to be respectable and dare not run the risks attending the desire of being both respectable and well-paid. The adventurous will find their opportunity; opportunity does not chase the student to his lair. The desire for learning and the desire for money are antagonists; in our editorial capacity we despise money; at other times we sometimes remember the sage advice of a north countryman: "Take care of thy money, my lad; after thy father and mother it will be thy best friend."

We noticed only one mistake in Mr. Pilcher's book, a mistake we ourselves made only a few days ago. He, too, seems to think that students may conduct research, and we must leave him to settle the matter with Prof. Thorpe. Our correspondent "Percy" this week implies that in some of the universities students do have opportunities of research to a greater extent than Prof. Thorpe admits. Perhaps the universities differ in this respect; if Prof. Thorpe and Mr. Pilcher will collaborate they will easily confer a favour on the industrialists; we suggest that they jointly publish a list of the various universities and university colleges in which chemistry is taught, marking in some distinctive manner those which reach the high standard referred to by Prof. Thorpe, and giving some other mark to those in which students conduct research. Such a list would possibly be a valuable addition to the other publications of the Institute. The work of the Institute has, however, not been confined to publication; it has laboured long and successfully to persuade the public to recognise more fully and more generously the importance of the profession of chemistry. Its jubilee meetings this week remind us of many successful banquets and meetings organised by the Institute in the past. The luncheon given by the Salters' Company is a further indication of the interest taken by the City Livery Companies in the advancement of scientific and technical education. A few companies like the Salters, the Dyers, and the Goldsmiths are directly connected with chemistry or metallurgy, including in the latter word the craft as well as the science,

but ever since we came to London we have met with very many instances of splendid support by the Livery Companies, whether directly connected with some particular craft or not. We well remember the work done in this connexion by Sir Owen Roberts and Sir Walter Prideaux; there were probably others who did equal work whom we knew not. The great companies have helped the educational efforts of the country in a very handsome manner. We should be grateful to them for this; many of us have other reasons for being grateful to them; chemists in particular should praise the Salters' Company, coupled with the name of the Worshipful Master. This note is written on his ancestral London estate; his ancestral Yorkshire estate was, in earlier days, equally well known to us. Professional speakers



Mr. R. B. Pilcher, Registrar of the Institute of Chemistry since 1900

usually speak well: his speech at the luncheon was a happy instance of this.

It is not easy for us to say all we think about the President of the Institute, Prof. Smithells; we can, of course, allude to his dignified appearance and graceful style of writing, and to the fact that each year tends to bring him nearer to the stage of being one of our senior chemical professors. We have known him for more years than either he or we care to admit; we studied chemistry under him for a few years, and owe to him that limited acquaintance with chemistry and considerable acquaintance with chemists which has brightened our life for, let us say, five and twenty years; we will admit so long an experience as that. He is too well-known to require any introduction to chemists, and his portrait has already appeared in our columns; as we do not remember to have published a portrait of Mr. Pilcher, we do so this week, so that his many friends and acquaintances in foreign parts may see what sort of man he now is.

THE WASTES OF THE PAPER PULP AND PAPER MILL INDUSTRIES

By J. B. C. KERSHAW

(Concluded)

As regards the present methods in use for dealing with the waste liquors of the sulphite process, it is correct to state, therefore, that in the majority of cases no attempts are made to recover the more valuable organic contents; and any treatment for their removal is done to obtain an effluent which can be turned into rivers and streams without danger to fish life. In the more up-to-date mills the liquor is passed through screens or "save-alls" in order to remove the finer particles of cellulose, and it is then treated with milk of lime and a solution of ferric chloride. A precipitate of flocculent ferric hydrate is thus produced, and on settling carries down all the suspended matter, and also a large proportion of the colouring matters extracted from the wood. The clear liquors from the acid sulphite process, after this treatment, are usually passed over a cascade, in order to remove any mechanically-held sulphur dioxide, before their discharge into drains or water-courses.

A relatively large loss occurs during incineration in the recovery of soda from the "black liquors" in the form of dust carried up the chimney; and the amount of fresh soda required in order to maintain the strength of the liquors varies from 150 lb. to 400 lb. per ton of pulp. Experiments are now being carried out in America with a new type of incinerator which will avoid this loss, and will also permit the utilisation of the carbon contained in this waste as a fuel. Developments have also taken place relating to the evaporation of sulphite waste liquor and the combustion of the concentrated sludge under the boilers. A new type of evaporator has been in successful operation for this purpose for some time, and the residue obtained is stated to have a fuel value of 8000 B.Th.U. per lb., which covers the cost of installation and operation. It is stated this plant can be installed for a capital outlay of \$1250 per ton of pulp per day, and that a plant of this size will deal not only with the main liquors from the digesters, but also with the wash-waters from the blow-pits.

Notes will now be given of recent work relating to improvements in the methods of dealing with these wastes.

Heat recovery from wood-pulp boilers

Nordstrom² has described a method of recovering heat and other valuable materials from the waste gases of the sulphite cellulose boilers, in which the raw cellulosic material which is to be submitted later to the sulphite treatment is charged into a filtering shaft in the form of chips and shavings. The material is partially dried by the hot gases coming from the boiler, and also serves as a filter to remove the dust and other solid matter carried away by the gases. The material in the shaft is then passed on to the boilers, and in this way both the heat of the waste gases and the absorbed products are turned to useful account.

Hanglighter and Schneider, two Canadian engineers,³

have also patented a method of recovering sulphurous acid and heat from the waste gases of sulphite cellulose boilers. This process depends upon suddenly reducing the pressure by withdrawal of part of the gas from the boiler, and leading it into a special storage vessel. The remainder of the gas is then withdrawn through another main where it meets fresh lye passing to the storage vessel or container. The heat absorption occurs on the counter-current principle. Hanglighter and Clemm,⁴ in a later Canadian patent, describe a modification of this method, which depends upon the introduction of the waste gases without any cooling into the fresh lye, the action taking place under pressure in a closed tank.

Improvements in the methods and apparatus for concentrating waste liquors

According to Bradley and McKee,⁵ a method of concentrating black liquor depends upon spraying it into a heated atmosphere containing carbonic acid and sulphurous acid gases. The organic matter is precipitated and a solution of sodium carbonate or sodium sulphite is obtained. In a later patent they describe another method of treatment, which depends upon the use of an ammonium compound, the acid radical of which will form a sodium salt. The organic matter contained in the black liquor is precipitated by lime, and the ammonia, which is set free by this treatment, is driven off by heat. After separating the precipitated organic matter, either by decantation or filtration, the liquor is causticised and again employed in the mill. In yet another modification of the process, nitre cake is used to provide the acid radical.

Brunler⁶ has described recently the application of his submerged flame system of heating to the evaporation of the waste liquors from the sulphite process of pulp manufacture. The ordinary submerged flame apparatus is employed to evaporate the water, and a liquid is produced of the consistency of pitch which can be easily gasified in an ordinary producer plant. Details are given by Brunler of a trial with a sulphite liquor containing 90% of water, which was reduced to less than 20% by aid of the submerged flame. The fuel used for the burner was a lignite tar having a calorific value of 16,400 B.Th.U. per lb., and 120 lb. of this tar was required per ton of liquor evaporated. The quantity of steam produced during concentration was 4295 lb., and after deducting the power required for compression of the combustion air, a surplus of 74 h.p. remained to the credit side of the account. The residue after the evaporation contained 20% of water and possessed a calorific value of 7270 B.Th.U. per lb., and as one ton of the waste liquor yielded 265 lb. of this concentrate, a heat recovery of 1,926,500 B.Th.U. was obtained per ton of sulphite liquor.

A method of evaporating sulphite waste liquors, due to H. A. E. Nilsson,⁷ depends upon the use of the compressed vapours for heating purposes; and in order to reduce the corrosive effects of the acid gases in these vapours upon the metallic parts of the compressor, they are first treated with absorbents or adsorbents to remove the acids before compression.

⁴ Canadian Patent, July, 1923.

⁵ Canadian Patent, Dec., 1923.

⁶ "Industrial Chemist," May, 1927.

⁷ Swedish Patent 58,778, May, 1926.

² U.S. Patent, Oct., 1921.

³ Canadian Patent, June, 1923.

R. H. McKee,⁸ in a recent article, dealing more especially with the recovery of alcohol and other products from sulphite liquors, describes a method of evaporation which furnishes a satisfactory boiler fuel. He states that owing to the colloidal nature of the sulphite liquor, a thermo-compressor type of evaporator can be employed, for the boiling point does not change appreciably during the evaporation. In this form of apparatus there is only a small temperature difference between the two sides: and when operated with steam at 150 lb. pressure, and with a double-effect evaporator, it is possible to evaporate 5.4 lb. of water per lb. of steam employed. This form of apparatus is, in reality, a triple-effect evaporator, and by its use the amount of high-pressure steam required is only 0.185 lb. as compared with 0.276 lb. with a quadruple-effect apparatus. The steam at 150 lb. pressure, which can be produced

The recovery of alkali from the black liquors of paper-pulp mills

In a recent American patent, A. H. White¹⁰ describes a method of regenerating the liquor obtained from the sulphate process of pulp manufacture. This is first subjected to destructive distillation, and the residual salts are heated with lime and carbonaceous material in order to reduce the sodium sulphate. The temperature required is between 600° and 700° C., and the product is finally lixiviated in order to recover sodium hydrate.

L. J. B. A. Colas and others,¹¹ in a patented improvement of the process for the recovery of alkali from black liquor, use calcium acetate as a flocculation catalyst to cause the separation of colloidal particles. The separated material is then treated with a solvent to remove fatty or resinous substances, and the residue is hydrolysed and fermented in order to obtain ethyl

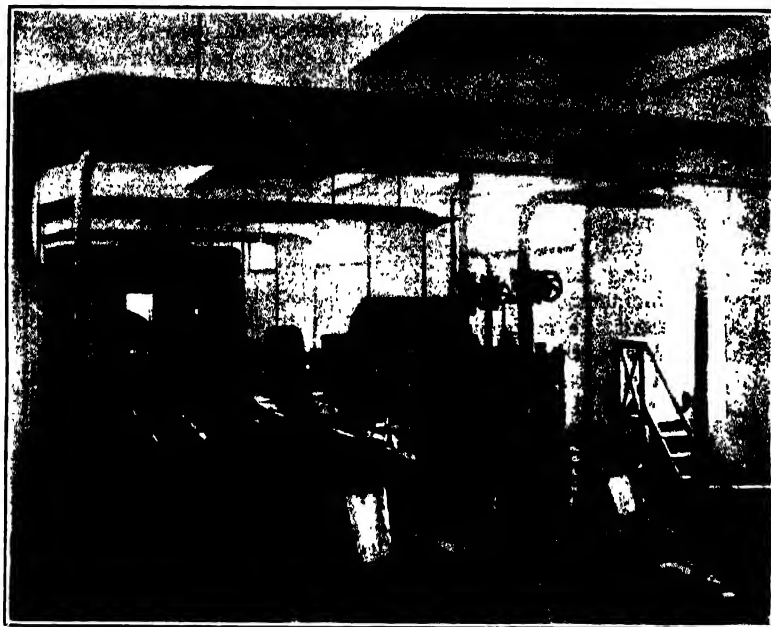


FIG. 2
Sand traps and strainers

per ton of pulp from the raw liquor by this apparatus, amounts to 7450 lb., and 12,480 lb. of water must be evaporated to achieve this result. The steam can be used for the development of power in non-condensing steam engines, and the exhaust from these can be employed again to evaporate the sulphite liquor in multiple-effect evaporators. When expressed in terms of fuel value, the combustible material in the raw liquor is equivalent to 780 lb. of coal, testing 14,000 B.Th.U., and in the fermented liquor to 610 lb. per ton of pulp.

J. E. Plumstead⁹ has patented a method of treating the black liquor by passing it through heat zones of varying intensity in order to effect its evaporation and to produce black ash. The evaporation is so conducted that the material attains its maximum temperature before the evaporation is completed, and in this way any risk of fusion of the ash is avoided.

alcohol. Oxalic acid may be employed as flocculation catalyst, and is recovered before the succeeding treatment with lime.

L. Bradley and E. P. McKeefe¹² in a Canadian patent protect the use of a precipitated basic aluminium compound for the treatment of black liquor from paper-pulp mills. This aluminium compound is first added to the liquor, and carbon dioxide is passed through it in order to throw down a precipitate of alumina in intimate mixture with the organic matter. The precipitate, on destructive distillation, yields a mixture of carbon and alumina, whilst the liquor, after removal of the organic matter, is concentrated and causticised in the usual way. The same two chemists in an earlier Canadian patent¹³ describe a method of concentrating waste liquors by spraying them into hot gases

⁸ "Paper," 1920.

⁹ U.S. Patent 1,600,890, 1924.

¹⁰ U.S. Patents 1,580,260 and 1,575,473, 1925.

¹¹ British Patents 218,288 and 200,482, 1923.

¹² Canadian Patent 245,851, 1925.

¹³ Canadian Patent 236,531, 1923.

containing carbonic acid, such as the waste gases from furnaces.

It is stated by E. D. Rimman¹⁴ that the dry distillation of the residue from waste liquors should be carried first up to the temperature of 400° C. in order to obtain the separation of the more valuable organic products, such as acetone, the alcohols, and ketones. The solid material which remains in the retort is cooled by a water spray down to 250° C., crushed and granulated, and then heated in a rotary furnace up to 750°, in order to causticise the lime. An alternative plan is to burn the residue as a powdered fuel with air, preheated to 1000 or 1200° C., and when the gases produced by this combustion are quite free from sulphur, they may be employed for preheating the lime sludge, obtained during the production of sodium hydrate from the residue. The calcium carbonate obtained in this way can then be burned, in order to recover the lime.

The latest process for the treatment of black liquors, due to C. L. Wagner, is being exploited by the Ross Engineering Corporation of New York. The process is now undergoing trial at a kraft paper pulp mill at Muskegon, in Michigan, and the following particulars are taken from an article by F. E. Coombs.¹⁵ The new method is based upon the atomisation of the liquor, and its evaporation and combustion in this state in a preheated furnace; one portion of the heat produced by the combustion is employed to concentrate the liquor in another apparatus. The method was first tried with the waste liquor from a soda mill, and later with the more difficult sulphate-mill liquor. These experimental tests showed that the heat liberated by atomisation and combustion was considerably in excess of that required to concentrate the liquors from 1.067 sp. gr. up to 1.332 sp. gr. in multiple-effect evaporators. These preliminary tests also proved that it was possible by this method to raise a large amount of steam which could be applied to other purposes, and at the same time to supply 500 gals. of the concentrated liquor per hour for the combustion furnace.

The unit of plant erected at Muskegon consists of a circular vertical combustion furnace provided with means for heating it to the ignition temperature of the concentrated liquor. This is sprayed into it by a number of atomising nozzles, arranged in the upper portion of the front wall of the furnace. These nozzles direct the spray downwards to the centre of the furnace, and a supply of heated air is forced into the furnace from below, in order to support the combustion of the concentrated liquor. A large dust chamber is interposed between the furnace and the 500 h.p. vertical water-tube boiler in which the steam is generated. A powerful induced-draught fan is necessary to give complete control of the draught through the boiler and furnace; and a mechanically-operated gas scrubber and an air compressor are also required. A removable oil nozzle for heating up the furnace when first starting is also required; and it may be necessary to assist the combustion with sawdust or wood waste, in order to complete the reduction of the sodium sulphate to sodium sulphide within the furnace. Generally, however, it has been found possible to reduce an addition of 1 lb. of sulphate

to the corresponding sulphide, per gallon of the concentrate, without the addition of sawdust or other wood waste; but to ensure this reduction it is necessary to maintain a mass of incandescent carbon on the floor of the furnace, at a temperature of 1500° F. This temperature should not be exceeded, since otherwise there will be a considerable loss of sodium salts by volatilisation. A dust chamber of ample dimensions in any case is needed between the furnace and the boiler, for the collection and retention of any soda particles that may be carried over by the draught.

JUBILEE OF THE INSTITUTE OF CHEMISTRY

The Institute of Chemistry was incorporated in 1877, and the celebration of its jubilee began most appropriately on December 14, with a historical exhibition of documents and portraits relating to the foundation of the Institute. The exhibition, which was held in the house of the Institute in Russell Square, included documents and apparatus relating to Joseph Priestley, lent by Mr G. H. Gabb; a series of prints and other exhibits of chemical interest, lent by Mr. C. H. Tribb; and the fine collection of lantern slides illustrating the history of chemistry, which belongs to the Institute.

In the evening of December 14, a *conversazione* was held at the Wharnccliffe Rooms, and the President, Prof. Smithells, F.R.S., and Mrs. Smithells were kept very busy receiving the numerous guests, who included all the leading figures in chemistry, either as members of the Institute or as representatives of allied societies.

During Thursday the New Gallery Cinema was crowded from 10.30 a.m. till after midnight by visitors eager to see the interesting series of films of British industries, which were shown by the courtesy of the Federation of British Industries and the Gaumont Company. Amongst the industries illustrated on the screen were coal and its products, the manufacture of steel, of heavy chemicals, nitrate of soda, and so on.

On the same day the Master and Wardens of the Worshipful Company of Salters celebrated the occasion by entertaining the President and Council, the Past Presidents, Vice-Presidents, and representatives of the sections of the Institute, and delegates of societies attending the Jubilee. An admirable and most interesting speech of welcome to the guests was delivered by the Master, the Rev. T. Basil Woodd, M.A., LL.B., who gave an account of the history of the company, its association with things chemical, and its present purpose in the Salters' Institute. Prof. Smithells made acknowledgment in a graceful speech, and was followed by a Vice-President of the Institute, Mr. E. Richards Bolton, who gave a very happy expression to the thanks of the guests. Prof. H. E. Armstrong then proposed the health of the Master.

The luncheon was a marked success and a most welcome illustration of the sympathy of the City Companies with science and in particular of the Salters' Company with chemistry.

The Institute of Chemistry held its Jubilee Banquet at the Wharnccliffe Rooms, Hotel Great Central, London, on December 15, when Prof. Arthur Smithells, F.R.S. (President), entertained over 500 members and guests on behalf of the Institute. Among those present were:

¹⁴ British Patent 217,285, 1923.

¹⁵ "Chem. and Met. Eng.," July, 1927.

Sir Alfred Mond, Bart., M.P.; Sir Ernest Rutherford (President of the Royal Society); The Hon. Sir Charles A. Parsons, F.R.S.; Prof. J. Millar Thomson, F.R.S. (Past President); Prof. H. Brereton Baker, F.R.S. (President of the Chemical Society); Col. Sir Edward Brotherton, Bart.; Lieut.-Gen. Sir Webb Gillman, D.S.O. (Master-General of Ordnance); Sir Robert Robertson, F.R.S. (Government Chemist); Mr. F. H. Carr, C.B.E. (President of the Society of Chemical Industry); Prof. H. E. Armstrong; Mr. Robert Mond; Prof. E. C. C. Baly (British Association for the Advancement of Science); Sir Richard Gregory (British Science Guild); Mr. H. T.izard, F.R.S. (Department of Scientific and Industrial Research); Mr. E. R. Bolton (President, Society of Public Analysts); Dr. Herbert Leivinstein (President, Society of Dyers and Colorists); Sir Hugh Bell, Bart.; Sir William Waters Butler, Bart. (President, Institute of Brewing); Sir Arthur Keith (President, British Association for the Advancement of Science); Sir Herbert Jackson, F.R.S.; Mr. A. Chaston Chapman, F.R.S.; Sir Dugald Clerk, F.R.S.; Sir Brodie H. Henderson (Institution of Civil Engineers); Sir William J. Pope, F.R.S.; Prof. G. G. Henderson, F.R.S.; Mr. C. A. Hill (Chairman of Council, Association of British Chemical Manufacturers); Prof. W. M. Thornton (Institution of Electrical Engineers); Mr. C. A. Klein (President, Oil and Colour Chemists' Association); Dr. H. H. Morgan; Mr. E. H. Cunningham Craig (Institution of Petroleum Technologists); Mr. H. D. Searles Wood (Royal Institute of British Architects); Mr. E. V. Evans (Institution of Gas Engineers); Prof. J. W. Cobb; Mr. W. J. U. Woolcock, C.B.E. (Association of British Chemical Manufacturers); Mr. J. Arthur Reavell (Vice-President, Institution of Chemical Engineers); Mr. W. Macnab; and Prof. G. T. Morgan, F.R.S.

After the Loyal Toasts had been honoured, the President read the following message from H.R.H. the Prince of Wales:—

"I am glad to be able to congratulate the Institute of Chemistry of Great Britain and Ireland on the completion of fifty years of useful service. The application of science to the daily life of the community becomes more and more apparent; as a consequence, the activities of such societies as yours have an ever-increasing value. The Institute has established a standard of professional education and qualification for the practice of the profession of chemistry—a standard which, I believe, is now recognised in every field of work in which the science is pursued. I am satisfied that nothing is more important at the present day for the well-being of our national industries than that they should utilise to the utmost the resources of science and know that this applies in a high degree to the science of chemistry. I have therefore not only to congratulate the Institute on its past achievements in advancing the efficiency and status of the profession which it represents, but to express my best wishes for its increased prestige and influence."

EDWARD P.

The President said he was sure it would be the wish of those present to send a grateful acknowledgement of this message.

The President said that the Royal Society had not only sent its President (Sir Ernest Rutherford) to the banquet, but had sent the following message:—

"The Royal Society offers its most cordial congratulations to the Institute of Chemistry on the completion of its fiftieth year, and looks forward to a continuation and enhancement of the great services which the Institute has already rendered to the science of chemistry."

Delegates from other societies then presented addresses as follow:—Prof. H. Brereton Baker (Chemical Society), Mr. F. H. Carr (Society of Chemical Industry), Prof. E. C. C. Baly (British Association), Mr. E. R. Bolton (Society of Public Analysts), and Mr. C. A. Klein (Oil and Colour Chemists' Association).

Sir Alfred Mond, Bart., M.P., proposing "The Institute of Chemistry of Great Britain and Ireland," said the Institute was founded in 1877 with very modest beginnings, and it was not until eight years later that it felt itself strong enough and powerful enough to approach the Privy Council with a demand for a charter. By that time the Institute numbered 430 members, and the application for the charter set forth at great length the advantages of such an Institute to the professional chemist and to the State and the community as a whole. The Institute had been founded primarily to give a status to the professional chemist, and to draw an adequate distinction between him and the other kind of chemist who sold drugs from behind a shop counter. The influence of the Institute was manifested in the fact that whereas when the charter was applied for the membership was 430, to-day it was 5200. Undoubtedly membership of the Institute was now recognised as a hall-mark of professional qualifications and ability, and all the important posts in which chemical qualifications were required were held by the members of the Institute. Referring to the list of past presidents of the Institute, Sir Alfred said he had been able to count many of them among his personal friends, and hoped that equally eminent chemists and scientists would hold the office of president in the future, to enable us to extend the boundless ocean of scientific knowledge. That the chemist was making his influence felt was shown in the fact that scientific research had become a catchword among the politicians. In the House of Commons the other day in connexion with the debate on the coal industry it was extraordinary what a lot of people talked of research, but who had not the faintest idea of what it meant. Member after member rose and adjured the Government that if they would only do something for research the coal problem would be solved, as if it were merely a matter of spending so much money and the thing was done. Those who had been brought up with research, and had watched its slow and painfully difficult progress, knew perfectly well that research could not be ordered in the same way as one ordered tea or butter at a store. Research after all was the work of human genius, and the genius was born and not made to order. When we got the genius, these people should be enabled to do their work unencumbered and unmolested by material wants, surrounded by all the opportunities which scientific apparatus and scientific assistance could give them. Even a little more might be done, and these people might be thought worthy of remuneration, say, equal to that of a successful stockbroker, although the research chemist might not be regarded as doing work worthy of the remuneration of a prize fighter. At any rate,

it was work which should not be carried out for a remuneration which just enabled subsistence to be maintained. The reward should be of a more substantial character. The researcher did not research because he wanted to, but because he could not help it, and that was why the world had always sweated him and said what a wonderful person he was without taking any steps to look after him. In industrial research we still had much to learn in this country. He had been struck during his recent visits to Germany by the scale and magnitude upon which industrial research was carried out there. As a consequence, technical results and financial success was secured, and we had no reason to grudge the Germans this because they deserved it on account of the long and patient research which they conducted and the large sums of money which they spent in the hope that the work would produce useful results. There could not be too much of this work going on in the world. No nation had a monopoly of scientific minds or scientific invention. It was the universality of the spread of science that was one of its chief charms. It had no national boundaries, it knew no creed, and was not limited by language. It was found all over the world, and Great Britain had its part to play in this work. Great Britain had never been deficient in great minds in the scientific world, as the history of scientific progress had shown throughout the centuries, and to-day we were not devoid of ideas or inventions. What we wanted was more of them and more support for them and as much co-ordination of the results as possible. Undoubtedly chemistry had more to do with the solution of the world's problems than any other science, and he wished the Institute an even greater success in the future than it had had in the past, that when their successors met in another 50 years' time they would have added to the lustre and the already very fine record of success of the Institute, and that they would be able to speak, also in no uncertain voice, of the good work they had done and the additional laurels they had gained for British science and British chemistry.

The President, replying to the toast, expressed his grateful thanks for what Sir Alfred Moud had said and also for the addresses that had been presented by the representatives of kindred societies, which were a great encouragement to the Institute and an augury for a continuation of the amity and good feeling that had existed between them for so long in the past. The Institute would always be at their service on every occasion when required in the future. In addition to the addresses that had been presented that evening, greetings, congratulations and good wishes had also been received from the German Chemical Society, the French Society of Chemical Industry, the South African Chemical Institute, the Cape Section of the Institute, the New Zealand Section of the Institute, the Malaya Section of the Institute, and the Chemical Industry Club, and he thanked all of them for their kindness and the thoughts expressed. Speaking of the Institute, he said that he himself had been connected with it almost from the beginning, because it was founded when he was a student, and he became a Fellow in 1887. The history of the Institute, down to 1914, had been

recorded in an admirable volume prepared by the Registrar, and this showed how the Institute had responded to the calls of war; that was a record of which the Institute would always be proud. The progress of the Institute down to the present day had justified the hope and illustrated the wisdom of those who founded it for a profession without organisation at the time and a profession which, through the variety of interests, was exceedingly difficult to organise. Yet all these interests had been brought into harmonious union for the benefit of the members of the profession and of the public at large. The Institute had set a high standard of professional qualification and conduct, but at the same time it had not adopted a narrowly dominant attitude in representing the interests of the profession. There were no complaints that the Institute was claiming too much or that it was trying to impose unfair restrictions either upon its own members or upon the public. It was hopeless to attempt adequately to express gratitude to those who had rendered services to the Institute in the past, and all he could say collectively was that the policy of the Institute had been framed on the lines of broad-minded progress and adaptability. Finally, Prof. Smithells paid a tribute to the work of Mr. Pilcher, the Registrar, and his able staff.

Mr. Charles A. Hill, proposing "The Founders and Past Presidents of the Institute," referred in turn to all who have been associated with the Institute either as founders or Presidents, and coupled with the toast the name of Prof. J. Millar Thomson, F.R.S.

Prof. Thomson, in his reply, said he had apparently been chosen for this task because not only was he the senior living past President, but he was also, he regretted to say, the only one alive of those who attended the small meeting in 1875 which really started the Institute of Chemistry. It was a matter of great gratification to him now to see the influence and ramifications of the Institute, and he could only ask those younger members in whose hands the management of the Institute would in due course be, never to forget the one aim of the original founders of the Institute, viz., the training and teaching of the chemist.

Mr. A. Chaston Chapman, F.R.S., proposed "The Guests."

Sir Ernest Rutherford, F.R.S., who made the first reply, said the great advances that had been made in chemistry during the last 50 years had been in the fundamental ideas of the nature of the atoms and molecules which chemists dealt with. Physics and chemistry had been drawing nearer together during this period, and apparently it all depended upon whether one was a chemist or a physicist as to the views held concerning which had absorbed the other. However, there had been, during the past half century, the discovery of the electron, the proof of the transformation of matter, and the detailed work upon trying to open up the structure of the atom. Finally, there had been the later work, still in the stage of transition, of the attempt to resolve the whole of matter into the simplest elements and associated with a type of wave motion. In what direction could we look for advance in the next 50 years? It was perfectly clear that the next important advance would be the attempt to solve

that most difficult of all problems, the nature and origin of chemical combination. When that was accomplished he did not know what there would be left for the chemist to put his hand to.

Sir Atul Chatterjee (High Commissioner for India) also briefly replied.

The final toast was "The Chairman," proposed by Mr. E. R. Bolton, to which Prof. Smithells replied in a few words.

SCIENTIFIC RESEARCH IN RELATION TO ACTINOTHERAPY

The first International Conference on Light and Heat in Medicine, Surgery and Hygiene was held at the Central Hall, Westminster, on December 13 to 16, concurrently with an exhibition of apparatus and accessories for light and heat therapy, which was opened by Sir Alfred Mond.

The afternoon of December 15 was devoted to the discussion of scientific research in relation to the practice of actinotherapy, under the Chairmanship of Prof. E. C. C. Baly, C.B.E., F.R.S., and three papers dealing with various aspects of the problem were presented.

Dr. Leonard Hill, F.R.S., dealt with the applications of ultra-violet light to the curing of disease. Ultra-violet in sunlight varied considerably in different months of the year and different hours of the day. It increased enormously in the summer, and decreased very greatly in the winter. Spectrographic investigation had shown that ultra-violet came from the whole of the sky, as well as from the sun. It was estimated that the ultra-violet coming from the whole of the blue sky amounted to more than the whole of that coming from the sun, even when the sun was high in the heavens. Thus, a patient could be exposed to sky-shine when he could not be exposed to the sun itself. With sky-shine, as distinct from sunshine, the ultra-violet was scattered, and diffused. Spectra taken in various localities were shown to indicate the enormous loss of ultra-violet in a smoky city. Discussing artificial light sources, Dr. Hill said that one could not judge the value of lamps merely by the spectra; the final appeal was a biological method. If vita-glass or vitreosil screens were used with the mercury vapour lamp, it would give a sunlight effect and could be used domestically; but the use of screens at present cut down enormously the intensity of the light. We were at the beginning of an epoch in the prevention of disease which was going to have colossal effects. At the same time, he believed that in the toning up of the body the open air was as important as, if not more important than, light.

Dr. I. M. Heilbron spoke on "Vitamin D and its relation to the irradiation of foodstuffs," and showed how the work of the chemist had helped the study of the problem. The discovery that cholesterol acquired antirachitic properties on irradiation by ultra-violet light, and that the activity of irradiated foods was due to the presence of chemically similar substances, had given great stimulus to research work. These observations were followed by the discovery that cholesterol itself was not the provitamin, but contained a minute quantity

of another substance, to which the antirachitic properties were attributable. This provitamin was probably identical with ergosterol, a substance present in large amount in yeast, and in small amount in human and animal skin. The fact that rickets could be cured by ultra-violet light was thus made clear, and actinotherapy was unified with photochemistry.

As regards the use of natural sunlight, appreciable photo-chemical reaction was likely to occur in this country, even under the most favourable climatic conditions, only during the summer period. For general clinical use, artificial methods of radiation were obviously more satisfactory, and its application deserved the fullest exploitation. It might be argued that, as vitamin D was more effective in the cure of severe rickets than light treatment, the latter was no longer necessary. He thought it more likely that the observed beneficial effects of radiation were due to many specific reactions, of which the formation of vitamin D was the only one as yet definitely characterised. Whether or not vitamins A and E, which were so closely associated with vitamin D in nature, had provitaminic origins equally capable of transformation by light was a question to which, owing to our meagre knowledge of their chemical character, no definite answer could be given. Nor could it be assumed that the number of vitamins yet recognised might not rapidly be supplemented. Apart from this, the knowledge that ultra-violet radiation brought about marked changes in the blood, whereby anti-bodies were seemingly produced, together with its well-known stimulant and bactericidal effects, was sufficient reason for continued application.

The fact that the effective rays concerned in the formation of vitamin D were those occupying the middle ultra-violet region (250 to 300 $\mu\mu$) raised the question whether better results would not be obtained by using restricted parts of the spectrum rather than its entire field. The fact that vitamin D was decomposed by short wave ultra-violet light suggested that the entire range of ultra-violet radiations as obtained from a source such as the quartz mercury lamp was unsuitable, and that screening should be adopted in the light treatment of rickets. Indeed, it was not inconceivable that the short wave ultra-violet radiations, below possibly a range of from 260 to 270 $\mu\mu$, were, despite their low penetrative power, actually detrimental, except in special cases concerned with bactericidal effects. As our knowledge of the chemical effects produced by light treatment increased, and we gained further insight into the specific effect brought about in the tissues, it should be possible to employ lamps of definite wave-lengths and intensity for each specific disease, and he looked for great advances in this direction.

He and other investigators had been able to detect the presence of ergosterol in cottonseed oil, linseed oil, maize oil, and certain samples of ground-nut oil, whereas no evidence could be found of its presence in pure olive oil, soya-bean oil, palm oil, or palm-kernel oil. The possibility of some provitamin being present in the last named oils was not wholly excluded, as the sensitivity of the spectrographic method of analysis depended on the transparency of the oil.

Dealing with the practical applications of irradiated

material, he said that, as cod-liver oil contained vitamin D, it did not require irradiation. The use of cod-liver oil had definite limitations, however, especially in severe cases of rickets, for not only were large doses not tolerated, but different samples of oil varied enormously in antirachitic potency. However, the use of extracts of cod-liver oil, such as Ostelin, provided a source of vitamin D vastly superior to the oil itself. The use of vegetable oils had not yet come within the province of practical application, as means had not yet been devised for their effective irradiation in bulk. On the other hand, many foodstuffs, *e.g.*, dried milk, would lend themselves to irradiation.

With the discovery of the provitamin, irradiated ergosterol preparations were now being largely employed, and Hess had reported favourable results from the use of irradiated dried yeast in place of the extracted ergosterol. Indeed, as Rosenheim and Webster had pointed out, there was now no real obstacle in the way of the mass production of margarine and other foodstuffs, normally deficient in vitamin D, containing quantities of vitamin in excess of that present in butter. Again, its presence in cattle cake would almost certainly be an efficient guard against the known vitamin paucity of winter milk and butter. A new chapter of food chemistry was thus opened up, and we could view the future with confidence. A final point was that one could readily over-irradiate provitamin and render it entirely negative. The vitamin itself, once formed, was labile, and was further altered by light.

Replying to a question as to the temperature which vitamin D would stand, Dr. Heilbron said he could not give a direct answer. He had envisaged treatment at normal temperatures. It had been found that vitamin D would stand very high temperatures under vacuum, and he had worked at temperatures up to 300° C. without destroying the vitaminic action. How it would stand against oxygen at elevated temperatures he did not know.

Mr. Francis H. Carr, C.B.E. (President of the Society of Chemical Industry), said that in his experience vitamins D and A, *in vacuo*, were both stable up to temperatures of at least 180° C. without more than fractional loss of activity over a number of hours. Vitamin A differed greatly from vitamin D, inasmuch as it was rapidly lost if oxygen were present during the application of the heat. On the other hand, vitamin D was not oxidised, and retained activity when in the air. Mr. Carr also emphasised the importance of controlling irradiation in order to arrive at the condition of optimum activation.

Dr. Heilbron said Rosenheim and Webster had shown that 10 minutes' irradiation brought about the best effect using the ordinary quartz mercury lamp, but that the best effect only showed a 10% conversion of the provitamin into the vitamin. Afterwards using the complete spectrum—the vitamin was decomposing as fast as it was being formed. The problem of preventing the decomposition of the vitamin once it was produced lay ahead.

Prof. Baly suggested that in the production of the vitamin from the provitamin it was very possible that we should not under any circumstances be able to get more than a certain maximum value of the vitamin dissolved

in the provitamin. The pioneers in this work must not forget that the solvent in which the vitamin was dissolved might have a great deal to say in the matter.

Dr. F. H. Humphris contributed a paper in which he put forward a number of problems in the solution of which the chemist and the physicist could help the science of actinotherapy. Practitioners in light therapy still lacked a definite scientific explanation as to why good results had often been secured with irradiations which differed in respect of continuity, intensity, and range. Ultra violet light irradiation was most beneficial in the treatment of patients suffering from a lack of calcium salts. Ultra-violet irradiation caused certain changes in the calcium content, but in many cases the calcium content could not be increased because the patient might be lacking in the essentials which were activated by light to facilitate the necessary calcium increase. It was suggested, therefore, that a certain type of patient who failed to improve with light required to be treated with a sensitising drug, which, with ultra-violet irradiation, would be the means of enriching the calcium content. It should be possible for some of the manufacturers, in co-operation with the practitioner, the chemist, and the physicist, to tabulate a preliminary working list of drugs for probable use with ultra-violet irradiations. Also, as the body contained many physiological products which fluoresced, and in which there were certain chemical changes, the substances having absorbed ultra-violet rays, knowledge of these products was essential. A knowledge of these and of the means of ascertaining whether or not a patient had a sufficient supply of them were primary problems to be tackled. Another question to which the specialist in light therapy would like an answer was whether pigmentation or tanning was an index of the powers of resistance of the patient.

Discussing the application of ultra-violet irradiation to foodstuffs in order to impart antirachitic properties to them, he pointed to the need for investigating the quantity and quality of the irradiation to be applied to the various types of foodstuffs, the distance, the conditions of treatment, and to what extent the time factor affected the deterioration of irradiated substances. Was it possible to irradiate milk in quantities large enough to enable us to supply on a large scale a sufficient quantity to combat deficiency diseases? He also asked if the objectionable taste acquired by liquid milk after irradiation by ultra-violet light could be prevented.

On the question of the quality of the rays, he said some lamps were very rich in their output of rays in the invisible spectrum, whilst others were decidedly poor in this respect, but had a preponderance of luminous heat rays. Many people maintained that the ideal outfit should give a spectrum as near the quality of the sun's spectrum as possible, but they would find difficulty in defining what quality of natural sunshine was best suited for therapeutic purposes. Therefore we wanted to know from the physicist from what standpoint we should judge natural sunlight for the standard therapeutic spectrum.

Prof. Baly, at the conclusion of the paper, pointed out that a new Society of Actinology and Actinotherapy had been formed for the purpose of achieving co-operation between chemists, physicists, and clinicians.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

BINDING CASES FOR BRITISH CHEMICAL ABSTRACTS AND JOINT INDEX

Abstracts "B" and Index to "A" and "B"

Binding cases for the above publications, in dark blue cloth, will be available, commencing with the 1927 issues.

The price will be 3s. 9d. per set of two cases, postage 6d. extra, or, separately, 2s., postage 3d. extra.

Abstracts "A" and Index to "A" and "B"

Cases are also available in maroon or blue cloth, price 3s. 9d. per set of two cases, postage 6d. extra.

Orders, accompanied with remittance, should be forwarded to Messrs. Gurney & Jackson, 33, Paternoster Row, London, E.C.4.

SUSPENSION OF ENTRANCE FEE

The Council has decided to continue the suspension of the Entrance Fee during the year 1928.

ABSTRACTS IN APPLIED CHEMISTRY

It has been arranged to supply members of the Society with reprints of the Abstracts of Applied Chemistry, printed on one side of the paper only, at the price of £1 for the year 1928.

Applications for these, accompanied by the appropriate remittance, should reach the General Secretary before the end of the present year.

BIRMINGHAM AND MIDLAND SECTION

A joint meeting with the local section of the Institute of Chemistry was held on December 16 in the new buildings of the Department of Biochemistry of Fermentation at the University of Birmingham at Edgbaston (by courtesy of Prof. A. R. Ling).

Prof. Ling, who presided, gave an interesting account of recent work in the University biochemical laboratories. He pointed out that the Department had always recognised that one of its main objects should be original research in the many fields open to investigation in connexion with biological problems. The work of Prof. Brown, his predecessor, was well known, for it dealt with micro-organisms—bacteria and yeasts—and the products obtained when they were cultivated on media containing definite chemical compounds. Prof. Ling stated that when he took up his position as Head of the Department, in 1920, his attention was directed, in the first place, to the chemistry of starch, a subject on which he had worked for many years previously. Methods had been devised for estimating starch in such materials as barley, wheat, and potatoes. These methods were now in use in various agricultural stations.

More than 100 years ago attempts were made to throw light on the constitution of starch, and after it had been discovered that starch might be converted into sugar when it was heated with dilute acid, and that it yielded a sugar when treated with an extract of germinated grain, it was found that by determining the nature of the products formed in these two cases

some light might be thrown on the constitution of starch, since the sugars produced might be regarded as the bricks out of which the starch molecule was built. The data obtained might also be used to explain the digestion of starch in the animal system, and similarly, to throw light on the mashing process carried out in the production of beer and of alcohol. It had long been known that starch in the form of granules consisted of more than one substance, and, in collaboration with D. R. Nanji, he (Prof. Ling) had shown how these two substances—amylose and amylopectin—might be separated. They were present in starch granules in the constant ratio of 2 : 1. Another substance had been recognised as a constituent of the starch granules of cereals by Prof. Schryver, who regarded it as hemicellulose. Amylose when treated with the diastase present in barley or in malt was converted into the sugar named "maltose," whilst amylopectin was converted by the diastase of barley into a substance to which Ling and Nanji had given the name " α -hexa-amylose," together with maltose. By the action of malt diastase on this α -hexa-amylose a series of substances named malto-dextrins was produced, together with a trisaccharide maltose and isomaltose.

Pectins had long been recognised as constituents of the cell wall of plant tissues, but their nature had remained obscure until quite recently. Work carried out in the Department had established the constitution of the so-called pectic acid obtained from these pectin bodies, which were of importance commercially in the confectionery industries on account of their property of forming jellies when boiled with sugars. Researches carried out in the Department had explained the formation of the colouring matter, caramel, when certain sugars were treated with ammonia and subsequently heated, and they had also explained the formation of colour and flavour in barley germinated by the malting process when it was heated on the kiln. This was a brief outline of some of the results which had been achieved in the Department during the past eight years.

The members next inspected the British School of Malting and Brewing and Department of Biochemistry of Fermentation, which now consists of a series of 16 rooms in the new block of buildings. There is a spacious general laboratory, a well-appointed microscope room, and a research laboratory. The professor and the lecturer each have a private room and a laboratory, and there is a special laboratory for analysis, an incubator room, and dark-rooms for photography and polarimetric work. The new departmental library will contain all the books in the university on the biochemistry of fermentation. The laboratories are equipped with the latest forms of apparatus and are unquestionably the best and most up to date of their kind in the country. The Department, which is fully maintaining the high reputation for training and research work built up by the late Prof. Adrian Brown, equips students who obtain an honours degree or a diploma to take appointments in breweries, distilleries and vinegar breweries, either as chemists or as technicians. The Department deals with agriculture and cognate industries, chemistry and bacteriology as applied to food and drugs, and water supply.

BRISTOL SECTION AND FUEL SECTION

A joint meeting was held with the Fuel Section on December 1, when Dr. C. H. Lander gave an address on "Low-temperature carbonisation." There was an excellent attendance, including members of the Bristol Association of Engineers, the Western Junior Gas Association, the Automobile Association (Western Centre), and officials of the Bristol Gas Company.

Dr. Lander said the subject was fraught with problems comparatively easy to deal with in regard to technical working, perhaps less easy to deal with in respect of commercial considerations, but still manageable, and with political considerations which to him at any rate were absolutely impossible to deal with.

The figures for the consumption of coal in this country in 1925 show that about 18% was used for domestic purposes, about 9% went to the making of gas; about 3% or 4% for electricity; for smelting purposes about 10%; general manufactures 35%; miners' coal, 4%. should be added to domestic purposes.

Consideration of these figures showed that the coal could be divided into two categories according to whether it was subject to pre-treatment before use, or whether it was used in the raw state. The amount used in the gas industry and the coke oven industry roughly amounted to about 40 million tons per annum; about the same amount of coal was used for domestic purposes. A considerable proportion of the coal was thus subject to some pre-treatment in order to make other fuels suitable for other purposes, and it was important to see whether any of the other groups might lend themselves to pre-treatment. It did not necessarily follow that it was economically sound to carry out systems of pre-treatment. When all was said and done, coal or the products obtained by pre-treatment of coal were, in the main, used as fuels, and it was only if the fuels made from the raw coal by this pre-treatment could be used with greater efficiency or with greater convenience, or with both, than the original coal that it really became sound economically or scientifically.

In regard to domestic requirements, as long as raw coal was used in the domestic grate, smoke was extremely likely to be given off, and this accounted for a large proportion of the smoke pollution over the whole country. In addition, the smoke which pollutes our towns came from constituents of the coal which were valuable for other purposes. The country imported an enormous quantity of oil and petrol every year, and the Navy at present was absolutely dependent on oil for its fuel supplies.

In view of these facts it appeared at first sight to be very uneconomical to burn coal in the raw state and scatter over the country in the form of smoke a considerable proportion of oils that might be recovered. The advantages of reducing smoke production were undoubtedly very great, but it was not necessary to carbonise all our coal in order to avoid smoke. Extreme statements were sometimes made as to the advantages that would accrue were all our coal carbonised before use, and it was sometimes claimed that this would make us independent of imported oils, but even if the whole of the coal raised, including that used for bunkers

and that exported, were carbonised, it would not suffice for national purposes in an emergency.

While it was possible to state with fair accuracy the amounts of coal now carbonised and the amounts used for domestic and industrial purposes, it was impossible to say definitely the amounts of coal used for the production of heat and power respectively. There was a *prima facie* case for asserting that the country required more coal for heating purposes than for power. The generation of power was always accompanied by certain intrinsic losses. The efficiency of power production from fuel was low—a modern power station usually reckoned about 20%—but the efficiency of heat production from fuel was fairly good. It was essential that more data should be collected as to the exact way in which the heat was finally used. We were not in a position to say the proportion, or even to form an opinion as to how far electricity in industry should go.

The figures quoted above indicate that 9% of the coal raised was used for gas production and 4% for electricity. How these proportions were altering to-day he was not prepared to say, nor would he express an opinion as to whether more economical results would be obtained for the country at large by an alteration in the proportion.

Speaking generally there would appear to be a great advantage if a large proportion of the domestic coal could be subjected to some carbonising process—something that would give a fuel which could be used in the domestic grate with the same facility as coal. The same applied to some industries, but with regard to industrial coal generally the advantages were more doubtful. It was quite possible to consume coal in most industrial appliances without smoke, and that ought to be done.

The consumption of coal in the raw state was not necessarily uneconomical. Where pre-treatment was desirable there still remained the question as to which method was the best, and this depended on the circumstances of each case. There were over 200 different methods of low-temperature carbonisation, and the methods fell into two or three clearly-defined sections, of which two were according to whether the retorts were heated by external or internal means.

Before a technical process became a proposition of value to the country, to the company, or to the customers, there were four stages which had to be gone through. First, a person had the idea and worked it out on the laboratory bench. Second, he took the process and worked it on a slightly larger scale. There was such a large jump, however, from trying a process in a test tube to the actual carrying of it out in a retort carrying 100 tons that the laboratory work frequently gave only a very small proportion of the data required for the large-scale work, so that it was often desirable to try out a plant capable of dealing with a few hundred-weights at a time. Third, this was an enlarged stage 2, but one in which the enlargement was taken up to the full size of a plant which could be multiplied in number, but not in scale. It was not difficult to multiply a plant, but an enlargement of scale frequently introduced new factors. In this stage the coal mostly experienced a different treatment from the treatment in the

laboratory, as conditions in an industrial plant were neither so closely controlled nor so uniform as those in the laboratory. At stage 3, if everything had gone well, material had been produced under ordinary working conditions, and at that stage the purely technical man had gone as far as he could. Fourth, this stage consisted in seeing whether, by multiplying the plant ten, twenty or more times, one could over a period of years make the process pay.

The development of a particular plant, namely, that developed at the Fuel Research Station, through the four stages, was then described and illustrated by means of lantern slides.

The next question that arose was, having got a plant so far which does not seem to be unsatisfactory, to get a try out under commercial conditions. It was pointed out to the Government of the day that it was all very well for people who had a process to make claims about it, but not until they were in a position to put their plans on the table could one do anything to help them. It was eventually suggested that some department, governmental or otherwise, should be given power, since so many claims were being made for low-temperature carbonisation, to test plants where owners were willing, free of charge, and that power was given to the Fuel Research Department. Up to the present a number of low-temperature fuel firms had availed themselves of that offer. An account was then given of those plants which were being developed by private initiative, and which had been tested under the scheme.

The lecturer next dealt with some of the later happenings with regard to low-temperature carbonisation from the national point of view. Various schemes for helping inventors and others to get their plants to such a stage that they could be said to be commercially feasible had been put forward. As a result of many conversations, the President of the National Gas Council, Sir David Milne Watson, was asked to re-examine the question of low-temperature carbonisation plants and see whether any of them were, in his opinion, worth running for three years to see if they could prove themselves commercially, or whether the whole thing was hopeless so far as the gas industry was concerned, and should be given up. He was also asked to say whether, if some suitable arrangement could be made, there was one which he would be willing to try. The result of the inquiry, which took the company over twelve months' examination of many types, was that he informed the Government that there were one or two which presented a certain amount of promise, and he would be willing to try one of them. The arrangement was that the company should be guaranteed the necessary capital, and that they should run one of these plants for three years and publish to the world at large an unbiassed account of how it worked. The plant finally chosen by Sir David was the one developed at the Fuel Research Station. This plant was to be erected at the Richmond Gas Works (small gas works recently taken over by the Gas Light & Coke Co.), and would be designed to supply 100 tons of coke per day to the district. The rich gas would be used in conjunction with gas from other processes, in order to give gas of the correct calorific value for the town's

use. In this plant the retorts would be heated by a hollow wall with flues zigzagging between retorts. The heating would be done by a supply of gas to the bottom flue. That and the air supply, would be the only controls. The air admitted at the bottom was insufficient for complete combustion, and the remainder of the air necessary was added at one or more positions higher up. This method could be made to give extraordinarily uniform results. A great deal of experimental work had been done, working on a full-size model with two dummy retorts (the heat being abstracted by means of water-tanks), and it had been proved that it was easy to get now, by this method of heating, temperatures which did not vary more than a few degrees from the top to the bottom in a length of about 21 ft.

In the past accusations had been levelled against the gas companies that they took no interest in the question of low-temperature carbonisation. The true facts of the matter were that the gas companies would take it up with vigour if they could be shown that it was as good as the processes they were now running.

In the ensuing discussion, Dr. Travers said that if many of the inventors had studied the dynamics of the process, 75% of them would never have attempted to plan a process. He also remarked on the change that takes place at about 500° C.

Mr. Robertson, in thanking Dr. Lander, said that as a humble representative of the high-temperature process, he was very grateful to him for his reference to the charge which had often been brought against the high-temperature people. In that part of the country, Plymouth and Dursley had tried the process, but without success. He also asked questions regarding the use of the pitch produced in fixing the briquette, and whether the resulting product was smokeless. He also asked the lecturer to what extent cast iron had stood the test.

Dr. Howard Butler raised the point that perhaps one of the reasons of low temperature carbonisation failing in some instances was the fact of the fuel being so friable that it was not easily carried about and used for domestic purposes.

Dr. Lander, replying, said that from a scientific point of view, Dr. Travers' figure of 500° C. as the line of demarcation was probably right, but that if a robust coke was required and external methods of heatings were used, the tendency always was to put up the temperature. 625° was a temperature which was fairly well associated with the products from low-temperature carbonisation. He also described the advantages and disadvantages of refractory and metal retorts, and dealt with the question of retort walls bulging. He said that if metallurgists had been as interested in cast iron 20 years ago as they were in the improvement of steel he was certain that by now they would have produced a satisfactory article.

In regard to the pitch, the pitch produced from a ton of coal was not sufficient to briquette the coke produced. It was found the retorts worked better if the coal was screened, and only that over, say, ½-in., put into the retorts. The fines might then be briquetted and the briquettes carbonised, in which case the result was smokeless. The pitch produced would be sufficient for such a process provided the proportion of fine coal were

not too great. Briquettes made with pitch were not smokeless unless they were afterwards carbonised.

He said that with reference to Dr. Butler's remarks the fuel was sometimes friable, but that with a suitable process it could be made fairly robust, though rarely as robust as high-temperature coke.

LIVERPOOL SECTION

A joint meeting of the Section with the Chemical Engineering Group was held on December 16, a paper, entitled "Oil pollution of seas and harbours—and a remedy," being presented. In the absence of Mr. C. S. Garland, the author of the paper, Mr. Albert Beale, one of the inventors of the plant described, read it in his place. (The paper was published in full in CHEMISTRY AND INDUSTRY of December 16.) The lecture was illustrated by a cinematograph film and lantern slides.

In the afternoon a party of members was conducted over the oil-storage installation of the Anglo-American Oil Co., at Dingle Bank, and later inspected the S.S. *Adda*, a Diesel-engined liner belonging to Messrs. Elder Dempster & Co., being also entertained to tea by the owners.

In the evening the lecturer and members of the Committee of the Chemical Engineering Group were guests of the Section at dinner at the University Club.

NOTTINGHAM SECTION

The third meeting of the session was held at University College on December 7, Dr. E. R. Prideaux in the chair, when Prof. R. Robinson, D.Sc., F.R.S., gave a lecture on "The indole group of the alkaloids."

Prof. Robinson said that from the point of view of the structural relationships of plant products the natural bases of the indole group have a double interest. On the one hand, the theory of the formation of isoquinoline alkaloids from amino-acids of the phenylalanine type suggested analogous transformations of tryptophan, and this led to the final elucidation of the constitutions of harmine and harmaline. On the other hand a retrospective survey of the group greatly strengthens the conviction that many alkaloids are actually transformation products of proteins. Even a casual inspection of the formulae suffices for the discovery of the constitutional relation of aribine, harmaline, physostigmine and rutecarpine to tryptophan. Closest to the amino-acid stands its methylated betaine *hypaphorine*, isolated by Greshoff from a Javanese tree. Aribine may be prepared from tryptophan by condensation with acetaldehyde and oxidation of the product; harmaline is methoxydihydroaribine, and rutecarpine contains the same fused benzene-pyrrole-pyridine nucleus. The physostigmine skeleton can be derived by methylating the tryptophan skeleton. The lecturer gave an account of the synthesis and the constitution of harmaline. Indole, skatole, methyl anthranilate (also damascenine) and indoxyl may be regarded as degradation products of tryptophan (or a substituted tryptophan), and it is therefore interesting to notice that rutecarpine and evodiamine contain the carboline nucleus of aribine and harmaline together with an anthranilic-type fragment of a second tryptophan molecule.

SOCIETY OF PUBLIC ANALYSTS

An ordinary meeting was held at the Chemical Society's Rooms on December 7, the President, Mr. E. Richards Bolton, being in the Chair.

Apparatus for determining benzoic acid in foods was demonstrated by Dr. G. W. Monier-Williams. The apparatus shown was devised for carrying out the author's method, based on the principle of passing benzoic acid vapour over moist metallic magnesium, to form a soluble magnesium benzoate, which can be subsequently extracted with hot water.

The use of the sodium flame for polarimetric work was demonstrated by T. McLachlan and A. W. Middleton. A pencil composed of sodium salts is used with a Bunsen burner to obtain a brilliant sodium flame.

"Oil bromide films and their use in determining the halogen absorption of oils," by Harold Toms, M.Sc. (Work done under the Analytical Investigation Scheme.) Oil films exposed to an atmosphere of bromine absorb the halogen quantitatively, and, after removal of the excess of bromine at a low temperature, the bromine absorption can be determined gravimetrically. The method, which gives accurate results with 20 to 50 mg. of an oil, has been used to determine the composition of the insoluble bromide of linseed oil, after removal of the bromine, by prolonged treatment with nascent hydrogen. The iodine values, calculated from the bromine absorbed, agree with those obtained by the Wijs method, except for tung oil, the gravimetric bromine absorption of which stands in a constant relationship to the iodine value. The brominated films of several oils (linseed, menhaden, soya, perilla, etc.) show characteristic differences in appearance.

"Tests for impurities in ether. I. Tests for peroxides," by G. Middleton, B.Sc., and F. C. Hymas, B.Sc. Only organic peroxide (probably dihydroxydiethyl peroxide) is to be expected in ether purified for anaesthesia. The sensitiveness of the various tests for peroxide (which renders the ether less stable) is compared, and two new tests are described. The ferrous thiocyanate test is recommended for official adoption, and a colorimetric limit for the amount of peroxide is proposed. An improved method of preparing the ferrous thiocyanate reagent is described, and it is shown that the test, which gives no coloration with pure ether, is not too stringent for practical purposes.

"Arsenic in coated papers and boards," by H. J. Stern, B.Sc., Ph.D. In general, uncoated papers and boards, and the adhesives used, are unlikely to contain a dangerous amount of arsenic. Mineral pigments are also usually satisfactory, but some of the synthetic inorganic pigments may be dangerous. Thus, a paper coated with an arsenical green may contain over 6 g. of arsenious oxide per sq. metre. Some of the lakes of synthetic dyes, notably magenta and methyl violet, precipitated with arsenious oxide, contain dangerous amounts of arsenic (e.g., 40-5% of As_2O_3). Certain dyes, notably Pigment Scarlet 3B and Orange II, may contain 50 to 100 pts. of arsenic per million. A provisional arrangement is in force among the users of pigments for this purpose, limiting the amount of arsenic to 10 pts. per million, and the boards in use seldom contain more than 2 or 3 pts. per million.

CORRESPONDENCE

"MORE ABOUT RESEARCH"

SIR,—It seems to me there is still much "More About Research" to be written. As I read Prof. Thorpe's letter, he means to tell us that the university student does the manipulative part of a research, that research being instigated, planned and "conducted" by the professor, as part of a more comprehensive series of related researches. If it is true, this is really very sad from the point of view of one who sometimes wants a map to do what may or may not be understood as industrial research. If it be true that a year or more as a post-graduate student has only developed his manipulative skill, it would seem to me to be rather a waste of time. I am by no means alone among industrial chemists in wanting men who can plan and actively control and initiate research, and the least of my difficulties is the finding of men who have experience of mere laboratory methods. The whole real difficulty is in finding men who see there are problems that chemistry can solve, and who can plan a campaign to solve them.

Would it be unreasonable to suggest that prizes, scholarships or other rewards—even a degree—be given for the origination and planning of a limited series of researches; the mere carrying out of the research being considered of secondary importance or altogether omitted? In practice, the value of a completed research depends very largely upon the way in which difficulties are met, but a well-planned research is one that anticipates difficulties and provides for them as far as it possibly can.

Yes, I am disappointed to learn that the professors do not regard the planning and "conduct" of research as an accomplishment of their research students, but I find consolation in the belief that some Professors are not quite so modest in their claims.

You must still call me

"PERCY"

PERSONAL AND OTHER ITEMS

The Physical Society has awarded the Duddell Medal for 1927 to Dr. F. E. Smith, C.B.E., F.R.S., for his important work on the development of electrical instruments.

Dr. G. T. Prior, M.A., F.R.S., has retired from the keepership of mineralogy in the British Museum, after serving for 41 years. He is succeeded by the deputy keeper, Dr. J. L. Spencer, F.R.S.

Dr. A. K. Macbeth, reader in chemistry in Durham University, has been appointed professor of chemistry in the University of Adelaide, South Australia.

Dr. H. Dixon, of Emmanuel College, has been appointed university lecturer in biochemistry at Cambridge for three years.

Mr. W. M. Short, M.Sc., has been appointed demonstrator in chemistry in the Department of Bacteriology in the University of Manchester.

Mr. J. H. Wolfenden, M.A., has been appointed lecturer in chemistry at Exeter College, Oxford.

From Germany the deaths are announced of:—Dr. H. Clemm, director of the Zellstoff-fabrik Waldhoff

since 1902; Prof. F. Giesel, for long chief chemist to the Chininfabrik Braunschweig, Buchler & Co., and an authority on quinine and on radium; Prof. M. Bemberger, emeritus professor of inorganic chemistry in the Technical "Hochschule," Vienna; Prof. H. Strache, director of the Institute of Fuel Technology of the Technical "Hochschule," Vienna, and a well-known authority on gas technology; Dr. P. Groth, the well-known Munich crystallographer; Dr. P. Brandt, director of the noble metal section of the Deutsche Gold- und Silber-Scheideanstalt; Dr. W. Eichholz, director of the Merck research laboratories.

The late Mr. Charles Butler, chairman of Willows, Francis Butler, & Thompson, Ltd., manufacturing chemists, left £24,380.

The late Sir William Galloway, D.Sc., left £5972.

The late Mr. J. Taylor, chairman of the British Insulated & Helsby Cables, Ltd., and various electrical companies, and a director of the British Aluminium Co., Ltd., left £176,897.

The late Mr. R. G. Murray, of Gorton, Manchester, chemical manufacturer, left £10,020.

The late Sir Gerald Muntz, Bt., left £12,784.

The restrictions on the importation of British coal into France have been removed.

Physical and Chemical Survey of the National Coal Resources: Lancashire and Cheshire Survey Committee

The Physical and Chemical Survey of the National Coal Resources is one of the main aspects of the fuel research work of the Department of Scientific and Industrial Research. In pursuance of the Department's policy of carrying out the work by means of local committees appointed in coal areas to advise upon the course of work in those areas, the first committee to be appointed was one to deal with the coalfield of Lancashire and Cheshire. In this area there already existed a research association formed by a number of colliery companies, and known as the Lancashire and Cheshire Coal Research Association. An arrangement was made whereby the Association agreed to carry out the work and to appoint, for its direction, a special executive committee, including representatives of the Fuel Research Board and the Geological Survey of Great Britain.

This Committee has recently been enlarged in order that it should be representative of the whole coalfield, and its composition is now as follows:—Mr. R. A. Burrows (Chairman), Mr. J. T. Browne, Mr. H. O. Dixon, Mr. J. H. Edmondson, Mr. R. Landless, Mr. J. Lomax, Mr. J. T. de Seyfried, Mr. N. Simpkin (Director of Research to the Lancashire and Cheshire Coal Research Association), Mr. F. S. Sinnatt (representing the Fuel Research Board), Mr. T. Stone, and Mr. W. B. Wright (representing the Geological Survey of Great Britain).

Committees are also actively at work in the following areas:—Durham and Northumberland, South Yorkshire, Nottinghamshire and Derbyshire, and North Staffordshire. Another Committee is dealing with the coalfields of Scotland.

A Special Pipette

A "special pipette" which has been devised by Mr. A. Conick (Patent No. 225,084) is constructed as follows:—A pipette, described as a volumeter, having a conical

socket into which is fitted a ground-in safety tube carrying a bulb and tap; the pipette delivers the required volume of liquid when filled to the base of the socket. Liquid is sucked into the safety-tube bulb, the tap above is closed, and the connexion is broken by a gentle rotational movement, the required volume then being automatically delivered. The safety tube is of standard size, and will fit the socket of any volumeter.

Industrial Peace

The General Council of the Trade Unions Congress has decided to accept the invitation of a representative group of employers to join with them in discussions on the problems of British industry. To Sir Alfred Mond is due the initiative of the movement amongst the employers, who include Sir Robert Hadfield, Sir D. Milne Watson, Sir Josiah Stamp, Mr. Arthur Dorman, Mr. S. Courtauld, and other leading industrialists.

Abrasives in Canada

An interesting addition to the publications of the Mines Branch of the Canadian Department of Mines is a series of bulletins dealing with abrasives, by V. L. Eardley-Wilmot. Part I. is devoted to "Siliceous abrasives—sandstones, quartz, tripoli, pumice and volcanic dust," Part II. to "Corundum and diamond," Part III. to "Garnet," and Part IV. to "Artificial abrasives and manufactured products and their uses." The bulletins provide a comprehensive account of the uses, sources of supply, preparation and markets of the various abrasives in Canada, attention being also paid to foreign methods of production and output. Each part is well illustrated with numerous geological maps, flow-sheets, diagrams of plant, and so on, and excellent photographs, and the series constitutes a most valuable compendium of information on abrasives. Three bulletins have so far been received, Part I., price 30 cents, Part II., 15 cents, and Part III., 20 cents.

Industrial Research in Ontario

Speaking at the Toronto branch of the Ontario division of the Canadian Manufacturers' Association, Mr. Ferguson, the Premier of Ontario, said that his Government was prepared to contribute dollar for dollar with the industrialists of the Province for the establishment of an industrial research endowment fund of \$2,000,000 (£400,000), if the money was raised within five years.

Lithium Development in Manitoba

According to a statement issued by the Industrial Development Board of Manitoba, the Silver Leaf Mining Syndicate intends to spend considerable sums on development work in the Province during the winter. A refining plant is being installed at Bradford, England, and lithia ore will shortly be moved out on a larger scale.

Franco-German Chemical Agreement

The report of the agreement between the I.G. and the Committee of French Chemical Industries is now confirmed. The agreement regulates production and sale and guarantees the independence of each of the parties. Further agreements to regulate the extent of overlap in production are being prepared. It is emphasised that there is no question of monopoly or hostility to chemical industries in other countries, as an understanding with similar industries in other countries is expressly contemplated in the agreement.

REVIEWS

THE CONSTITUTION OF GLASS. A series of papers reprinted from the Journal of the Society of Glass Technology. Edited by Prof. W. E. S. TURNER, O.B.E., D.Sc., M.Sc., F.Inst.P. Pp. 191. Sheffield: Society of Glass Technology, 1927. Price 7s. 6d.

Although glass is a material which has long received wide commercial application, our knowledge of its constitution is still very indefinite. There are, however, at the present time, several lines of research on the subject in process of exploitation which offer great possibilities. This work, although it must undoubtedly appeal to a wide scientific public, is, in general, difficult of access (except in the form of abstracts) to those who cannot readily obtain the technical journals on the subject. Realising this difficulty, the Society of Glass Technology has here performed the welcome task of republishing in book form a number of papers from the pages of recent issues of its Journal.

The volume is designed to be representative rather than exhaustive, but it admirably fulfils its function in giving a useful survey in an inexpensive form. Moreover, the results of the investigations outlined give the present position of the branch of which they treat, and probably in not more than one important case have views put forward needing serious modification in the light of subsequent research.

The list of papers includes a study of glasses as supercooled liquids by G. Tammann, an investigation of the ternary system, sodium metasilicate-calcium metasilicate-silica (the region which includes the majority of commercial glasses) by G. W. Morey and N. L. Bowen, and papers on the viscous properties of glass by V. H. Stott and H. le Chatelier, whilst X-ray analysis is represented by a study of the structure of quartz by Sir W. H. Bragg, and of soda-lime-silica glasses by R. W. G. Wyckoff and G. W. Morey. The interesting problem of the changes of property of glass in the annealing range is treated in a paper by A. Q. Tool and E. E. Hill. Theoretical contributions by W. E. S. Turner and F. Eckert summarise the knowledge at present available on the general aspect of the problem, whilst the book is rounded off by an interesting tentative hypothesis as to the nature of the vitreous state by W. Rosenhain.

A. COUSEN

PHOSPHORIC ACID, PHOSPHATES, AND PHOSPHATIC FERTILISERS. By W. H. WAGGAMAN and H. W. EASTERWOOD. American Chemical Society Monograph Series. Pp. 370. New York: The Chemical Catalog Company, Inc., 1927. Price \$7.50.

It would seem as if the great elements involved in organic life are each in turn to have a period of emphasis. Following the breakdown of Liebig's mineral hypothesis, nitrogen claimed a predominant part of our attention. This emphasis on the importance of nitrogen was greatly enhanced by Crookes' notable calculations, which foreshadowed an exhaustion of suitable compounds of nitrogen at a relatively early date. The subsequent establishment of processes for fixing nitrogen from the atmosphere solved this problem, and thenceforth phosphates have taken the predominant place in the literature of plant food.

It can scarcely be said that anyone foresees an exhaustion of available supplies of phosphate, but nevertheless the question of phosphate supplies is not without its difficulties. It would seem that so far as they can be computed the phosphate supplies of North America may not last for another century. Fortunately they cannot be computed with any assurance of accuracy, and even if they do run out the world holds other supplies. In this country the great difficulty of recent years has been the cessation of the output of Bessemer slag consequent upon modifications in the process of steel manufacture.

• The commercial uses of phosphate are manifold. Apart from their outstanding application as plant fertilisers, they are involved in such diverse industries as the refining of sugar, photography, the manufacture of dental cements, the manufacture of fire-proofing compounds, and of rust-proofing compounds, ceramic products, the weighting of silk, the production of fermented liquor, and doubtless other industries. Moreover, the cheaper production of phosphoric acid may make it possible for phosphoric acid to replace sulphuric and other acids in manufacturing processes in which the acid itself is not involved in the end product. It is therefore in no way surprising that phosphoric acid and its compounds form the subject of one of the American Chemical Society's Monographs which are now becoming so familiar to us.

The authors, after a historical introduction, give a concise account of the chemistry of the acids of phosphorus, and a résumé of their rôle in animal and crop metabolism. The sources of phosphate are described in considerable detail, and a full account is given, with many illustrations, of the processes of manufacture, a large section of the book being devoted to the volatilisation processes.

The literature of the subject appears to have been surveyed very exhaustively, and in all the descriptive matter abundant references are given. The book constitutes an invaluable source of reference to those concerned with phosphoric acid from any point of view, and is worthy of the careful study of those concerned with the manufacture of phosphoric acid and phosphates.

The segregation of "so-called available phosphates" and "water-soluble phosphates" into separate chapters, through each of which some discussion of availability is dispersed, seems a little unfortunate. It would, perhaps, be better to discuss the question of availability apart from the systematic description of the phosphates and their production. Our understanding of the availability of phosphates is admittedly very limited and vague, and that makes it all the more necessary that the fact of its vagueness shall be stated concisely.

A further improvement would be effected by a reconsideration of the illustrations. Whilst many of these are excellent, some of the photographs are very obscure, and might be replaced by, or accompanied by, line diagrams. One or two illustrations appear to be unnecessary. The picture of a freight train carrying pebble phosphate in Florida, which might be a picture of any freight train, anywhere, carrying anything or nothing, seems scarcely compatible with the dignity of the book.

N. M. COMBER

COMPANY NEWS

IMPERIAL CHEMICAL INDUSTRIES, LTD.

A circular has been issued to the preference shareholders calling a meeting for December 29, when they will be asked to sanction a resolution giving the directors power to increase the preference capital, as may be deemed expedient from time to time, from £16,220,000 to £22,800,000 by issues out of the existing balance of unissued capital amounting to 6,580,000 shares. The directors explain that they have under consideration the acquisition of additional undertakings, and that the operations will call either for an exchange of shares or a cash consideration. Since this consolidation of chemical interests was formed in December, 1926, it has already acquired the Cassel Cyanide Company on a share exchange basis. Last October the directors declared an interim (maiden) dividend of 3 per cent. on the ordinary shares for the year 1927.

BOOTS PURE DRUG CO., LTD.

An interim dividend has been declared of 6⁰., less tax, on the ordinary shares for the quarter.

BRITISH CYANIDES CO., LTD.

This company has purchased the privately held shares in the Beetle Products Co., making it the owner of the whole of the issued share capital. Col. Josselyn, of British Cyanides, Mr. S. W. Doherty and Mr. C. H. Glassey have been elected directors of the Beetle Products Co.; Col. Josselyn has been elected chairman, and Mr. K. M. Chance managing director.

ALUMINIUM CORPORATION, LTD.

The seventeenth ordinary general meeting was held on December 16, Mr. S. G. Berry presiding. It was not easy to realise at this date all the difficulties that had to be surmounted during the past two years, principally the Eigiau Dam disaster which occurred in November, 1925. In 1926 the company had to start with its works out of commission, and was only able to deal with a small portion of its business at a heavy additional cost. Their first task was to bring the power plant again into service, which took months of very hard work. The works had to be cleared of the debris and the furnaces rebuilt, during which time the rainy season had passed and the benefit of the major portion of the year's rainfall was lost. It was a source of considerable satisfaction that, in spite of all these setbacks, the company was able to show a net profit, after paying running costs and administrative charges, sufficient to cover the first debenture interest (cf. CHEM. AND IND., Dec. 16, 1927, p. 1189). As foreshadowed at the meeting in 1926, the Norwegian Aluminium Factory had been established, and under the arrangement to act as its sole selling agent, the company had already received first deliveries of metal. They had thus gone some way towards retrieving the company's position, firstly, by providing for the full use of the alumina and electrode plants, and secondly, by securing an ample supply of metal for the rolling mills at a cost which will enable the company to compete in the world's markets, with ample facilities for expansion.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned.

Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £30 per ton; Powder, £32 per ton; Extra fine Powder, £34 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 5d.—2s. 10d. per gal.; Pyridinised Industrial, 2s. 7d.—3s. per gal.; Mineralised, 3s. 6d.—3s. 10d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt).—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.
 Diphenylguanidine.—3s. 9d. per lb.

Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton. f.o.b. London.

Sulphur. £9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime. Brown, £10 5s. per ton. Good demand. Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carbolic.—Crystals, 7½d.—7½d. per lb. Crude 60's, 2s. 5d. per gal. prompt; lower for 1928 delivery.
 Acid Cresylic, 99/100.—2s. 11d.—3s. per gal. • 97/99.—2s. 4d.—2s. 5½d. per gal. Pale, 95%, 2s. 3d.—2s. 4d. per gal. Dark, 95%, 2s. 1d.—2s. 2d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40% £5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9½d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 7d. per gal., ex works in tank wagons.
 Toluene.—90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 10d.—2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.
 Creosote.—Cresylic 20/24%.—10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7½d. per gal. ex works. Salty, 7d. per gal., less 1¼%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/100, 9½d.—10½d. per gal. Solvent 95/100, 1s. 3d.—1s. 4d. per gal. Solvent 90/100, 8½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals, £13—£13 10s. per ton. Flaked, £14—£15 per ton.
 Pitch, medium soft.—85s.—90s. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—5s. 6d.—6s. 6d. per gal. 90/180.—3s. 6d.—5s. per gal. Heavy.—3s.—3s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acid Gamma.—4s. 6d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid H.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—8d. per lb., naked at works.
 Aniline Salts.—8d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb., 100%.
 Benzaldehyde.—2s. 3d. per lb.

Benzidine Base.—3s. 3d. per lb. 100% basis d/d.

Benzoic Acid.—1s. 8½d. per lb.

o-Cresol 29/31° C.—5½d. per lb.

m-Cresol 98/100%.—2s. 3d.—2s. 5d. per lb.

p-Cresol 32/34° C.—2s. 3d.—2s. 5d. per lb.

Dichloraniline.—1s. 10d. per lb.

Dimethylaniline.—1s. 11d. per lb.

Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton.

Dinitrochlorbenzene.—£84 per ton d/d.

Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.

Dinitrotoluene.—66/68° C.—9d. per lb., naked at works.

Diphenylamine.—2s. 10d. per lb. d/d.

a-Naphthol.—2s. per lb. d/d.

β-Naphthol.—10d. per lb. d/d.

a-Naphthylamine.—1s. 3d. per lb.

β-Naphthylamine.—3s. per lb.

o-Nitraniline.—5s. 9d. per lb.

m-Nitraniline.—3s. per lb. d/d.

p-Nitraniline.—1s. 8d. per lb.

Nitrobenzene.—6d. per lb., naked at works.

Nitronaphthalene.—1s. 3d. per lb.

R. Salt.—2s. 2d. per lb.

Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.

o-Toluidine.—8½d. per lb.

p-Toluidine.—2s. per lb., ex works, naked.

m-Xylidine Acetate.—2s. 6d. per lb. 100%.

N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.

Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.

Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum.—1s.—1s. 3d. per oz., according to quantity.

Acid, Boric B.P.—Cryst. 36s.—39s. per cwt. Powder 40s.—43s. per cwt.; Extra Fine Powder, 42s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—1s. 6½d.—1s. 7d. per lb. Less 5%.

Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.

Acid, Pyrogallic, Cryst.—7s. 3d. per lb. Resublimed.—8s. 3d. per lb.

Acid, Salicylic.—B.P. pulv. 1s. 2½d.—1s. 3½d. per lb. Technical 11½d.—11½d. per lb.

Acid, Tannic, B.P.—2s. 8d.—2s. 10d. per lb.

Acid, Tartaric.—1s. 3½d. per lb. Less 5%.

Acetanilide.—1s. 6d.—1s. 9d. per lb. for quantity.

Amidol.—7s. 6d.—9s. per lb. d/d.

Amidopyrin.—8s.—8s. 3d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 5d. per lb., according to quantity.

Ammon. Carbonate B.P.—Lump £37 per ton. Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.

Atropine Sulphate.—9s. per oz.

Barbitone.—5s. 9d.—6s. per lb.

Benzonaphthol.—3s. 3d. per lb.

Bismuth Carbonate.—10s. 4d. 10s. 7d. per lb. Bismuth Citrate.—9s. 10d.—10s. 1d. per lb. Bismuth Salicylate.—9s. 10s.—10s. 1d. per lb. Bismuth Subnitrate.—8s. 4d.—8s. 7d. per lb. Bismuth Nitrate.—6s. 1d.—6s. 4d. per lb. Bismuth Oxide.—13s. 10d.—14s. 1d. per lb. Bismuth Subchloride.—13s. 10d.—14s. 1d. per lb. Bismuth Subgallate.—8s. 1d.—8s. 4d. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi et Ammon. Cit. B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.

Borax B.P.—Crystal 25s. per cwt. Powder 26s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—1s. 11d.—2s. 1d. per lb.

Potassium.—1s. 7½d.—1s. 9½d. per lb. Sodium.—1s. 10d.—2s. per lb. Granulated ½d. per lb. less.

All spot. Large quantities at lower rates.

Calcium Lactate B.P.—1s. 2½d.—1s. 3½d. per lb.

Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.

Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.

Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.

Creosote Carbonate.—6s. per lb.

Ethers: S.G. 730, 10½d.—1s. 1½d. drums. Other gravities at proportionate prices.

Formaldehyde.—£39 per ton. Ex wharf in barrels.

Guaiacol Carbonate.—4s. 9d.—5s. per lb.

Hexamine.—2s. 3d.—2s. 6d. per lb.

Homatropine Hydrobromide.—30s. per oz.

Hydrastine Hydrochlor.—English make offered, 120s. per oz.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s.—2s. 3d. per gal.; 20 vols., 3s.—4s. per gal.

Hydroquinone.—3s. 10d. per lb.

Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots.

Potassium 4s. 1d. per lb. Sodium 4s. per lb.

Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.

Iron Perchloride.—18s.—20s. per cwt., according to quantity.

Magnesium Carbonate.—Light Commercial £31 per ton net.

Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.

Menthol.—A.B.R. recryst., B.P., 15s. 6d. January delivery per lb. net. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.

Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb.; Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb.; Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb.; Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.

Methyl Salicylate.—1s. 9d. per lb.

Methyl Sulphonate.—9s.—9s. 3d. per lb.

Metol.—9s.—11s. 6d. per lb. British make.

Paraformaldehyde.—1s. 9d. per lb. 100% pdr.

Paraldehyde.—1s. 4d. per lb. Less in quantity.

Phenacetin.—2s. 6d.—2s. 9d. per lb.

Phenazone.—4s.—4s. 3d. per lb.

Phenolphthalein.—6s. 6d.—6s. 9d. per lb.

Potass. Bitartrate.—99/100% (Cream of Tartar) 96s. per cwt., less 2½%.

Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.

Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.

Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.

Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.

Potass. Permanganate.—5½d. per lb. spot.

Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.

Resorcin.—2s. 10d.—3s. per lb. spot.

Saccharin.—55s. per lb., and lower in quantity.

Salol.—2s. 4d. per lb.

Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.

Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.

Sod. Ferrocyanide.—4d. per lb., carr. paid.

Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.

Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net. Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 7d.—1s. 9d. per lb. Crystal, 1s. 8d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton according to quantity, delivered U.K.
 Sulphonol.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.
 Aubepine (ex Anethole).—11s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate.—5s. 3d. per lb. Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 3d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—8s. 3d. per lb. Geraniol (Palmarosa).—17s. 9d. per lb. Geraniol.—6s.—10s. per lb. Heliotropine.—4s. 9d. per lb. Iso Eugenol.—13s. per lb. Linalol.—(ex Bois de Rose) 14s. per lb.—(ex Shui Oil) 9s. 9d. per lb. Linalyl Acetate.—(ex Bois de Rose) 17s. 6d. per lb.—(ex Shui Oil) 13s. 9d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—31s. 6d. per lb. Sufrol.—1s. 6d. per lb. Terpeneol.—1s. 8d. per lb. Vanillin.—15s. 3d.—16s. 6d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb. Bergamot.—26s. per lb. Bourbon Geranium.—13s. per lb.
 Camphor.—9d. per lb. Cananga, Java, 15s. 9d. per lb. Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d. per oz. Citronella.—Java, 1s. 9d. per lb., c.i.f. U.K. port, for shipment over 1928: Ceylon, Pure, 1s. 7d. per lb. Clove, pure 5s. per lb.
 Eucalyptus, Australian.—2s. 1d. per lb. Lavender.—Mont Blanc, 38/40%, 17s. per lb. Lemon.—8s. 6d. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d. per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian, 75s. per oz. Palma Rosa.—10s. 3d. per lb. Peppermint.—Wayne County, 15s. 9d. per lb. Japanese, 8s. per lb. Petitgrain.—7s. 9d. per lb. Sandalwood.—Mysore, 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST.

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Feb. 13th, 1928. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C. 2, on Dec. 29th 1927. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Bowrey, and Duckham & Co. Apparatus for heating materials. 33,153. Dec. 7. (U.S., Electroflux, Ltd. Refrigeration. 33,099. Dec. 7. (U.S., 8.12.26.)

Erz u. Kohle-Flotation Ges. Classifying materials. 32,974. Dec. 6. (Ger., 22.3.27.)

Farmer. Crushing-plant jaws. 33,447. Dec. 10.
 Hurrell. Production of emulsions etc. 32,950. Dec. 6.
 Hurter. Catalytic materials etc. 33,128. Dec. 7.
 Johnson (I.-G. Farbenind.). Improving absorption capacity of materials. 33,468. Dec. 10.
 Lehmann and Lehmann. Filter presses. 32,766. Dec. 5. (Ger., 19.9.27.)
 Metallwerke vorm. J. Aders. 32,848. See VII.
 Montgomerie. Producing emulsions. 33,300. Dec. 9.
 Rigby. Rotary kilns. 33,431. Dec. 10.
 Wade (Thomas). Manufacture of desiccating material. 33,376. Dec. 9.
 Zwicky. Filters. 33,372. Dec. 9.

I.—Complete Specifications

20,955 (1926). Billwiller. Prevention and removal of incrustation in boilers. (281,361.)
 21,570 (1926). Illingworth Carbonisation Co., Ltd., and Illingworth. Separation or extraction of liquids from materials. (281,390.)
 31,512 (1926). Kemp and Thomson. Apparatus for separating solid materials by the float and sink method. (281,479.)
 10,217 (1927). Marks (Polysius). Tube and drum mills. (281,528.)
 *31,879 (1927). Krupp A.-G. Centrifuging-machines. (281,649.)
 *32,145 (1927). Buechler, Kiser et Cie. Vertical drying-apparatus. (281,664.)
 *32,289 (1927). Soc. L'Air Liquide. Liquefying and separating the constituents of gaseous mixtures. (281,675.)
 *32,440 (1927). Fischer. Apparatus for treating solutions. (281,695.)

II.—Applications

Anglo-Saxon Petroleum Co., Ltd., and Dawson. Refining petroleum distillates. 33,207. Dec. 8.
 Axtell Research Laboratories, Inc. Refining petroleum. 30,397. Dec. 9. (U.S., 27.12.26.)
 Chamber Ovens, Ltd. (Pintsch & Otto Ges.). Carbonisation apparatus. 33,091. Dec. 7.
 Crunston. Carbonisation of coal. 32,801. Dec. 5.
 Dupont. Carbonising-oven. 32,966. Dec. 6. (Fr., 8.12.26.)
 Electroflo Meters Co., Ltd. (Republic Flow Meters Co.). Gas analysis apparatus. 32,721. Dec. 5.
 Gas Accumulator Co. (United Kingdom), Ltd. Manufacture of porous masses for storing explosive gases. 32,808. Dec. 5. (Ger., 4.12.26.)
 Hirschberg. Treatment of carbonaceous etc. materials. 33,216—7. Dec. 8.
 Humphreys & Glasgow, Ltd. Manufacture of gas. 32,967. Dec. 6. (Fr., 8.2.27.)
 I.-G. Farbenind. Manufacture of liquid products from coal etc. 33,339. Dec. 9. (Ger., 20.12.26.)
 Johnson (I.-G. Farbenind.). Production of liquid hydrocarbons. 32,797. Dec. 5.
 Lee and Slate. Drying and purification of coal gas etc. 33,305. Dec. 9.
 Pope. Low-temperature carbonisation apparatus. 33,336. Dec. 9.
 Saniter, and United Steel Companies, Ltd. Working gas-producers. 33,150. Dec. 7.
 Siemens & Halske A.-G. Determining content of combustible gas in gas mixtures. 33,272. Dec. 8. (Ger., 10.12.26.)
 Wischin. Purifying used lubricating oil. 33,245. Dec. 8. (Ger., 3.11.27.)

II.—Complete Specifications

14,299 (1926). Low-Temperature Carbonisation, Ltd., and Parker. Retort furnaces for distillation of coal etc. (281,348.)

30,340 (1926). Cooper, Holmes, and Holmes & Co., Ltd. Treatment of coal-gas etc., and production of ammonium sulphate. (281,474.)

31,512 (1926). Kemp and Thomson. *See* I.

25,327 (1927). Brand and Laing. Utilisation of pulverulent or powdered carbonaceous materials. (281,588.)

*31,965 (1927). Soc. Anon. La Carbonite. *See* III.

*32,808 (1927). Gas Accumulator Co. (United Kingdom). Manufacturing porous masses for storing explosive gases. (281,718.)

III.—Applications

Cox and McDermott. Purification of benzol etc. 33,256. Dec. 8.

Morgan & Pratt. Treating tar etc. 32,929. Dec. 6.

III.—Complete Specifications

19,499 (1926). Prodorite, Ltd. Pitch compositions. (256,640.)

13,122 and 14,641 (1927). Still. Recovering sulphuric acid from acid-tar of benzol purification. (277,619 and 281,547.)

*31,965 (1927). Soc. Anon. La Carbonite. Separating-apparatus for tar etc. (281,653.)

IV.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of sulphonic acids etc. 33,131. Dec. 7.

Fabr. de Prod. de Chimie Organique de Laure. Manufacture of primary amines. 33,355. Dec. 9. (Fr., 9,12,26.)

Imray (Soc. Chem. Ind. in Basle). 32,981. *See* XX.

Johnson (I.-G. Farbenind.) Production of vat dyestuffs. 32,799. Dec. 5. Manufacture of anthracene dyestuffs. 33,340. Dec. 9. Manufacture of salts of acid sulphuric esters of nitroxyanthraoles. 33,341. Dec. 9. Dyes. 33,469. Dec. 10.

Morgan and Harrison. Manufacture of acenaphthene derivatives. 33,199. Dec. 8.

IV.—Complete Specifications

23,917 (1926). I.-G. Farbenind. Preparing Bz-2 hydroxy-benzanthrone. (258,910.)

19,602 (1927). I.-G. Farbenind. Manufacture of derivatives of acenaphthene. (274,902.)

*32,679 (1927). Soc. Chem. Ind. in Basle. Manufacture of dyestuffs. (281,713.)

V.—Applications

Bemberg A.-G. Production of artificial threads. 33,399. Dec. 9. (Ger., 20,1,27.)

Harrison. Manufacture of artificial filaments from cellulose esters. 33,203. Dec. 8.

Lucas, and Vickers, Ltd. Treatment of fibrous materials. 33,232—3. Dec. 8. Obtaining fibres for spinning. 33,241. Dec. 8.

Soc. Chem. Ind. in Basle. Manufacture of artificial materials. 32,803. Dec. 5. (Switz., 4,12,26.)

V.—Complete Specifications

13,300 (1926). Dreyfus. Treatment of yarns, fabrics, films, etc. (281,084.)

16,363 (1926). Lilientfeld. Manufacture of artificial materials from viscose. (281,351.)

16,449 (1926). Lilientfeld. Manufacture of artificial threads. (281,352.)

30,316 (1926). British Dyestuffs Corp., and Hailwood. Natural vegetable fibre. (281,473.)

*31,678 (1927). Böhm. Chlorination of hair and wool. (281,646.)

*32,002 (1927). Kuppel. Manufacturing impermeable paper. (281,655.)

*32,143 (1927). Eschingen. *See* XI.

*32,308 (1927). Sajitz and Pott. Production of viscose. 281,679.)

VI.—Applications

Hackenbroich. Impregnating-apparatus for dyeing fabrics. 33,158. Dec. 7. (U.S., 13,8,27.)

Imray (I.-G. Farbenind.). Dyeing animal fibres. 32,804. Dec. 5. Production of fast dyes etc. 32,982. Dec. 6.

VI.—Complete Specifications

22,058 (1926). British Dyestuffs Corp., Baddiley, Chorley, and Brightman. Dyeing with azo dyes. (281,410.)

28,783 (1926). Soc. Chem. Ind. in Basle. Dyeing cellulose esters. (261,423.)

*31,921 (1926). Zethtitz and Pfeifer (Brosch). *See* XV.

32,445 (1927). Herminghaus & Co. Ges. Modifying the capacity of cellulose-containing materials for taking up colours. (281,696.)

*32,568 (1927). Soc. Chem. Ind. in Basle. Producing fast tints on cellulose esters or ethers. (281,704.)

VII.—Applications

Ashcroft. Recovering constituents of metallic salts. 32,793—4. Dec. 5.

Caro and Frank. Production of hydrocyanic acid. 32,837. Dec. 5. (Ger., 17,12,26.)

Hayhurst. Pumping acid for acid towers etc. 33,490. Dec. 10.

Johnson (I.-G. Farbenind.) Recovery of phosphoric acid from crude phosphates. 32,796. Dec. 5.

Metallwerke vorm. J. Aders. Obtention of salt by vacuum evaporation. 32,848. Dec. 5. (Ger., 4,12,26.)

VII.—Complete Specifications

28,290 (1926). Dand. Limestone. (281,460.)

29,091 (1926). Weyman and Wallis. Saturators for manufacture of crystalline salts. (281,465.)

29,866 (1926). Lundin. Producing carbonic acid gas. (278,304.)

30,340 (1926). Cooper, Holmes, and Holmes & Co., Ltd. *See* II.

514 (1927). Johnson (I.-G. Farbenind.). Manufacture of anhydrous chlorides and hydrogen chloride. (281,491.)

4732 (1927). Sharp (Soc. Gén. Metallurgique de Hoboken). Manufacture of sulphuric acid. (281,510.)

15,115 (1927). Petersen. Manufacture of sulphuric acid. (281,551.)

*25,890 (1927). Caro and Frank. Production of high per cent calcium cyanamide. (281,610.)

*25,894 (1927). Caro and Frank. Production of the cyanamides of the alkaline earth metals and magnesium. (281,611.)

*31,529 (1927). Norsk Hydro-Elektrisk Kvaestofakt. Concentration of dilute nitric acid. (281,642.)

*32,430 (1927). Fröcher. Concentration of nitric acid. (281,691.)

*32,848 (1927). Metallwerke vorm. Aders. Obtaining salt by vacuum evaporation. (281,726.)

VIII.—Application

British-Thomson-Houston Co., Ltd. Production of vitreous silica. 32,771. Dec. 5. (U.S., 29,12,26.)

VIII.—Complete Specifications

21,343 (1927). United States Metals Refining Co. Magnesite refractories. (276,916.)

*32,673 (1927). British Thomson-Houston Co., Ltd. Abradant material. (281,711.)

IX.—Applications

Bouzin. Kilns for cement etc. 33,249. Dec. 8.

Hadfield. Coloured building material. 33,243. Dec. 8.

IX.—Complete Specification

*32,428 (1927). I.-G. Farbenind. Manufacture of acid-proof cementing-compositions. (281,689.)

X.—Applications

Ashcroft. Treatment of ores. 32,786 and 32,790—1. Dec. 5. Metallurgy of lead-bearing compounds etc. 32,787.

Dec. 5. Recovering zinc etc. from blue powder etc. 32,788.
Refining etc. silver-lead bullion etc. 32,789. Dec. 5. Pro-
duction of metals from minerals. 32,795. Dec. 5.
Boumphrey. Prevention of corrosion of metals. 33,426.
Dec. 10.

Feild. Manufacture of stainless iron. 33,489. Dec. 10.
(U.S., 18,12,26.)

Haughton and Rosenham. Iron alloys. 32,928 and 32,930.
Dec. 6.

Jackman & Co., Ltd., and Neville. Cupola furnaces.
33,178—9. Dec. 8.

Jones, and Sylvette, Ltd. Acid-resisting alloy. 33,037.
Dec. 7.

Kantzow. Fire-resistant alloys. 33,495. Dec. 10.
Manos. Alloys. 33,484—5. Dec. 10. (Switz., 11,12,26.)

Siemens-Schuckertwerke. Annealing furnaces. 33,271.
Dec. 8. (Ger., 9,12,26.)

Sicurin. Production of iron sponge. 33,012. Dec. 6.
Standard Telephones and Cables, Ltd. (Matériel Télé-
phonique). Manufacture of lead antimony alloys. 33,472.
Dec. 10.

X.—Complete Specifications
13,444 (1926). Guggenheim, Guggenheim, Guggenheim,
Guggenheim, MacGowan, and Smith. Metallurgy of tin.
(254,284.)

15,185 (1926). Davies (Watkins). Pickling, annealing,
and otherwise treating metal sheets. (281,349.)

18,137 (1926). Liban. Coating iron articles with tin and
zinc. (281,357.)

23,829 (1926). Jessup. Electrolytic preparation of mag-
nesium and metals of the alkaline earths. (259,554.)

*28,575 (1927). Meyer. Manufacture of steel. (281,621.)

XI. Applications
British Thomson-Houston Co., Ltd. Filaments for incan-
descent lamps etc. 33,105. Dec. 7. (U.S., 3,12,26.)

Electric Furnace Co., Ltd., and Taylor. Electric induc-
tion furnaces. 33,113. Dec. 7.

Hatfield. Electrodes for indication etc. of chemical com-
position of liquids. 32,876. Dec. 5.

Kershaw and Woodbridge. Electric batteries. 33,285.
Dec. 8.

Mallon. Electric accumulators. 33,501. Dec. 10. (Fr.,
11,12,26.)

XI.—Complete Specifications
21,444 (1926). Davis, and Metropolitan-Vickers Electrical
Co., Ltd. High-frequency electric induction furnaces.
(281,379.)

23,829 (1926). Jessup. See X

*32,143 (1927). Eschngen. Increasing electric disruption
strength or resistance of films of cellulose esters or ethers.
(281,663.)

*32,453 (1927). Schmid. Galvanic cells. (281,698.)

XII.—Applications
Flesch. Production of sulphonated oils and fats. 33,338.
Dec. 9. (Ger., 27,1,27.)

Hurrell. 32,950. See I.

Kellett. Soap preparation. 33,435. Dec. 10.

Kernot. Refining and bleaching fish oils. 33,412. Dec. 10.
Montgomerie. 33,300. See I.

Reddie (A.-G. für Medizinische Produkte). 33,022. See
XIX.

XII.—Complete Specifications
30,027 (1926). Horn. Producing clear oils soluble in water.
(281,476.)

*31,208 (1927). Oel- u. Fett-Chemie Ges. Treating tall oil.
(281,637.)

XIII.—Applications
Major. Production of lamp black. 33,015. Dec. 6.

Trist. Printing-ink. 33,334. Dec. 9.

XIII.—Complete Specifications
21,406 (1926). Bennett and Hadfield. Treatment of resins
for making varnish, paints, etc. (281,377.)

28,218 (1926). Wade (Titanium Pigment Co., Inc.). Manu-
facture of composite titanium pigments. (281,459.)

XIV.—Applications
Galbraith and Mills. Preparation of synthetically-produced
rubber. 32,761. Dec. 5.

Johnson (I.-G. Farbenind.). Production of rubber. 32,798.
Dec. 5.

XIII.—Complete Specifications

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Johnson (I.-G. Farbenind.). Production of rubber. 32,798.
Dec. 5.

XIV.—Complete Specifications
28,908 (1926). Consort. f. Elektrochem. Ind. Manufacture
of products resembling rubber. (261,748.)

32,957 (1926). Standinger. Manufacture of hydro-cyclo-
caoutchouc. (263,862.)

*27,209 (1927). Goodyear Tire & Rubber Co. Preserving
rubber. (281,616.)

XV.—Complete Specifications
13,260 (1927). Jager, and Herold A.-G. Manufacture of
white artificial horn. (281,537.)

*31,921 (1926). Zettlitz and Pfeiffer (Brosch). Method of
tanning and dyeing furs and leather. (281,592.)

XIX.—Applications
Bennett. Foodstuffs. 32,923. Dec. 6.

Chem. Fabr. Schlutup. Leaching fish waste etc. 33,107.
Dec. 7. (Ger., 7,12,26.)

Massard. Method of producing almond-milk product.
33,391. Dec. 9. (Switz., 10,12,26.)

Redde (A.-G. für Medizinische Produkte). Manufacture of
margarine etc. 33,022. Dec. 6.

XIX.—Complete Specifications
21,452 (1926). Jellicoe. Preserving fruit etc. (281,380.)

5711 (1917). Schwartzauer Hongwerke u. Zuckerraffinerie
A.-G. Manufacture of pectin products. (281,513.)

8929 (1927). Posternak. Obtaining the total bodies con-
taining phosphorus and iron derived from the proteids of
egg yolk. (268,805.)

XX.—Applications
Carpmael (I.-G. Farbenind.). Manufacture of derivatives
of hydroxy compounds containing mercury. 33,205.
Dec. 8.

I.-G. Farbenind. Manufacture of gland preparations etc.
33,114. Dec. 7. (Ger., 11,1,27.)

Inray (Soc. Chem. Ind. in Basle). Manufacture of uni-
laterally acylated diamines. 32,981. Dec. 6.

Thuniss, and Wellcome Foundation, Inc. Preparation of
soluble salts of ergotoxine. 33,095. Dec. 7.

XX.—Complete Specifications
21,149 (1926). Vidal (Riedel A.-G.). Production of active
sedative, hypnotic, and sleep-producing compounds. (281,365.)

27,864 (1926). Scheller. Arsenising organic compounds.
(261,026.)

1169 (1927). Soc. Chem. Ind. in Basle. Obtaining
highly active substances from female secretory organs.
(265,567.)

3427 (1927). Riedel A.-G. Producing adipic acid and its
alkyl substitution products. (265,959.)

6494 (1927). Parke, Davis & Co. Measles toxin and anti-
toxin. (267,520.)

10,528 (1927). Abraham. Production of a material con-
taining thymol and polymerised formaldehyde. (281,530.)

20,472 (1927). I.-G. Farbenind. Manufacture of asym-
metrically substituted diamino-propanols. (275,622.)

21,300 (1927). I.-G. Farbenind. Manufacture of 1-amino-
3-dialkylamino 2-propanols. (270,012.)

21,544 (1927). Wellcome Foundation, Ltd., Henry, and
Sharp. Preparation of therapeutic substances. (281,582.)

*31,958 (1927). Deuts. Gold- u. Silber-Scheideanstalt.
Preparing 2-chloropyridine. (281,650.)

*32,142 (1927). Ohle and Othmarneuscheller. Manufacture of ethyl alcohol-gols. (281,062.)

*32,429 (1927). I.-G. Farbenind. Manufacture of arseno-benziminazolones. (281,690.)

*32,567 (1927). I.-G. Farbenind. Manufacture of benziminazolone-arsinic acids. (281,703.)

XXI.—Applications

Robertson. Photographic films for colour photography. 32,805. Dec. 5.

Vilaseca. Photographic plates. 33,364. Dec. 9.

XXI.—Complete Specification

*32,473 (1927). Zippermayr. Hardening and drying colloids, particularly photographic layers. (281,700.)

XXII.—Application

Rakowitzky and Rakowitzky. Manufacture of matches. 33,209. Dec. 8. (Austria, 15.4.27.)

XXII.—Applications

Paterson. Purification of water. 33,388. Dec. 9.

Prüss. Artificially heating sludge-digestion chambers. 33,221. Dec. 8.

XXIII.—Complete Specification

13,772 (1927). Prüss. Accelerating sludge digestion for sewage treatment. (281,541.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*British India*: Brass foundry, galvanised tinned and aluminium hollow-ware (483); Soap, varnish, paint (484); Surgical appliances (486); Glass bottles, cranes (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Canada*: Iron, steel, metals (8276/27). *Chile*: China-ware, waterproof cloth (501). *Cyprus*: Chemical manures (489). *New Zealand*: Bituminous tape (B.X. 4067); Paper (B.X. 4061). *South Africa*: China, crockery (491); Rolled mild steel bars (A.X. 5631); Boiler tubes (A.X. 5644).

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during November, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 762, of which 639 were from merchants or importers. To these should be added 33 cases outstanding on October 31, making a total for the month of 795. These were dealt with as follows:—Granted, 693; referred to British makers of similar products, 70; referred to reparation supplies available, 2; outstanding on November 30, 30. Of the total of 795 applications received, 728, or 88%, were dealt with within seven days of receipt.

Merchandise Marks Act

The Board of Trade has referred to the Standing Committee appointed by it under the Act, applications for Orders in Council to require the marking of *inter alia* imported copper plates, sheets, and strips, and copper wire; sheet lead and lead pipes.

New Spring Shades

"Fashionable Shades for Spring, 1928," is the title of the latest pattern card issued by the British Dyestuffs Corporation, Ltd. These shades include the following:—Gazelle, D.O. 49; Blush Rose, D.O. 50; Mavis, D.O. 51; Maize, D.O. 52; Passion Flower, D.O. 53; Chestnut, D.O. 54; Bluettes, D.O. 55; Puritan, D.O. 56; Atlantic, D.O. 57; and Zulu, D.O. 58. Recipes for the various colours are given, and it is stated that recipes for matching other shades will be supplied on request.

High Temperature Insulation

It is well known that there are important heat losses due to radiation and convection from boiler settings, furnace walls and other heated equipment, losses that have become still more important on account of modern developments in the use of high temperatures far above that of steam. How these losses can be reduced is discussed in an interesting brochure, compiled by the Celite Products Co., which deals with the question of high-temperature insulation from a chemical engineering standpoint. Data are given to show that an insulating brick prepared from diatomaceous silica is about ten times as effective in retarding the passage of heat as a representative refractory material. Methods are given for determining the rate of heat flow by conduction through walls composed of materials of varying conductivities, and figures are quoted which indicate that without increasing the thickness of the wall, but by replacing parts of the thickness with "Sil-o-Cel" insulating brick, the heat loss was reduced by over 70%. A number of applications of high-temperature insulation is described in the brochure, copies of which can be obtained from the Celite Products Corporation, Windsor House, 46, Victoria Street, London, S.W.1.

News from Advertisements

The Senate of the University of London invites applications for the Ramsay Memorial Chair of Chemical Engineering tenable at University College (p. vi).

A chemist is wanted for textile process work (p. vi).

A chemical library requires a lady assistant (p. vi).

Various sets of the JOURNAL etc. are required (p. vi).

There are now 129 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

ECONOMIC ASPECTS OF CANE SUGAR PRODUCTION. By F. Maxwell, D.Sc., M.I.Mech.E., F.C.S. Pp. vi + 198. London: N. Rodger, 1927. 12s. 6d.

FORTSCHRITTE IN DER KALI-INDUSTRIE. By Dr. C. Hermann. Band XVII. Technische Fortschrittsberichte. Fortschritte der Chem. Technologie in Einzeldarstellungen, edited by Prof. B. Rassow. Pp. viii + 117. Dresden and Leipzig: Th. Steinkopff, 1927. Paper 6.80 rm.; bound 8 rm.

TABELLÄRISCHE ÜBERSICHT DER NAPHTHALINDERIVATE AUF GRUNDLAGE DES WERKES: SUR LA CONSTITUTION DE LA NAPHTALINE ET DE SES DÉRIVÉS. Revised with reference to the recent literature by E. J. Van der Kam. Part I. Tabellen. Part II. Litteratur. Pp. x + 251. Haag: Martinus Nijhoff, 1927. Paper 35 fl.; bound 40 fl.

LEICHTE KOHLENWASSERSTOFFÖLE. DIE NEUEREN VERFAHREN ZUR GEWINNUNG VON BENZIN UND EINIGEN ERSATZSTOFFEN. Edited by Dr. M. Naphtali. Pp. xii + 512. Berlin: M. Krayn, 1927. Paper 42 m.; bound 45 m.

JOURNAL of THE SOCIETY OF CHEMICAL INDUSTRY CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council of Pure and Applied Chemistry

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

VOL. 46 NEW SERIES

LONDON, DECEMBER 30, 1927

No. 52

EDITORIAL

Our New Year's Greeting

WE are glad to wish all our readers a very happy and prosperous New Year and to assure them that they have every reason to be proud of the present state of chemistry, of the chemical industry, of the Society of Chemical Industry, and in particular of its JOURNAL. We are firmly of opinion that our readers will have a happy and prosperous New Year. to begin with, all our readers are a year older than they were last year, and about ninety-eight per cent. of so highly educated people as our readers get automatically happier as they grow older. No one has so many bitter sorrows as the young infant. the desire for food, a sense of boredom, an ungratified wish, or an uncomfortable garment causes a degree of acute misery which is heart-rending, and has even been known to distress the mother and the other less important members of the household. The schoolboy and the schoolgirl are far happier, for they feel they are well on the road to that almost divine state of being grown up and having the power of doing as they like. Even the young people of the age of twenty or twenty-five have periods of acute misery; they are—or, at any rate, used to be—afflicted by shyness, love, toothache, examinations, and spots on the face. they are continually striving to be more beautiful, more accomplished, and more athletic than Nature intended them to be; this involves them in a series of grievous disappointments. The middle-aged, by which we mean those who are between forty and sixty, are free from most of these disappointments: towards the latter end of that period, for it has two ends, they view with complacency the frost, for it enables them to clean their skates and talk of the pleasure of doing the outside edge and cutting eights, and with equal complacency the thaw, because it saves them a cold journey in the train and the trouble and expense of buying a new pair of boots; they get almost greater pleasure out of a game of bridge, and are prepared to go three no trumps on two kings and a couple of martinis, hoping for the best as only the mature and experienced can do. We know some oldish people, about eighty, who are as happy as kings and almost as autocratic; one of them plays a very good game of snooker, and not only scores off us with the cue, but also by his reminiscences of the opera and the theatre in the 'sixties and 'seventies; another

oldish man gets far more satisfaction out of a few score of wooden blocks cut by a yet older man—and accurately cut, mark you into rhombic dodecahedra than any young child gets out of an equal number of wooden bricks. These two oldish men have more spare time, more experience, and more imagination than those of a younger generation, and they simply revel in the possibilities of this new chemical implement: whether it will prove to be comparable with Newton's pet calculus or Tait's pet quaternions or Moseley's pet X-rays no one can say; that is not part of our theme, which is of happiness merely. Secondly, let us deal with prosperity; this is possible to everyone who really, with all his soul, desires it, and it is, moreover, the only hobby which all may be successful in pursuing. There are two ways of obtaining it—one by increasing your income, the other by decreasing your expenditure. The chemist may easily do the latter: he has only to give up all the foolish luxuries of this life and devote himself to study and he will find that every hour he spends in reading will save him fivepence or sixpence, according to his habits, when he is not so engaged. It is a noble thought to indulge in, after perusing a solid treatise on allotropy or crystallography, that you have not only mastered the subject, but are also a guinea in hand. Read as we may, we cannot keep pace with the growth of chemistry; it advances so fast and from so many points, and in so many directions. Herein, also, the man or woman who is philosophically minded may find cause for happiness. If you come to think it out, although you cannot read all that is written, you can, by about the time you are sixty, read pretty nearly all the books that are worth reading. Few books are worth reading that are not worth keeping, and the total number of books worth keeping, not as curiosities, investments or articles of furniture, is only about fifteen hundred. If a reader has discrimination and reads the best twenty books in Greek, and the best twenty in Latin, all the rest may go hang. Probably thirty or forty of the best books in French and German will suffice for most English readers; and as for chemical books to read, the number is small, too small. We wish a few of our readers would give us a list of the best fifty books on chemistry which a chemist may read for pleasure. We think we are right in thinking that a

chemist may, long before he gets into a stage of senile decay, read all that is worth reading in his own subject and several other subjects too. All that is required is a sufficiently high standard of literature. We thought we should have space to show causes for happiness in contemplating our industry, our Society and our JOURNAL, but these are so many and so obvious that it cannot be done. Here again we see the advantage of middle age; neither we nor our readers feel any sense of disappointment. We know, however, one cause of satisfaction that some of our readers do not: the prudent conduct of the Council of the Society has resulted in a state of financial prosperity which in the fullness of time will be apparent: let us gloat over this, until finally the auditors will tell us whether the margin is fifty or seventy-five pounds, and whether it is on the credit or the debit side of the account. As for the JOURNAL, we think it will maintain its high standard: the solid part is almost incapable of improvement: the ephemeral part we intend to improve, and we have every intention during the New Year of curbing that editorial flippancy which on three occasions during 1927 has been apparent. Our good wishes to you all!

Electro Magnetic Radiation

It was in the year of the Great Fire of London that our worthy Newton discovered the spectrum of visible light, but radiological research—that is, the study of electro-magnetic radiations—cannot be said to have commenced in real earnest until towards the close of the eighteenth century, when Scheele discovered the action of rays existing beyond the violet end of the visual spectrum by means of a sensitive plate. The Crookes tube was invented in 1879, and the experimental work and hypotheses which this discovery stimulated were crowned in 1895 by Röntgen's discovery of X-rays. In the past two decades much work has been carried out upon those rays which exist in the ultra-violet part of the spectrum, and, if it is not invidious to mention a single name in connexion with electro-magnetic radiation research so ably pursued by many investigators, we may commend the papers of Milliken to those who wish to delve deep.

We wrote recently that the physicist might soon discover a terrible "death ray," and we implied that the abuse of scientific discovery provided no adequate reason for the suppression of radiological research, since much of value to mankind would on this event remain undisclosed. We hope in this short note to show that the ultra-violet rays, the X-rays and other electro-magnetic radiations are in reality already being applied to the service of man.

In order to visualise a clear picture of the wide range of radiations, we consulted a chart published by the Royal Society, and we think it not amiss to traverse with our readers the range of electro-magnetic vibrations. The rays of shortest wave-length are the gamma rays emitted by radium—one three hundred millionth of an inch—whilst the longest, thirty miles in length, are given out by alternating current machines. Between these extremes lie the "wireless" waves, the heat rays, the infra-red Herzian rays, the light rays of the visual spectrum, the ultra violet rays, the X-rays and other regions, some comparatively little explored. X-rays

and those ultra-violet rays emitted by our modern lamps are coming to be applied in many directions in industry and medicine. Thus, it is not long since we published a paper by A. A. King dealing with the application of the ultra-violet rays in the detection of minute amounts of arsenic. It was found that absorption of the rays by the mercury-arsenic stain, suitably produced and exposed to the ultra-violet rays, makes it intensely black, so that stains which are quite indistinguishable in ordinary light stand out markedly upon a fluorescent background. Quantities of arsenic as small as 0.00000005 gm. have been estimated, and even smaller amounts have been detected qualitatively.

But we were inspired to look into the matter of electro-magnetic vibrations more by the appearance of a book by Pullin and Wiltshire, of the Research Department, Woolwich Arsenal, entitled "X-rays, Past and Present." With much that the authors say about the presentation of scientific knowledge and discovery to the lay reader we are in firm accord, and we ourselves have tried in the past to plead for accurate, simple expositions from the pens of those qualified to write—and only those—upon matters of fundamental import. Of this we must say no more at present. "X-rays, Past and Present" gives readable accounts of "The Nature of Visible Light," "Weighing the Electron," "X-rays and the Atom" and "X-rays and Crystals," whilst the application of X-ray spectroscopy is given adequate treatment.

We believe that X-rays have not yet been properly appreciated by the practical metallurgist: by means of X-rays flaws can readily be detected in large castings or in welded joints, but this method is not yet duly employed. With a fore-knowledge of such flaws, much money might be saved, for unnecessary expenditure upon metal working could be avoided, whilst even more danger to human lives might be minimised. How often do accidents upon land and in the air occur by reason of faulty structural materials, faulty in a way perhaps only detectable by means of the X-ray!

Pullin and Wiltshire tell us, in addition, that glued wood joints are best inspected by means of X-rays, that these rays may be used to detect impurities in foodstuffs, to discover pearls in oysters and to determine the perfection of insulation of electric cables. Moreover, actual analysis of materials by means of X-rays is possible, and the writers look forward to the greater application of X-ray analysis.

The applications of X-rays and ultra-violet rays are already with us, and the technique of using such radiations is rapidly becoming simplified, so that the immediate future may see important developments. What will come when the unexplored region of the spectrum between the shortest ultra-violet ray and the longest X-ray has been made to yield its secrets it is impossible to say. We are content to know of the above practical uses of rays, of the value of X-rays in surgery and the treatment of disease, of the production of vitamins by the irradiation of ergosterol with ultra-violet light, and of the results of the tanning of the "wireless" waves which, strangely enough, are to bring to us almost at this very moment a lecture which we could not otherwise have heard. Light is life, but other electro-magnetic vibrations will afford us a life undreamed of by old Newton.

W. J. MÜLLER'S WORK AND VIEWS ON PASSIVITY

U. R. EVANS

In his famous letter addressed to Faraday in 1830 Schoenbein¹ described iron as being "indifferent or passive" when it failed to react with nitric acid of sp. gr. 1.35. Other early investigators employed the word "passivity" in a similar sense, to denote the condition in which the metal showed no reaction or only a slow reaction with solutions that normally would attack it readily. Gradually, however, the use of the word has changed. Faraday himself,² in his reply to Schoenbein, pointed out that the entry of iron into the passive condition is promoted by contact with "platinum wire"—that is, by making the iron the anode of a cell. Later workers found it convenient to apply this anodic treatment by means of a current supplied externally from a battery. It was found, for instance, that in many solutions an iron anode dissolved quantitatively at low current densities to give a soluble ferrous salt, but that when the current density was raised the metal soon became passive, after which nearly all the current passing was devoted to the production of oxygen. Fredenhagen³ pointed out that the passage of iron into the passive state was accompanied by a sudden rise in the electrode potential, and it gradually became natural to associate the passivity of iron with an abnormally high potential, similar to that shown by noble metals. It became evident also that other metals besides iron were capable of existing in two separate "conditions," associated respectively with low and high potentials—but it appeared that in some cases the metal was able to pass freely into solution in both conditions, although different substances were produced according to the condition. Indeed, as early as 1898, Hittorf⁴ had stated that chromium existed in three conditions, in one condition it passed into solution as a blue chromous salt (with chromium divalent), in a second condition it was supposed to produce a chromic salt (with chromium trivalent),⁵ and in the third it yielded yellow chromic acid or a chromate (with chromium hexavalent). In view of various analogies between the "conditions" of chromium and the "conditions" of iron, it was inevitable that electrochemists should begin to refer to chromium as "passive" when it was dissolving to give chromates, and thus we have arrived at a usage in which the term "passivity" does not indicate a condition of "inertness," but rather "dissolution in an abnormal manner." In late years this usage—far wider than the original sense in which the word was employed by Schoenbein—has been extended to iron also; thus, Müller⁶ talks of iron dissolving (in hydrochloric acid) as ferrous chloride when active, and as ferric chloride when passive.

There is no doubt that whilst to the ordinary chemist the word "passivity" still calls up the idea of chemical

inertness or at least of *sluggish reaction*, the average electrochemist regards an *abnormally high potential* as the really entertaining feature of passivity. But since—as we have seen with chromium—a high potential, does not necessarily imply sluggish reaction, it is clear that the explanation of the chemical inertness is not quite the same as that of the elevated potential, although no doubt the two phenomena are often closely connected. It is inevitable, therefore, that the "theories of passivity" as put forward by chemists and electrochemists will at first sight appear to conflict, since their authors are using the word in different senses: but this apparent divergence of opinion disappears in part (unfortunately only in part) when the rival statements are translated into a single system of terminology.

For instance, the views of W. J. Müller, based on electrochemical research, may at first sight appear to be quite irreconcilable with the opinions based on recent chemical work in this country. But when they are closely studied it is found that the essential part of Müller's theory is the explanation of the potential rise, and this portion of the theory will be found capable of being accepted by many of those who still regard his explanation of the slow dissolution of passive iron as unconvincing. But whether Müller's theories are accepted or rejected, his experiments have contributed so much to our knowledge of the subject that a short account of his results may be of value to those in this country who are unacquainted with them. It is for that reason that this article is being written.

One of the difficulties in studying the production of passivity by anodic treatment has been the lack of reproducibility in the results. Müller has succeeded in finding the chief causes of these irregularities, and eliminating them. When a vertical electrode is subjected to anodic treatment, the heavy metallic salts formed sink down the electrode surface, producing convection currents which are very difficult to control; since, as Müller showed, the production of passivity by anodic treatment depends on the accumulation of the anodic product in the layer next to the metal, it is inevitable that there must be discordance between the setting in of passivity in different experiments. Müller⁷ has overcome the trouble by using a horizontal anodic surface. In his apparatus the anode consists of a metal cylinder with its flat top uppermost and exposed to the solution, all its other sides being protected from the solution by glass; the anode surface is further protected from stirring in the main body of the liquid by means of a glass hood. This arrangement allows the layer of heavy liquid produced over the anode surface to remain there undisturbed by any convection phenomena.

Using this apparatus, Müller⁸ found that when iron is subjected to anodic treatment in *N*-sulphuric acid at low current density, it passes into solution as ferrous sulphate at a potential of about 0.2 volt (hydrogen scale). Even at high current densities this dissolution as ferrous sulphate at about —0.2 volt takes place freely at first: but, after a certain time, a quick rise in the potential, accompanied by a decrease in the

¹ Phil. Mag., 1830, 9, 53.

² Phil. Mag., 1830, 9, 58.

³ Z. Phys. Chem., 1903, 43, 1.

⁴ Z. Phys. Chem., 1908, 25, 729.

⁵ There is now some reason to believe that under ordinary conditions the formation of chromic salts is a secondary reaction; chromous salts are first formed, and are either oxidised or become decomposed, giving chromic salts and hydrogen.

⁶ Z. Elektrochem., 1924, 30, 414.

⁷ Z. Elektrochem., 1924, 30, 406. For details of the apparatus, the original paper should be consulted.

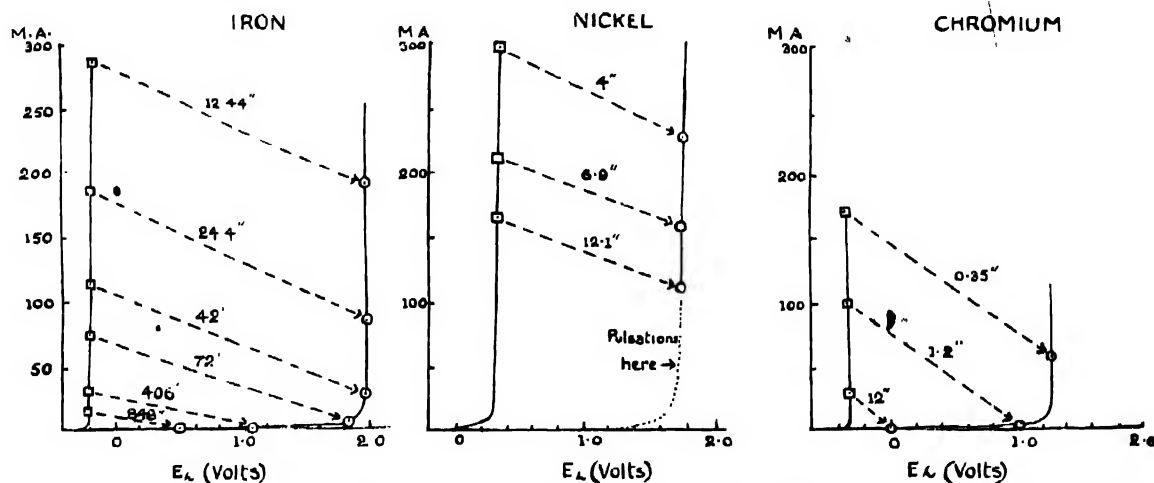
⁸ Monatshefte für Chemie, 1927, 48, 65.

current density, occurs, as indicated by the broken lines in the diagram. After this change, the iron anode is passive both in the chemical and electrochemical senses; the potential is abnormally high (+0.6 to +2.0 volts) and the iron has practically ceased to dissolve. If the total E.M.F. applied to the cell is sufficient, current may continue to flow, but it will now be devoted mainly to the production of oxygen, the anodic potential having risen sufficiently to make this possible. Oxygen is freely evolved if the anode potential reaches about +2.0 volts; but if the anodic potential only reaches about +1.0 volts, practically no current passes at all. On breaking the circuit, and touching the iron with zinc wire, the iron again becomes active; the whole experiment may then be repeated, the time needed to produce passivity being the same as before, provided the current density and other conditions remain the same.

The interesting feature of this work is that the time during which the current must flow before the sudden

the case of chromium. The matter is further complicated by the fact that the chromous salt produced over the anode surface decomposes spontaneously to yield hydrogen gas and a chromic salt, which in turn tends to hydrolyse to give chromic hydroxide, or perhaps a basic salt; this hydrolysis is possible because the migration of cations away from the anode leaves the surface layer next to the anode denuded of hydrogen ions.

The fact that passivity can be produced equally well by a short application of a high current, or by a long application of a low current, rather suggests that a quantity of some substance must accumulate at the anode surface before passivity can set in; this idea is well in accord with the observations of Alvares,¹² who found that a much higher current density was needed to produce passivity on a rotating iron anode than was required to render passive a stationary anode. Müller's view,¹³ for which he is able to furnish good experimental support, is that some substance must accumulate until the solution becomes supersaturated and a solid is deposited on the



Curves connecting current (in milliamperes) with anode potential (hydrogen scale) for iron, nickel, and chromium in sulphuric acid solution. Active values shown in Squares. Passive values shown in Circles. Transition to passive conditions shown as Broken Lines.

change to the passive condition sets in depends on the current density. The times are shown in the diagram by the numbers placed above the broken lines. It will be noticed that a fairly small current density working for a long time can produce the result just as surely as a high current density working for a short time. A rather similar state of affairs was found by Müller⁹ to be true of a nickel anode immersed in normal sulphuric acid (previously saturated with nickel sulphate to diminish diffusion), although here the curves are of a slightly different form,¹⁰ and the matter is complicated by the occurrence of pulsations. Chromium also behaves in a manner analogous to iron, but the times needed for the production of passivity are much smaller with chromium than with iron: Müller and Noack¹¹ found it necessary to use an oscillograph to obtain the measurements in

anode; when this deposition on the anode has occurred, a large part of the electrodic surface will be covered up, and since the current flowing is concentrated on the small fraction remaining uncovered, the "effective" current density at this portion increases, perhaps to 100 or 1000 times the original value; as a necessary consequence of this rise in current density, the anode potential must rise, until a value is finally reached which renders possible the reactions characteristic of the passive state.

The composition of the deposit responsible for the change varies in different cases. According to Müller, the deposit produced on iron anodically treated in a sulphate solution is probably ferrous sulphate,¹⁴ whilst that produced on chromium is usually a basic chromic salt, or even chromic hydroxide.¹⁵ It is not maintained by any one that this deposit causes passivity by acting as a protective sheath to the metal. Müller particularly points out that the deposit formed on an iron anode during—or just previous to—the entry into the passive

⁹ Monatshefte, 1927, 48, 559.

¹⁰ For instance, there is an appreciable rise in the potential with the current density before the occurrence of the sudden rise which accompanies the transition to the passive state; thus the potential of nickel may become "nobler" than that of hydrogen as a result of ordinary polarisation, without the nickel becoming definitely passive; this, Müller thinks, may be the reason why nickel produces hydrogen so slowly at ordinary temperatures when placed in dilute acids.

¹¹ Monatshefte, 1927, 48, 203.

¹² Z. Elektrochem., 1909, 15, 142.

¹³ Z. Elektrochem., 1924, 30, 401.

¹⁴ Z. Elektrochem., 1924, 30, 405.

¹⁵ Monatshefte 1927, 48, 304.

condition completely vanishes when once the electrode has become passive; these visible deposits are conducive to the *assumption* of the passive condition, but are not responsible for its *maintenance*. This is shown particularly clearly by the well-known work of Hedges¹⁶ on anodic periodicity. Iron anodically treated in 10% sulphuric acid at a current density of 420 m.a./cm.² showed oscillations between the active and passive conditions, the period being 40 sec. The electrode acquired a dull grey film during the active intervals, but each time passivity set in, the film peeled off and dissolved in the solution, the anode remaining quite lustrous during the passive intervals.

Müller's idea that the formation of a deposit on the electrode surface raises the effective current density on the exposed portions seems entirely reasonable as an explanation of the rise of potential—that is, as an explanation of passivity in the *electrical* sense of the word. It does not in itself explain the fact that the metal, having reached the high potential, almost ceases to dissolve—the fact which is mainly of interest to the *chemist*. Müller's views on this subject¹⁷ may be summarised as follows:—At the surface of a metal which normally goes into solution at a low valency, an equilibrium exists between free (or virtually free) electrons and metallic ions. When the metal is dissolving in the active state, metallic ions of low valency can be supplied, as it were, "ready-made," as fast as they are required; but if the effective current density at a point becomes too high (owing to the screening action of the deposit explained above), the high potential alters the condition of the metal in the surface layers, and the metal either ceases to dissolve altogether, or commences to dissolve as ions of a higher valency.

This theory, which has much in common with that of Smits,¹⁸ appears only to be applicable to metal rendered passive by anodic treatment. It does not tell us, for instance, why pure iron can be rendered inert towards copper nitrate simply by exposure to dry air. This and similar facts are easily explained on the view that the surface layers of the metal are converted into oxide, which when once it has become continuous over the surface and has ceased to develop cracks, protects the underlying metal from the action of the reagent. The author's recent studies of the films removed from the metal have indicated that this is the correct explanation.¹⁹ The film is invisible whilst it is in union with the metal, since such films are always invisible unless they possess the thickness needed to give interference colours. Müller, however, opposes the view that passivity (in the chemical sense) is due to a protective skin. He bases his objection on some careful optical work performed by himself and Koenigsberger²⁰ over twenty years ago, when they showed that the reflecting power of iron was not appreciably altered when it passed from the active into the passive state. It is impossible to describe this work here, or to discuss the criticisms of

Ruer,²¹ Siedentopf,²² Haber and Maitland,²³ Krassa,²⁴ Manchot,²⁵ and others. Indeed, it is not really necessary to enter into the optical side of the controversy, since recent work has indicated that a *discontinuous* film exists even on *active* iron (if it has been exposed to the air or to dissolved oxygen), and that the process of passivation consists in repairing the discontinuities of this film sufficiently to exclude the most penetrating ion or molecule present.

Thus, whilst Müller's views on the cause of the rise in electrode potential may be accepted, at least provisionally, it is difficult to feel satisfied with his views as to the cause of the chemical inertness which is—to most chemists—the interesting feature of the passive condition. Considering Müller's work along with other recent work on passivity, the following appears to be a reasonable attitude to adopt.

Three different types of reactions are theoretically possible at an anode:—

- (1) The production of a soluble salt of the metal composing the anode.
- (2) The production of an oxide of the metal.
- (3) The evolution of oxygen gas.

In general, the first reaction involves least expenditure of energy, and will occur at the lowest anode potential; the second requires rather more energy, and can only take place when the potential is raised somewhat; the third calls for most energy of all, and requires a highly elevated potential.

Consider now an iron anode in a sulphate solution. When current passes, the iron dissolves as soluble ferrous sulphate, because the potential will not—at any ordinary current density—rise high enough for reactions of type (2) and (3). But sooner or later the layer of liquid next to the anode will become supersaturated with ferrous sulphate (or perhaps with some hydrolysis-product) and a solid deposit will be precipitated on the anode surface, covering up a large fraction of the area. This layer, *deposited on* the iron, will frequently be *visible*, but will *not* be protective, since it is discontinuous; it will, however, serve to increase the effective current density on the points not covered up, and hence—as Müller has suggested—the potential will rise at these points. Reactions of type 2 will then become possible, and sooner or later the surface portion of the metal will become transformed to oxide; this oxide-film formed *in situ* (in contradistinction to the layer previously deposited from without) will be *invisible* and will have *protective* value, hindering the iron below from passing into solution as ferrous salt. It will also soon begin to protect the iron below from further conversion into oxide, but the conversion of iron into oxide may gradually extend sideways, as the layer of ferrous sulphate gradually passes into solution (since the production of fresh ferrous sulphate has now ceased, diffusion will permit of a slow removal of the solid ferrous sulphate already present). Finally the whole surface layer of the metal is converted to a

¹⁶ J.C.S. 1926, 2880.

¹⁷ Z. Elektrochem., 1924, 30, 102.

¹⁸ Trans. Faraday Soc., 1923, 19, 172.

¹⁹ J.C.S. 1927, 1020. The film thus separated represents the original surface of the metal in an oxidised condition, preserving all the irregularities of the original metallic surface; it is not a layer laid upon the metal.

²⁰ Phys. Zeitsch., 1901, 5, 413—1906, 7, 796. Z. Elektrochem., 1907, 13, 650.

²¹ Phys. Zeitsch., 1904, 5, 802.

²² Phys. Zeitsch., 1904, 5, 802.

²³ Z. Elektrochem., 1907, 13, 309.

²⁴ Z. Elektrochem., 1909, 15, 490. See reply by Müller, Z. Elektrochem., 1909, 15, 792.

²⁵ Ber., 1909, 42, 3042.

continuous layer of oxide, the surface being now clear of visible deposit. At this stage, the only possible reaction is that of type (3), and if the E.M.F. applied to the cell is sufficient to furnish the necessary high anodic potential, the current will continue to flow, but it will be devoted to the production of oxygen gas. If now the current is stopped, the electrode, being sheathed with oxide, will not show the reactions of active iron, and being supersaturated with oxygen gas will show a very high potential, although this will fall off with the time.

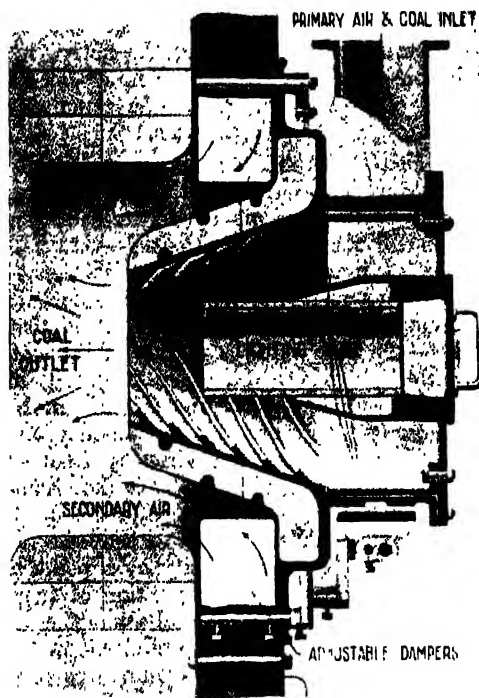
•With chromium the state of affairs is modified by the fact that the highest oxide is freely soluble. Hence, even after the deposition of the layer of chromic hydroxide—postulated by Müller—has raised the effective current density and thus the anode potential, the metal continues to dissolve as yellow chromic acid, and no oxygen is evolved. After turning off the current, the electrode is free from any continuous insoluble film, and consequently the potential at once drops to a value which is usually more negative than the value before the anodic treatment. This drop is well shown by the curves published by Aten.²⁶

NEW BRITISH SHORT FLAME BURNER FOR PULVERISED FUEL

One of the objections to the otherwise highly efficient principle of pulverised fuel firing has been the great length of the flame which, for example, is about 30 ft. with large water-tube boilers in land practice, having a row of burners of the usual type pointing downwards. As a result a combustion chamber, say 50 ft. deep, is necessary, with a very high overall setting of 100–120 ft. from the ground level. A new British burner on the turbulent principle has been designed which represents a notable advance, as it enables combustion with pulverised fuel to be complete in about 10 ft. only. As a result the combustion chamber volume of a water-tube boiler can be cut down by half, a great saving in capital cost, whilst the burner takes oil fuel or gas equally well, and the possibilities for cylindrical boilers and general furnace work, in the chemical and other industries, are important items. A single burner will take up to 150,000,000 B.Th.U., 5–6 tons of coal per hour, so that instead of 10–12 burners for a very large water-tube boiler of 200,000 lb. per hour evaporation, only 2–4 are necessary. The design is the result of extended investigations by the research staff of Messrs. International Combustion, Ltd., of London, and the perfected burner, which has been operated at Barrow continuously for a number of months past, is to be fitted on a number of plants, including the new Hams Hall power station at Birmingham. A solution is also claimed for other difficult problems in turbulent burner design, such as "stratification" troubles at the burner tip, absence of complicated parts, one simple adjustment only, and ability to stand the heat.

The details of the design are shown in the illustration. In general 15% of the total volume of the air, at the low pressure of only about 2" W.G., is supplied directly round

the centre of the burner, along with all the coal, by means of a concentric casing, while 85% of the total volume, as secondary air, enters in another concentric casing at 1" W.G. behind the first casing. This secondary air is given a violent cyclonic motion in addition to that of the primary air and fuel, by means of spiral ribs, so that separation of air and coal particles at the burner



tip is impossible irrespective of what happens in the primary air circuit on the way. The number of separate parts is very small, and the only adjustment necessary is a single slide damper on the secondary air supply pipe, although hitherto turbulent burners have been largely dependent on the personal skill of the operator, with constant adjustment necessary to suit varying steam demands.

THE "A" TUBE AN IMPROVED FORM OF "U" TUBE

By A. O. JONES and F. HOBSON

The ordinary U-tube has two serious disadvantages, the chief being the ease with which it is broken by slight pressure or tension exerted on its limbs in the same direction as the plane of the tube. The other is the fact that the bend often becomes choked with solid caked material, difficult to remove, and at which impatient students are prone to pick with wire or glass rod, to the detriment of the tube.

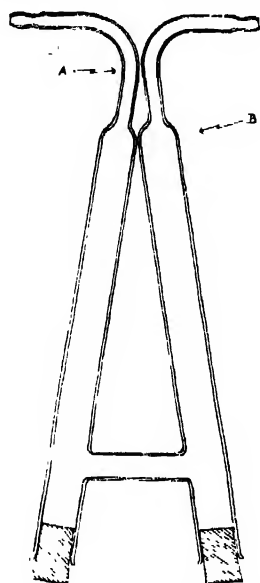
It has been the experience of both authors to see many U-tubes thus broken, more especially perhaps by elementary students; and it was with a desire to avoid such mishaps that the authors, independently of each other, devised the A form of tube shown in the sketch given.

It has several advantages over the usual U-tube. It is easily made, filled and cleaned, not being likely

²⁶ Proc. R. Akad. Wetensch. Amsterdam (English version), 1918, 20, 1121. Aten would probably not interpret his results in the way suggested above.

to break even when caked solid in the limbs is picked at with a rod, and has great mechanical resistance to crushing in the hands owing to the shoulders being in contact at B; whilst wiring of the bends together at A makes it impossible to pull the tube apart with the exertion of any ordinary force. A minor advantage is that it can be more easily clamped by the cross tube, with less likelihood of breakage than the ordinary U-tube can be by the bend. When filling, material should be prevented from entering the cross tube by inserting plugs of asbestos or glass wool.

An obvious disadvantage is present in the dead spaces below the cross tube, but these can be easily minimised, and are of no consequence in elementary work and may



An improved form of "U" tube

sometimes be of advantage, permitting for instance, the collection of liquid without interference with the flow of gas.

In the form supplied with taps, these are put on at right angles to the plane of the tube so as to permit it to be used upside down if necessary without the plugs falling out.

The tube can be obtained from Messrs. Gallenkamp not only in the simple form here depicted, but also with taps on the side tubes, and in lighter, smaller sizes with longer legs which can be sealed off after filling for combustion work.

Depts. of Chemistry and Colour Chemistry,
Technical College, Huddersfield

CANADIAN MINING AND METALLURGY

Diamond drilling has been conducted in the Creighton Mine of the International Nickel Co., with the result that ore of equal quality to that of the Frood Mine has been discovered.

ALBERTAN OILFIELDS

The oil and gas wells of Turner Valley, Alberta, are at present producing various grades of crude oils and naphtha at the rate of 41,840 barrels a month.

SOCIETY OF CHEMICAL INDUSTRY OFFICIAL NOTICES

SUPPLY OF JOURNAL TO MEMBERS

It has been arranged that all Members of the Society shall be supplied with the issues of the JOURNAL for January irrespective of whether their subscriptions for 1928 have been received or not. Those who have not yet remitted the amount to the Society's offices are recommended to do so as soon as possible, in order to ensure that the issues subsequent to that for January 27 are despatched to them on publication.

BINDING CASES FOR BRITISH CHEMICAL ABSTRACTS AND JOINT INDEX

Abstracts "B" and Index to "A" and "B"

Binding cases for the above publications, in dark blue cloth, will be available, commencing with the 1927 issues.

The price will be 3s. 9d. per set of two cases, postage 6d. extra, or, separately, 2s., postage 3d. extra.

Abstracts "A" and Index to "A" and "B"

Cases are also available in maroon or blue cloth, price 3s. 9d. per set of two cases, postage 6d. extra.

Orders, accompanied with remittance, should be forwarded to Messrs. Gurney & Jackson, 33, Paternoster Row, London, E.C.4.

COAL CLEANING CONFERENCE

Copies of reprint of the papers read at the Coal Cleaning Conference held in Edinburgh in July, with the discussion thereon, are still obtainable.

The reprints are in JOURNAL format, with paper cover, and the price is 2s. 6d. net and post free.

Orders, accompanied by the appropriate remittance, should be sent to the General Secretary at the Society's Offices, Central House, Finsbury Square, London, E.C.2.

SUSPENSION OF ENTRANCE FEE

The Council has decided to continue the suspension of the Entrance Fee during the year 1928.

ABSTRACTS IN APPLIED CHEMISTRY

It has been arranged to supply members of the Society with reprints of the Abstracts of Applied Chemistry, printed on one side of the paper only, at the price of £1 for the year 1928.

Applications for these, accompanied by the appropriate remittance, should reach the General Secretary at once.

CHEMICAL SOCIETY'S LIBRARY

Members of the Society of Chemical Industry are reminded that they are entitled to consult the Library of the Chemical Society, Burlington House, Piccadilly, W.1, and to borrow books therefrom.

The Library is open daily from 10 a.m. to 9 p.m. Saturdays from 10 a.m. to 5 p.m. The Library is closed on Bank Holidays, the day following, and on such other occasions as the Council may direct.

ROTHAMSTED LIBRARY

By the courtesy of the Lawes Agricultural Trust, any member of the Society of Chemical Industry, on present-

ing a card from the General Secretary, shall be allowed access to this Library. The rules of the Library preclude journals and periodicals from being sent out, and these are, therefore, always accessible.

A catalogue of the journals and periodicals is in the Society's Offices at Central House, and may be consulted there by members.

CALENDAR OF FORTHCOMING EVENTS

Jan. 2.—Society of Chemical Industry, London Section. Chemical Society's Rooms, Burlington House, Piccadilly, W.1, at 8 p.m. "Future of biochemical research," by Dr. J. C. Drummond.

Jan. 2.—Institution of the Rubber Industry, London and District Section. Engineers' Club, Coventry Street, W.1. "Synthetic resins," by A. A. Drummond.

Jan. 5.—Institution of Mechanical Engineers, Manchester Meeting. "Cutting temperatures: their effect on tools and on materials subjected to work," by E. G. Herbert.

Jan. 5.—Institution of Electrical Engineers, Ordinary Meeting. Savoy Place, Victoria Embankment, W.C.2, at 5.30 p.m. "Storage batteries in relation to modern supply of electric lighting and power," by E. C. McKinnon.

Jan. 5.—Society of Chemical Industry, Bristol Section. Joint meeting with the Chemical Society. The University, Woodland Road, Bristol, at 7.30 p.m. "The catalytic oxidation of aromatic hydrocarbons and their derivatives by means of air," by Dr. E. B. Maxted.

Jan. 6.—Society of Chemical Industry, Manchester Section. Engineers' Club, 17, Albert Square, Manchester. "Action of caustic alkali on partially-methylated cellulose—the heat of reaction and absorption," by F. C. Wood and Agnes C. Alexander.

Jan. 7.—Manchester Literary and Philosophical Society, Chemical Section. Soirée, 36, George Street, Manchester, at 7 p.m.

Jan. 7.—Western Junior Gas Association. Visit to the works of the Bath Gaslight & Coke Co. Papers as follows:—(1) "Some notes on water softeners and water softening," by W. L. Ashmun. (2) "Future of the gas engine," by H. C. Feltham.

Jan. 9.—Institute of Metals, Scottish Local Section. 30, Elmbank Crescent, Glasgow, at 7.30 p.m. Open discussion. Various subjects.

Jan. 9.—Institute of Chemistry, Manchester and District Section. Manchester Limited, Royal Exchange Buildings, St. Ann's Square, Manchester. "Some inter-relations of chemistry and physiology," by Prof. H. S. Raper.

Jan. 10.—Institution of the Rubber Industry, Meeting of Liverpool Section, at the Common Hall, Hackins Hey, Dale Street, Liverpool.

Jan. 10, 11 and 12.—Annual Exhibition of Scientific Apparatus, Imperial College of Science and Technology, South Kensington, S.W.7.

Jan. 10.—Institution of Petroleum Technologists. General Meeting. House of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5.30 p.m.

Jan. 11.—Society of Chemical Industry, Nottingham Section. "Action of acids on wool," by S. R. and E. R. Trotman and J. Brown.

Jan. 12.—Institution of the Rubber Industry, Birmingham and District Section. Grand Hotel, Birmingham. "India-rubber as an auxiliary to suspension," by F. W. Lancheater.

Jan. 13.—Institute of Chemistry, Liverpool and North-Western Section. Jubilee celebrations. Dinner at Adelphi Hotel, Liverpool, at 7.30 p.m.

CERAMIC SOCIETY

The autumn meeting of the Refractory Materials Section was held in Bournemouth on September 26 and 27, being the opening meeting of the Clay Convention. The chair was occupied by the President of the Society, Mr. H. J. C. Johnston, who was also the President of the Convention.

The first contribution, by A. T. Green, was entitled "A consideration of open-hearth steel works' refractories." A general description was given of the construction and working of an open-hearth steel furnace, including the regenerators. In the taking up of heat by the refractories of the regenerator chambers, and then imparting it to the air, only to a distance of one inch from the exposed surface does the material take part in heat-transmission. The heat losses from the regenerators amount to 16% of the total heat losses of the steel plant, which is excessive when it is noted that the thermal efficiency of the open-hearth process is only about 17%. Insertion of an insulating wall between the outer red brick wall and the inner lining should serve to minimise these losses. Wear and tear on refractories would be lessened if the air and producer gas be properly mixed at the right places and projected so that no very hot flames strike certain portions of the brickwork. These conditions being strictly adhered to, it should be possible to work at higher temperatures than at present, using the normal silica bricks. The author, after a consideration of the texture of silica bricks used in steel furnaces, came to the conclusion that it is advisable to compromise and have a product of specific gravity about 2.42, with increased resistance to spalling and corrosion, at a reasonable cost, and make allowances for expansion, rather than to have a very expensive, highly-converted product, with less expansion, but liable to the introduction of spalling strains during the initial heating, a softening at high temperatures, and a liability to excessive corrosion.

A paper on "Silica bricks made without added bond" was given by W. Hugill and W. J. Rees. It was found that, with a suitable grading of the silica rock, including a large proportion of very fine material, the melting of which supplied the matrix, silica bricks could be made by ordinary hand-moulding methods, and fired in a commercial kiln, the strength and other properties being inferior to those of bricks made with added bond. The degree of quartz conversion was greater when no bond was added than in lime-bonded bricks, but in the former the inversion was almost entirely to cristobalite, whilst in the latter tridymite was formed in fair proportion.

R. S. Troop and R. Wheeler described "Some experiments in drying clay." The linear measurement of contraction is not to be relied upon, because, in the preparation of the test pieces, accidental stretching or compressing may cause sufficient distortion to invalidate the measurements made. In order to obviate this source of error it was decided to determine volume contraction instead of linear contraction by the use of a special mercury volumeter designed by S.-R. Hind. In all cases the contraction in the earlier stages of drying is exactly equivalent, in volume, to the water removed from the sample by evaporation, and is very uniform. This continues during what may be termed the "main

contraction" period, at the end of which the rate of contraction changes very suddenly, becoming very small during the "residual contraction." This last extends from the end of the "main contraction" period to the "100° C. dry state." The change from "main contraction" to "residual contraction" in Stourbridge fireclay occurred at a moisture content of 14 to 15.7%, with ball clay at about 12%, and with china clay at about 28%. Whilst between 28 and 11% of moisture a very little contraction occurs in china clay, between 11% and the "dry state" there is actually an expansion which was observed with several different china clays, but with no other kind of clay. Careful tests showed that the minimum volume in china clay occurred with a moisture content of 8 to 10%. The rate of drying had no measurable effect on the total contraction. When the foregoing method is not applicable, Robinson's "plasticene coating method" can be applied to the indirect measurement of contraction of clay. Further experiments on the drying of clays showed that the rate of drying could be greatly accelerated, without risk of distortion, by drying at higher temperatures (up to 70° C. or beyond), providing the humidity of the atmosphere be suitably increased.

A paper by W. C. Hancock and J. G. Cowan, on "The crushing strength of unfired fireclay bodies," was presented by the former. The materials used were a mixture of two Stourbridge pot clays, and hard-fired Stourbridge clay for "grog," which was crushed and sieved to give a fine grade and a coarse grade. The bodies used for these tests were (1) neat clay, (2) 80 clay with 20 fine grog, (3) 80 clay with 20 coarse grog, (4) 60 clay with 40 fine grog, and (5) 60 clay with 40 coarse grog, respectively. The tensile strengths in lb. per sq. in. were respectively 156, 171, 137, 108 and 71 (each the average of five tests). For crushing strength determinations three forms of test piece were used, viz., cylinders 1 in. diameter and 2 in. high, rectangular blocks 2 in. by 1 in. by 1 in., and cubes with 2 in. edges. Results of the tests were given. The figures for the cubes, allowing for amounts and size of grog, were much more consistent than the others. Three types of fracture were observed in the crushed test-pieces, viz., fracture due to "cone" formation, fracture due to (plane) shearing, and fracture due to a combination of the two.

A paper by Dr. A. F. Joseph, Sudan Government chemist, followed, on "The characterisation of clays." In 12 samples of ceramic clays, the mechanical composition of which was given, the finest fraction (less than 0.002 mm.) ranged from 12.8 to 89.8% of the whole. In some cases the plasticity is very different in materials containing practically the same percentage of the finest fraction, and this different behaviour must be ascribed to difference in the nature of the fine fraction. The abbreviated chemical composition, imbibitional water capacity, and molecular ratio of silica to alumina were given for six "clay" separates (the finest fractions) and three typical clays, and it was pointed out that the greater the molecular ratio (silica : alumina) the greater the imbibitional water capacity, and that where this ratio approximated to 2 : 1, as in china clay, this capacity was very low. Researches in the author's laboratory

indicate that the colloid content of a raw material may be taken as identical with its "clay" content.

The last paper was by A. J. Dale, on "The effects of temperature on the mechanical properties of silica products," the term "silica product" being restricted to materials containing more than 92% silica. The experimental results suggested that there are two fairly distinct classes of commercial products, for convenience termed class A bricks and Class B bricks respectively. Conversion during kiln firing of Class A bricks produced mainly cristobalite, but in Class B bricks a considerable proportion of tridymite is present. Three peculiarities are noticeable when testing a Class A silica brick under five different static loadings (75, 50, 30, 18, and 4 lb. per sq. in.). The curves obtained, considered collectively, seem to offer a fairly complete explanation of the causes of failure under stress, thermal and mechanical, at low or high temperatures, of a large class of silica products. The first peculiarity is an accelerated rate of thermal expansion which occurs during the low-temperature range (100° to 350° C. under test conditions). This is attributable to sudden inversions of tridymite and cristobalite. The actual recorded vertical expansions within this temperature range are governed by the magnitude of the applied loading. Generally speaking, the greater the load the less the low-temperature inversion-expansion in the direction of the applied stress. The second peculiarity in these curves is the gradual and increasing difference between the rates of vertical thermal expansion under different loads at temperatures above approx. 900° C. The third peculiarity appears in the final portions of the curves, especially when comparing the 75 lb. and 4 lb. test results. Between 1450° and 1500° C., and onwards, the test-piece under a 4 lb. per sq. in. loading shows an increasing rate of "thermal expansion" (short for "vertical thermal expansion under load"), whereas under a 75 lb. per sq. in. loading, "thermal expansion" is retarded at about the same temperature (1480° C.) as it was accelerated under the 4 lb. per sq. in. stress.

Considering jointly the five curves, it can be concluded that under the imposed conditions (of test), the higher the load the less the low-temperature and high-temperature local expansions, and also the lower the temperature at which vertical expansion ceases.

METALLURGY IN CANADA

Apart from the Rouyn developments in N.W. Quebec, the greatest interest in eastern Canada is centred in the Froid Mine and the Froid Extension, respectively owned by the International and the Mond-Nickel Companies. It is estimated that the Froid Mine of the International contains 100,000,000 tons of ore, high in copper and precious metals, compared with the presently operated Creighton Mine. A five-compartment shaft is being sunk to the depth of 2300 ft. The Mond Nickel Co. is also actively developing the Froid Extension, having completed a shaft 2030 ft. deep, from which levels are being developed at 1700 and 3000 ft. The International will use the Froid Mine ore for nickel, copper and precious metals recovery, while the ore from the Creighton Mine will take a secondary place, being employed largely for making Monel-matte.

CORRESPONDENCE

THE CHEMICAL PROFESSION

SIR,—In regard to the lucky dog of a chemist who had the opportunity to work 12 hrs. a day, seven days a week for the munificent remuneration of 1s. 2d. an hour, and to the comments of "Chemist" on the incident in your issue of November 25, will you grant me the opportunity also to say something? "Chemist" knew of at least half-a-dozen concerns in the beet sugar industry that pay £20 a month to "chemists" (I need the quotation marks again), for 84 hrs. a week for their four months' campaign.

Whether the pay be in pounds or dollars or marks or francs, I believe a somewhat similar situation exists in all industrial countries: many chemists deplore their low salaries; they compare the time and expense of their preparation with the pay received and it hardly seems worth while.

Of course, it isn't easy to be philosophical over an 84-hr. week at £20 a month in these days for professional or any other kind of work. But is it really professional work in which such men are engaged? How much previous training does it require to make those routine tests? How much professional judgment does it demand? How much scientific thought? I venture to suggest that what they perform in their long, 12-hr. shifts is manual labour rather than professional service. When a chemist accepts such a post, his professional life goes into eclipse and he becomes a day labourer. And if the men so employed have not the wit to organise and get better pay, whose fault is it?

It is a dreadful thing to be out of work, but it is remarkable how few really good men do stay idle or receive so little for their services. The need of real chemists who can think for themselves is greater to-day than ever it was before, because one industry after another is developing chemical control and discovering that its chemical features must be studied and mastered in the interests of economical operation and production.

Let us admit that many of the men who are pegging away for long hours and short returns are men who have studied diligently and taken their professional degrees. We can hardly blame their teachers, because they have instructed the successful men as well as those who fail. And yet the latter have missed something in their equipment.

Chemistry is a profession, not a trade. Chemists cannot do *professional* work in gangs in which all do the same thing. They may work at co-ordinated research with others, which is something entirely different, because the incidence of scientific scholarship among them is from many angles. If we were to take a group of the unfortunates who cannot make a decent living and examine them, I think we should be likely to find most of them lacking in one or more of the following respects:—

He has not learned the relations of his science to the life of to-day. He does not observe the incidence of chemistry on every hand and he lacks the initiative to prepare himself to improve and economise and control the laundry, the bakery, the boiler-house, the engine-room, the foundry, the machine-shop—in short, to consider as an industrial chemist the wasteful activities which he meets on every hand.

He has not prepared himself for chemical industry by the study of unit processes and the immense variety of apparatus available to achieve the best results with different materials. He can neither specify nor design.

He may not have learned to express himself so as to tell an uninformed person of the incidence of chemistry upon his affairs.

I know of a great organisation that has many departments. Heads of these departments attain promotion when they have worked themselves out of their jobs; when their departments run so well that they are no more needed for supervision. How many of these unsuccessful chemists could or would work themselves out of jobs for promotion?

Some of them will be found to have studied and worked under the illusion that in professional life promotion goes by seniority. It does not.

Some have been careless in the selection of the biological strain contributed by their parents and earlier forebears, some should not have become chemists and some splendid fellows are pegging away under a streak of hard luck with the chances a hundred to one that they will pull out. In short, I suggest that we draw upon that very direct oriental jargon known as Pidgin English and recognize chemists as of two sorts: Can-do and no-can-do.

It seems improbable to me that the Society of Chemical Industry or any other scientific organisation can do anything effective on behalf of those who have studied professionally to do a man's work, but find themselves restricted in their activities to work which does not require more mind than that of a boy.

This is a nasty letter to write, Mr. Editor, but I think the time is fast approaching when the distinction will have to be made between can-do and no-can-do chemists.

I am, Sir, etc.,

ELLWOOD HENDRICK

139, East 40 Street,

New York, December 10

PERSONAL AND OTHER ITEMS

In consequence of the amalgamation of certain works of Sir W. G. Armstrong Whitworth & Co. and of Vickers, Ltd., the board of the former company has been reconstituted as follows:—Lord Southborough (chairman), Mr. J. Frater Taylor (vice-chairman), Sir Eustace Tennyson d'Eyncourt, Mr. J. Ferguson, Sir G. Hadcock, Mr. J. Hawson, Lieut.-Col. C. F. Hitchins, Mr. B. Irving, Mr. J. D. Siddeley, and Mr. J. Stewart. It is interesting to note that Mr. Ferguson is one of the partners of Sir Alexander Gibb and Partners, the well-known consulting engineers; Sir Alexander Gibb is, of course, the President of the Institution of Chemical Engineers.

Messrs. Briggs, Son & Co., West Yorkshire coalowners, have offered a scholarship of £150 a year for 5 years to the Mining Department of the University of Leeds.

The degree of D.Sc. in chemistry of the University of London has been conferred upon Mr. A. W. Chapman and Miss P. V. McKie.

The late Mr. J. Brierley, asbestos mill manager, for over 40 years with Turner Bros. Asbestos Co., Ltd., left £12,203.

New Beet-Sugar Factory

A contract, amounting to over £350,000, for the erection of a beet-sugar factory at Brigg, Lincolnshire, has been awarded to Stewart & Partners, Ltd. The factory, which is to be ready for the 1928 campaign, will be capable of dealing with 1000 tons of beet per 24 hrs., and will be able, in the campaign October to January, to treat the crop from 12,000 acres. The design of the factory is by the Hallesche Maschinenfabrik, but not less than 75% of the machinery will be made in this country.

Third Census of Production (Non-ferrous metals trades)

The following figures are from a statement which shows the output in the year 1924 of firms whose main business consisted in the smelting, rolling and casting of copper and brass, and is confined to the output in Great Britain:

Products, 1924	Quantity Tons	Selling Value £
Brass and alloys of copper		11,081,000
Copper		7,927,000
Aluminium		
Crude	2,200	266,000
Manufactures	200	40,000
Nickel alloys		
Manufactures (including tubes)	200	27,000
Tin:		
Blocks, ingots, bar, slabs and manufactures	200	50,000
White metal alloys (i.e., alloys of tin, lead, zinc, antimony, etc., other than soft solder)		
Unwrought or partly wrought		
Anti-friction metal	1,300	101,000
Other sorts	100	19,000
Other non-ferrous metals or alloys, not elsewhere specified, and manufactures thereof		229,000

Figures are also given below of the output in 1924 of firms mainly engaged in the smelting, casting or rolling of lead, tin, zinc, aluminium and other non-ferrous metals. Among other products were the following:—

Products, 1924	Quantity Tons	Selling Value £
Aluminium		3,058,000
Antimony and manufactures thereof	1,200	195,000
Arsenic, bismuth, cobalt and magnesium and manufactures thereof		198,000
Lead		5,835,000
Other manufactures (except white lead)		
Weight stated	21,500	929,000
Weight not stated		261,000
White lead	27,500	1,174,000
Nickel, unwrought and manufactures thereof	10,400	1,169,000
Nickel alloys		751,000
Tin:		10,860,000
Tungsten (except ferro-tungsten) in powder, wire and other forms	712,000*	105,000
Zinc		1,581,000
Crude (i.e., cakes, slabs, blocks, etc.)	16,600	211,000
Manufactures (including sheet zinc oxide, etc.)	4,900	1,360,000
Brass and alloys of copper (excluding nickel alloys and manufactures thereof)		130,000
Copper, unwrought and manufactures thereof (excluding copper sulphate)		6,000
Copper sulphate	21,000	165,000
Gold, melted and refined	10,700*	17,000
Platinum, refined	8,000*	206,000
Silver, refined and manufactures	1,980,000*	303,000
Palladium, iridium and other precious metals		183,000
Paints and enamels prepared (including ready mixed)		281,000
Total value of goods made and work done		31,222,000

* lbs. 14 oz. (112 lb.)

The total production of pig lead in the United Kingdom in 1907 was estimated as about 141,000 tons, of which 111,000 t. were produced for sale and 30,000 t. were used by the makers in their own works in the production of sheet, pipes, etc. The 1924 output of Great Britain

totalled 58,700 t. Exports of pig lead in 1907 were 27,000 t. or about 19% of the total production, as against 9400 t. in 1924, or 16% of the production. Net imports of pig and sheet lead increased from 191,000 t. in 1907 to 228,000 t. in 1924. White lead is produced on a large scale by paint and colour manufacturers, the total amount made during 1924 by such firms being returned as about 8100 t., whilst lead smelters returned an output of white lead amounting to 28,200 t. Exports during the year amounted to 8800 t. out of the total production of the United Kingdom of 50,000 t. Net imports of white lead were in 1924 6600 t., and in 1907 14,800 t. The tin production in 1907 was 13,100 t. of unwrought tin, valued at £2,195,000, compared with 38,400 t. valued at £9,477,000 in 1924. Exports of unwrought tin amounted in 1907 to 8700 t. and to 18,100 t. in 1924, and imports for the two years were 17,000 t. and 5900 t. respectively. The total weight of crude zinc or spelter returned in 1907 was 38,000 t. valued at £918,000, plus a further 10,000 t. valued at £298,000 returned on schedules for other trades. This compares with the 1924 output of 46,600 t. valued at £1,581,000. Exports in 1907 amounted to 5200 t., whilst net imports were 89,000 t. against exports of 6100 t. in 1924 and imports totalling 118,500 t. The net output of the factories and workshops covered by the foregoing statement was £5,943,000 in the year 1924, the net output per head of persons employed being £289 (£133 in 1907). The average number of persons employed in 1924 was 20,544 compared with 8233 in 1907. The total capacity of engines employed in the industry in 1924 was 65,953 h.p., of which slightly over 6% was in reserve or idle during the year. The capacity of electric motors at factories was not ascertained in 1907, but in 1924 motors aggregating 34,068 h.p., driven by purchased electricity, were recorded, of which slightly over 9% capacity was in reserve or idle during the year. The capacity of electric generators at these factories during 1924 was 39,020 kw., and 6297 kw. in 1907.

Third Census of Production (Aerated Waters, Cider, Vinegar, British Wine and Cognate Trades)

Below are given figures of the outputs during the years 1924 and 1907 of table waters and other goods produced by firms in Great Britain making returns on schedules for these trades:—

Products	1924		1907	
	Quantity Gallons	Selling Value £	Quantity Doz. bottles Gallons	Selling Value £
Table water	36,001,000	4,848,000	94,054,000	4,046,000
Cider and perry	8,653,000	967,000	2,603,000	151,000*
Wine, British made	1,742,000	390,000	817,000	108,000*
Vinegar and acetic acid	14,613,000	979,000	11,769,000	422,000*
Lime and lemon juice	531,000	151,000	1,794,000	203,000
Other fruit juices	96,000	41,000		
Non-alcoholic drinks, brewed (e.g., ginger beer, herb beer, etc.)		302,000		221,000*
Beer and ale purchased and bottled		2,114,000		164,000
Other liquors purchased and bottled		139,000		19,000
Other products		331,000		265,000
Total value		10,391,000		5,562,000

In order to avoid the possible disclosure of particulars relating to certain firms, the figures for Ireland (amounting to £37,000) were, in these cases, included with those for the rest of the United Kingdom in the year 1907. This sum is not included in the total for the year 1907.

Excluding the value of beer, ale and other liquors bottled and that of "other products," the total value of

goods produced in 1924 amounted to £7,477,000 and in 1907 to £5,114,000. The net output of aerated waters, cider, vinegar, British wine and cognate trades in 1924 was £5,751,000, and the net output per head of persons employed in that year was £316, in 1912 £131, and in 1907 £125. The average number of persons employed during 1924 at the factories and workshops was 18,217, compared with 26,540 in 1907, and 28,000 in 1912. The total capacity of engines employed in the industry in 1924 was shown as 6,720 h.p., of which about 13% was in reserve or idle during the year. The capacity returned in 1912 was 7,018 h.p., and in 1907, 10,410 h.p. The capacity of electric generators at these factories during 1924 was 210 kw., compared with 191 kw. in 1907, and 569 kw. in 1912.

Third Census of Production (Leather Trade)

The figures given below show the value of the leather outputs for the years 1907 and 1924, the particulars for the latter year being given in aggregate figures in respect of undressed and of dressed leather, in order to conform to the more restricted detail in which the output of the trade in 1907 was returned:—

Products	Selling Value, 1924 £	Selling Value, 1907 £
Leather, undressed	15,026,000	8,646,000
Leather, dressed, other than varnished, japanned or enamelled	11,905,000	5,957,000
Leather, varnished, japanned or enamelled	897,000	299,000
Machinery belting	1,192,000	1,159,000
Machinery accessories of leather	453,000	114,000
Flat leather	585,000	89,000
Wool	560,000	681,000
Hair	186,000	73,000
Hides and skins, pickled, etc.	362,000	230,000
Machinery accessories of hide	104,000	91,000
Parchment and vellum	51,000	41,000
Waste products	215,000	316,000
Other products	492,000	302,000
Work done for the trade	587,000*	204,000*
Total Value	32,948,000	18,202,000

* Amount received for work done

Calculated in terms of value, the 1924 output of undressed leather sold or added to stock as such exceeded the 1907 figure by about 74%, whilst for dressed leather the value shown for 1924 was a little more than double that of 1907. The average value per ton of undressed leather made in 1907 and returned by weight was about £120, and in 1924 £145, an increase of only 20%; for dressed leather other than varnished, japanned or enamelled, the average value per ton produced in 1907 was about £154, and in 1924 about £260, the increase being 68%. On this basis the aggregate values for the two years indicate that a fairly considerable increase in the production of both undressed and dressed leather occurred in the later year. On the other hand, the quantity of machinery belting made in 1924 (2600 tons) was only about one half of that recorded for the year 1907 (5300 tons). The net value of the output of factories and workshops engaged in the leather industry in 1924 was £8,711,000, and the net output per head of persons employed in 1924 was £286, and in 1907 £117. The average number of persons employed during 1924 at factories and workshops was 30,458, compared with 28,671 in 1907. The total capacity of engines at the leather factories in 1924 was shown as 40,747 h.p., of which nearly 14% was in reserve or idle during the year. In 1907 the capacity returned was

22,495 h.p. The capacity of electric motors at factories was, in 1924, 33,536 h.p., driven by purchased electricity, and slightly over 11% of the capacity of these motors was shown as in reserve or idle during the year. The capacity of electric generators at factories was, in 1924, 9315 kw., compared with 1568 kw. in 1907.

Metallurgy in British Columbia

The mineral production of British Columbia, which in 1925 exceeded all previous records by reaching a value of \$61,492,242, surpassed this amount in 1926 by several million dollars. It has been estimated by Mr. J. D. Galloway, Provincial Mineralogist, that the mineral production of British Columbia in 1926 reached \$67,718,000, an increase over 1925 of 11%. This increase is due more to acceleration by the larger companies than to the advent of new producers. The Consolidated Mining and Smelting Co., Ltd., increased the capacity of their Sullivan mill from 3000 to 4000 tons a day, and completed a new mill at Moyie to treat the old dumps of the St. Eugene mine. The Britannia Mining and Smelting Co. increased the capacity of their mill from 3000 to 3300 tons a day. The Granby Consolidated Mining, Smelting and Power Co., during the first nine months of the year, increased their monthly production of copper from 3,130,296 lb. to 3,394,013 lb., and lowered the costs from 9.240 to 7.896 cents per lb. The Allenby Copper Co., a subsidiary of the Granby, which operated for only a few months of 1925, has been producing throughout 1926 at the rate of 2000 tons of ore a day. Early in the year the capacity of the Premier mill was doubled to 400 tons a day. Almost all of the smaller producers have slightly increased their production for the year. The coal production will probably show a small decrease this year, due to fuel-oil competition and an unusually small demand for domestic purposes.

One of the most outstanding developments of the year was the success attained by the Allenby Copper Co. in operating the large low-grade copper deposits of Copper Mountain, near Princeton. These deposits contain several million tons of developed ore consisting of nearly equal proportions of bornite and chalcocopyrite, rather finely disseminated in a highly aluminous and somewhat refractory gangue. The mill is now treating 2000 tons of this ore daily and producing a concentrate carrying 30% copper, which is smelted by the Consolidated Mining and Smelting Co., Ltd., at Trail, B.C. The operations of the Allenby Copper Co. yielded a profit of \$86,633 during the second quarter, and a profit of \$116,335 during the third quarter of 1926. In view of the many failures to operate this property, the present success is a tribute to the management of the company.

Other developments in milling and metallurgy are worthy of mention. The Consolidated Mining and Smelting Co., Ltd., have enlarged the capacity of their lead smelter from 350 to 400 tons a day, and their zinc refinery from 200 to 280 tons a day. The same company expects soon to commence the erection of a refinery to treat the cadmium which is recovered as a by-product from the Sullivan ores. They will also, in the near future, double the daily capacity of their concentrator to 600 tons. A mill of 100 tons daily capacity will soon be completed at the Dunwell mine in the Stewart district.

International Conference on Bituminous Coal

Dr. Thomas Stockham Baker, president of the Carnegie Institute of Technology, Pittsburgh, Pennsylvania, U.S.A., expects to spend six weeks in Europe during February, March, and April of 1928, to organise plans for the Second International Conference on Bituminous Coal at Pittsburgh. The first conference, it will be remembered, was held in November, 1926, under the auspices of the Carnegie Institute of Technology, and was attended by 1700 delegates and leading fuel scientists from thirteen different countries. The second conference, which will be held under the same auspices, is fixed for the week of November 19, 1928. President Baker's itinerary will include visits to scientists throughout Europe. His European address, after February 25, will be the Guaranty Trust Company, Paris, France. In connexion with the preliminary plans a decision has been made to include the subject of "synthetic fertilisers from coal" in the program for the second conference. Other subjects to be considered will probably include the latest development in obtaining substitutes for gasoline from coal, power from coal, low and high-temperature distillation processes, smokeless fuel, gasification of coal, utilisation of coal tar products, and coal in relation to the production of fixed nitrogen. Formal letters of invitation to be officially represented at the 1928 meeting have been sent to the ambassadors, ministers, and *chargés des affaires* in Washington of the following countries:—Argentina, Belgium, Brazil, Chile, Cuba, France, Germany, Great Britain, Italy, Japan, Mexico, Peru, Spain, Austria, China, Czechoslovakia, Denmark, Greece, Hungary, Norway, Panama, Poland, Sweden, Switzerland, Netherland, and Roumania.

U.S. Export Trade in Chemicals

Exports of chemicals and allied products from the United States during the first three quarters of 1927 advanced 9% in value from \$132,428,000 in the first three quarters of 1926 to \$145,000,000 in the 1927 period. Improvements occurred in all of the major groups with the exception of fertilisers and explosives. Notable decreases in the prices of rosin and turpentine kept the aggregate value of the naval stores group at about the same figure as in 1926, but quantities were much higher. In the coal-tar products group, exports of benzol and other crudes were much larger than in 1926, and in the fertiliser category phosphate rock shipments showed a tendency toward recovery, with much better demand from the larger European markets, especially England and Germany.

Developments in the United States

The Grasselli Dyestuffs Corporation intends to enlarge its plant at Grasselli, N.J., at a cost of \$200,000.

The plant of the American Aniline Products Co., New York, is to be enlarged at a cost of \$200,000.

The German Oxygen Industry

The "Gesellschaft für Linde's Eismaschinen A.-G. and the I. G. Farbenindustrie A.-G. are introducing a method for supplying oxygen in the liquid form, which is said to offer advantages and economies.

Long-distance Transport of Gas in the Ruhr

A memorandum has been issued by the "Deutscher Verein von Gas- und Wasserfachmännern" on the

question of the supply of gas in the Ruhr from one central station. The conclusion reached is that this is not desirable, though grouping is advocated. (*Z. angew. Chem.*, November 24, 1927.)

German Light Alloys Industry

It is reported that the Metallbank u. Metallurgische Gesellschaft A.-G., the Vereinigte Aluminiumwerke A.-G., and the Berg-Heckmann Selve A.-G. have amalgamated under the title of the "Vereinigte Leichtmetallwerke A.-G." Although the capital is said to be only £60,000, the I. G. Farbenindustrie has an important financial interest in the new company, which will specialise in a new light alloy steel, patented by the Berg-Heckmann Selve A.-G.

German Glycerin Industry

The German output of glycerin is estimated at 6000 to 7000 tons a year, or only two thirds the pre-war production. The chief producer is the Vereinigte Chemische Werke A.-G., of Berlin. According to the U.S. Trade Commissioner in Berlin, the decreased production is due to a decline in the consumption of soap. Work is said to be in progress on a process—used during the war—for the production of glycerin.

Cellulose Varnish in France

The du Pont de Nemours Co., of New Jersey, and the Société Centrale de la Dynamite, have founded the Société Française Duco, with a capital of 20 million fr., for the manufacture of cellulose varnish. A factory, which will be the largest of its kind in France, will be erected in the neighbourhood of Paris.

French Artificial Silk Industry

The Kuhlmann, Agache Fils and Dollfus-Mieg concerns have formed a company with a capital of 50 million francs for the manufacture of artificial silk. A licence for use of the Borvis process has been obtained.

The Rhodasset, a subsidiary of the Usines du Rhône, has made an agreement with German interests for the establishment of a cellulose acetate factory at Fribourg. Negotiations with a similar aim are said to be proceeding with Courtaulds in England and the du Pont Co. in the United States.

Production of Butyric Acid from Sawdust

The "Société le Kétol," which manufactures butyric acid from sawdust by the Lefranc process, is building a new factory at Sauley-sur-Meurthe, in the Vosges, and intends to build a second at La Cluse (Ain). The mixture of ketones obtained by distilling calcium butyrate, although too costly for use as a fuel, has been used as an anti-knock agent, and is suitable for preparing nitro-cellulose varnishes.

Belgian Sugar Output

The British Commercial Secretary at Brussels has forwarded statistics published in the *Moniteur Belge*, which show the output of Belgian sugar factories during October to have been 72,954,295 kg. (23,654,856 raw, 19,299,439 white powdered). The production of refineries is given as 12,841,062 kg., total stocks at end of month as 50,725,815 kg., and the month's consumption as 15,447,148 kg. According to the *Echo de la Bourse*, the beet sugar crop this year is proving unremunerative. The average yield in weight appears likely to be a good deal in advance of the 1926 output, but the percentage sugar content seems very deficient.

Italian Chemical Exhibition

In connexion with the Italian celebrations of the fourth centenary of Emanuele Filiberto and the tenth anniversary of the victory, to be held in 1928, a large exhibition will be held in Turin which will include a chemical exhibition. The chemical section will comprise the whole of the chemical and allied industries, including chemical engineering, but will be national in scope, except for exhibits of plant, apparatus and instruments. Applications for admission should be sent before December 31, 1927, to the Chemical Section of the Executive Committee, 24, via Carlo Alberto, Turin, Italy.

Economic and Industrial Conditions of Rumania

According to the report of the Commercial Secretary to the British Legation at Bucarest, there was a noticeable improvement during 1926 in the economic conditions of Rumania. There was an increase of exports, which was almost entirely due to oil and cereals. The new Customs tariff came into force on April 24, 1927, the main object being to protect all growing Rumanian industries in proportion to their capacity to supply the needs of the population. It is hoped that, with the growth of home manufactures, encouraged by the new high tariffs, an opportunity will present itself for the setting up of British machinery. Imports into Rumania from Great Britain amounted to nearly 10% in value of the total imports for the years 1923, 1924 and 1925. It is probable that the percentage declined in 1926 owing to the coal stoppage, but an improvement was shown for the first quarter of 1927. Industry in Rumania has shown progress during the last year, especially in those industries for which the raw materials were to be found in the country. The prospect of greater tariff protection had given an impetus to certain classes of industry, including the textile and metallurgical industries. During 1926 the production of oil was a record one. The area exploited was about 2500 hectares, on which approximately 3340 wells were installed by the end of the year—1605 producing, 1073 in working, and 662 abandoned or suspended. It is estimated that the oil-bearing land in Rumania amounts to about 20,000 hectares, with probable reserves of 150,000 hectares. The production of crude oil in 1926 was 3,241,329 metric tons, over 900,000 tons more than for 1925, which, at 2,316,979 metric tons, was a record yield. The following figures show the quantities, in metric tons, of the various products refined, the figures in brackets being for 1925:—Benzine, 749,963 (497,545); refined petroleum, 511,077 (365,033); mineral oil, 291,963 (211,888); residues, 1,478,425 (1,036,723). The total exports amounted to 1,492,953 metric tons, compared with 784,545 metric tons in 1925, as follows:—Benzine, 424,967; refined petroleum, 527,069; motor spirit, 199,808; mineral oil, 42,396; residues, 298,713. The reorganisation of the marketing of oil products on foreign markets is seriously engaging attention in view of the continued increase of production, and the most up-to-date refining plant is being installed to enable the producers to compete with the higher-class products of other countries.

New Oxygen Factory in Budapest

It is reported that the Favorit A.-G. intends to erect an oxygen factory in Budapest, whilst the Hydroxygen A.-G. is to undertake the production of carbon dioxide.

REVIEWS

OLD CHEMISTRIES. By EDGAR F. SMITH. Pp. xi + 89. London: McGraw-Hill Publishing Co., Ltd., 1927. Price 12s. 6d.

Dr. Edgar F. Smith has done much to promote the study of the history of chemistry in the United States, and his own researches on the subject are appreciated highly on both sides of the Atlantic. The present book is infused with the author's enthusiasm, and cannot fail to impart some share of it to his readers. Sumptuously produced (though the reviewer confesses to a dislike of the cream paper upon which the illustrations are printed), it does not pretend to be anything more than the outcome of a chemical bibliophile's contemplation of the old text-books of chemistry on his shelves. Those treatises which influenced the progress of chemistry in early days in America have been the subject of Dr. Smith's selection, and on this central theme he has strung together biographical and bibliographical particulars, many of which will, we fancy, be new even to the most widely-read historian of chemistry. How many chemists, for instance, have ever heard of Jane Marcet (died 1858, aged 89), and her delightful "Conversations on Chemistry"? And who remembers how Richard Watson, after having been made Bishop of Llandaff, destroyed all his chemical manuscripts as a sacrifice "to other people's notions . . . of *Episcopal Decorum*"? Dr. Smith has rescued from oblivion these and innumerable other interesting personal details, and his book is one which any chemist will find an enthralling companion for leisure hours, whilst its solid value as historical research is by no means insignificant.

We have noticed one or two typographical and other errors, e.g., p. 8, *Goeffroy* for *Geoffroy*; p. 51, *Mecaenas* for *Maccenas*; and p. 32, where Chaptal's initials are given as M. I. A.—surely the "M" is merely a contraction of "Monsieur"? Chaptal's Christian names were Jean Antoine Claude. E. J. H.

HANDBUCH DER ANORGANISCHEN CHEMIE. Part IV. First Half. Die Elemente der sechsten Gruppe des Periodischen Systems. Edited by Dr. R. AEBIG, Fr. AUERBACH, and Dr. I. KOPPEL. Pp. xii + 966. Leipzig: S. Hirzel, 1927. Price, paper, 60 m.; bound, 64 m.

Chemists will welcome this further instalment of an important text-book. The fourth volume will evidently be a large one, as this first half of the first part contains over 950 pages of text. It deals with the elements of the sixth group of the periodic classification, and contains a review of the chemistry of the whole group, by the late Prof. Auerbach, followed by a very full account of the four elements—oxygen, sulphur, selenium, and tellurium.

The book is especially useful at the present time, as all existing accounts of selenium and tellurium are long out of date, and it will yet be some time before Dr. Mellor reaches Group VI. Here we have the chemistry of the four elements, brought closely up to date (apparently to about April, 1927) in a characteristically thorough and complete manner.

It is, of course, impossible in a short time to examine critically the whole of such a work, but a part of it, the section on selenium, has been subjected to the searching test of use in connexion with research during the last few months. It has been found that nothing is omitted, even of recent literature, which may be considered to pertain to the inorganic chemistry of selenium. A careful examination of the very large section (452 pages) on sulphur leads to the conclusion that here, too, nothing of any importance has been omitted.

The numbered references are assembled at the end of each section—a very convenient method—and the book is well printed on good paper, yet of a manageable thickness. As a reference book for a chemist interested in the elements with which it deals, it must be highly commended.

H. V. A. BRISCOE.

GMELIN'S HANDBUCH DER ANORGANISCHEN CHEMIE. System—Nr. 2. Wasserstoff. Edited by the DEUTSCHE CHEMISCHE GESELLSCHAFT. 8th edition. Revised by R. J. Meyer and F. Peters. Pp. xvi + 273. Berlin: Verlag Chemie G.m.b.H., 1927.

This section of the eighth edition of "Gmelin" incorporates the literature up to the end of 1926. It is altogether praiseworthy that so short a time should have elapsed before publication. The survey is, of course, exhaustive in character—no less than 38 closely-printed pages are devoted, for instance, solely to the spectrum of hydrogen—and is well presented, tabulation being frequently employed. Ten pages are devoted to atomic hydrogen, and seven to triatomic hydrogen. A few rather obscure facts, applied as a test, were readily found in their appropriate sections, where the corresponding references were correctly quoted. This section (series—number 2), with that on the inert gases (series—number 1) forms Volume I of the "Handbuch." A. A. E.

DIE WELT DER VERNACHLÄSSIGTEN DIMENSIONEN: EINE EINFÜHRUNG IN DIE KOLLOIDCHEMIE, MIT BESONDERER BERÜCKSICHTIGUNG IHRER ANWENDUNGEN. By W. OSTWALD. 9th and 10th revised and enlarged edition. Pp. xv + 325. Dresden and Leipzig: Theodor Steinkopff, 1927. Price 12 gm.

The title of this work still holds a spell, although its author in the preface to the new edition admits that one can no longer speak of colloid chemistry as the science of a neglected domain. Of all the books that have helped in drawing attention to the importance of colloid chemistry, and in laying firm foundations upon which to amass an accurate knowledge of its domain, this book ranks highest. Its very title compels notice, its arrangement, clarity, broadness of view and felicity of exposition place it among the really great introductions to any science. Those who know the book do not require to be told this; to those who are not yet acquainted with it, the issue of a new edition offers an opportunity which will bring pleasure and profit, all the more if the book is read in German and not in translation. The work has been largely re-written and expanded, especially in the discussion of the practical and technical applications of colloid chemistry, and the addition of many footnotes and references to literature not only enhance its value, but ensure that recent progress is not

overlooked. This edition equally with the first can be thoroughly recommended, not only to the student, but to the practitioner.

H. W. GREENWOOD

KOLLOIDCHEMISCHE TECHNOLOGIE. Ein Handbuch kolloidchemischer Betrachtungsweise in der chemischen Industrie und Technik. Edited by Dr. R. E. LAESEGAARD and others. Pp. viii + 1047. Dresden & Leipzig: Th. Steinkopff, 1927. Price, paper, 66 m.; bound, 70 m.

A preliminary notice of this work appeared in May last (CHEM. & IND., Vol. 16, No. 18, 406). The complete work has now been received, and the impression made by even a cursory perusal of its 1000 pages is one of amazement and admiration. A common criticism of many German compendia is that they are undertaken by one man, and that it is not possible for an individual to cover so wide a field adequately. The present volume labours under no such disability. Its sections, each complete in itself, are the work of specialists. Thirty well-known colloid chemists have contributed articles covering the whole field of colloid chemistry and its applications to technology. The value of the book does not lie in its completeness, but in the remarkably comprehensive view it gives of the field of colloid chemistry, and the silent emphasis it lays on the necessity for an accurate knowledge of the laws regulating colloidal phenomena, to all who control technologically in industry to-day. Such a survey is of incalculable value to the chemist who desires to keep abreast of modern developments in his own and cognate industries. As a source of inspiration and of illustration of the methods and application of colloidal theory to the solution of technical problems, this work can hardly be surpassed. Its breadth may be realised if a dozen or so of the industries dealt with are mentioned: rubber, colours, ink, soap, paper, textiles, ceramics, cement, glass, brewing, tanning, glue, photography. Each section is well illustrated and excellently documented. Particular mention may be permitted of the one English contribution, namely, a masterly survey of the relation of colloid chemistry to the making of butter and margarine, by Dr. William Clayton, of Liverpool.

An adequate review of such a work is impossible, but it is possible to recommend the work to all progressive chemists as one that will prove of value in matters pertaining to their own work, will widen their horizon by indicating the methods and results obtained in other fields, and will emphasise the fact that materials, however dissimilar in outward appearance, yet obey the same physical laws, and are amenable to the same methods of investigation.

H. W. GREENWOOD

ON THE BECKMANN REARRANGEMENT. By MITSURU KUHARA. Edited by SHIGERU KOMATSU. Pp. 83. Kyoto: Kyoto Imperial University, 1926.

Mitsuru Kuhara was born in 1855, and died in 1919. For over twenty years he was professor of chemistry of the College of Science and Engineering in the Kyoto Imperial University. He was one of the founders of the Chemical Society of Japan (1878), and was elected as its first president. His principal work was "On the Beckmann rearrangement," under which title nine papers were published between 1908 and 1920, out of a total of 32 original papers which he contributed to various

journals. In view of their outstanding character, his pupils have reprinted this series of papers in a separate volume, as a tribute to his memory. Since these papers were all published in Japan (although not in Japanese), and deal with a subject of very wide general interest, there will be many workers in the field of organic chemistry who will be glad to have them collected for easy reference within a single cover, in a volume comparable with a single issue of the journal in which they first appeared.

- **ALLEN'S COMMERCIAL ORGANIC ANALYSIS.** Fifth edition.
 - Vol. V. Tannins, Inks, Leather, Colouring Matters in Foods, Aniline, etc. Pp. xii + 700. London: J. & A. Churchill, 1927. Price 30s.

This book presents the reviewer with a somewhat difficult task, as it includes such a heterogeneous collection of monographs arranged in no logical order. The following are the sections contained in this volume in the order in which they are given: Tannins; Writing, stamping, typing, and marking inks; Printing inks; Amines and ammonium bases; Analysis of leather; Colouring matters of natural origin; Colouring substances in foods; Benzene and its homologues; Aniline and its allies; Naphthylamine, pyridine, quinoline, and acridine bases. Most of the sections appear to be full, accurate, and up-to-date, but the book as a whole suffers from lack of cross references between the sections in those cases where closely related substances are dealt with in different sections. For example, antipyrine and pyramidon are described in the sections on amines and ammonium bases, and one might naturally expect to find acetanilide and phenacetin in the same section, but these are to be found some 250 pages further on in the section devoted to aniline and its allies.

These and other deficiencies are difficult to avoid in a large work such as this, which has gradually evolved and developed into something quite different from and lacking the unity of its original state. The responsibility for each section now rests not only with the present authors and editors, but also with the previous contributors whose work has to be altered and enlarged to bring it up to date.

The individual sections of the work are mostly excellent, though some are far better and more authoritative than others. By far the largest section of the volume is that on tannins by Dr. M. Nierenstein, which is remarkably full and complete. The preliminary theoretical part, though of interest, is perhaps somewhat excessively full in a work dealing with analysis. The section on writing inks, etc., by Mr. C. Ainsworth Mitchell, is excellent, and, though short, is full of useful and accurate information. The section on printing inks by Mr. J. B. Tuttle is short and clearly written, but might be somewhat expanded with advantage, particularly with regard to British practice, the point of view of the writer being somewhat too exclusively American. Dr. H. E. Cox, who has revised the section on amines and ammonium bases, has had a somewhat more difficult task than most of the other contributors, as most of the compounds of importance in the field of commercial organic analysis which might have come under this category have been allotted to other sections. Most of

the information given appears to be accurate and complete, but the description of the colour reactions of pyramidon is not quite accurate, especially with reference to dilute solutions, such as are usually dealt with after the extraction of pyramidon from mixed drugs. The section devoted to the analysis of leather is written by Mr. A. E. Caunce, and amounts to less than twenty pages, which appears to be a somewhat meagre allowance, but within these limits the subject is dealt with clearly and thoroughly.

The section on colouring matters of natural origin, by Prof. W. M. Gardner, rightly devotes most attention to indigo, the analytical aspects of this important dyestuff being well described. Some of the other natural dyes are rather scappily treated: for example, under annatto nothing is said about its detection in milk or butter, nor of its colour reaction with stannous chloride. A little more might also be said about the detection of gamboge, as it is the only natural dyestuff the use of which in foodstuffs is prohibited in this country. One of the most interesting sections of this volume is that on the detection of dyestuffs in foods, revised by Mr. W. E. Mathewson. This difficult subject is dealt with in great detail, attention being given to spectroscopic examination in addition to the ordinary physical and chemical methods of detection. Lists are included of the permitted food colours of the U.S.A. and of France, but, unfortunately, none is given of the colours prohibited for this purpose in Britain. Similarly, the section on benzene and its homologues by Mr. J. Bennett Hill deals with American rather than British practice, and, unfortunately, the minor details of the standard processes differ appreciably in the two countries. No mention is made of the determination of aromatic hydrocarbons in petrol by the aniline point method, which is the one usually used in this country. The last two sections on aniline and its allies, and on naphthylamine, pyridine, quinoline, and acridine bases are by Mr. A. B. Davis. The first of these includes aniline and its derivatives and homologues, and also some of the derivatives of the aminophenols, including ortho-anisidine, and phenacetin and its derivatives. A quantity of useful and detailed information is given concerning these, but para-aminophenol and the various photographic developers derived from it are badly neglected. The last section on the naphthylamines and the heterocyclic bases is on similar lines, and includes the important flavine antiseptics derived from acridine.

In spite of the few minor blemishes to which attention has been drawn, the book is extremely valuable, and is one which no industrial organic chemist can afford to be without.

PERCY MAY

DIE REAKTIONSFÄHIGKEIT DES KOKSES. By Drs. R. MEZGER and F. PISTOR. Part 12. Kohle, Koks, Teer. Abhandlungen zur Praxis der Gewinnung, Veredelung u. Verwertung der Brennstoffe, edited by Dr. J. Gwosdz. Pp. viii + 88. Halle: Wilhelm Knapp, 1927. Price, paper, 7.20 r.m.; bound, 8.80 r.m.

This book is Vol. 12 of the series "Kohle, Koks, Teer," and constitutes a companion to Vol. 6, by Häusser

and Bestehorn, on the combustibility of coke (cf. *CHEM. AND IND.*, 1926, 325). The authors' methods of attack form an interesting contrast, for, whilst Häusser and Bestehorn experiment with a charge of several hundred kgs. of lump coke, the present authors determine the "reactivity" on only 0.2 g. of 200-250-mesh coke, claiming for their method rapidity, homogeneity of sample, and applicability to cokes produced both on the large scale and in a laboratory crucible. Details of the method and deductions from the results have appeared elsewhere (cf. *B.*, 1927, 160-161).

The widespread lack of uniformity in the use of the terms "reactivity" and "combustibility" as applied to coke is becoming increasingly confusing and regrettable. The present authors deal with the determination of the rate of burning of coke in air, and refer to it as "reactivity." Surely it were more rational to speak of "combustibility" in this connexion and apply the term "reactivity," when unqualified, to the other main blast-furnace reaction of coke, viz., its ability to reduce carbon dioxide.

The value of the book is greatly enhanced by an excellent bibliography and a detailed and critical account of the methods and results of previous investigators. It will be found a most useful work of reference to all concerned with elucidating the causes of the different combustibility of different cokes.

W. T. K. BRAUNHOLZ

LE CAOUTCHOUC DURCI. By A.-D. JETERINGER. *Encyclopédie du Caoutchouc et des Matières Plastiques*, edited by A.-D. Gillard. Pp. 198. Paris: A. D. Gillard, 1926. Price 31.50 fr.

While an overwhelmingly large proportion of the world's output of raw rubber is utilised in the production of what are described, by contrast, as soft rubber goods, the manufacture of hard rubber, or, as it is more generally called in this country, ebonite or vulcanite, still forms an important branch of the rubber industry.

The present work forms part of the "Encyclopédie du Caoutchouc et des Matières Plastiques," and a general knowledge of rubber technology is presupposed, such information as is to be found in the companion volumes being omitted. The author's previous writings will lead readers to expect a thoroughly scientific treatment, and this is manifested throughout the book. For example, in discussing the production of ebonite dust extensive reference is made to the recent publications of Gibbs and others relating to the risk of explosion.

At the same time due regard is paid to the practical aspect of ebonite manufacture, and in describing the making and finishing of sheets, tubes, rods, and moulded articles such incidentals as the preparation of sheet tin and the use of suitable mould varnishes receive attention.

Exception might be taken to the amount of space allotted to the reproduction of a number of mixing formulæ, many of which are of purely sentimental interest, recalling as they do the days when chemists had not yet begun, or were only just beginning, the series of investigations which ultimately pointed the way for the construction of rubber mixes on a scientific basis. Moreover, many of the grades of wild rubber specified would be unobtainable to-day, the development

of the plantation industry having resulted in their disappearance from the market.

One of the best chapters in the book is that which deals with the use of ebonite in making or covering chemical plants such as tanks, rollers, and hydro-extractors, and a consideration of some of the difficulties involved may help to explain why a material so resistant to alkalis and weak acids has not found wider application in chemical industry.

The book will be welcomed as the first to be devoted exclusively to ebonite, references to which in technical literature have hitherto been restricted to chapters in works dealing with the rubber industry as a whole. Its appearance at the present moment is opportune, the developments in the use of electricity and the advent of radio-telephony having served to draw attention to the value of ebonite as an insulating material.

B. D. W. LUFF

THE DISPOSAL OF SEWAGE. By T. H. P. VEAL, B.Sc., A.M.Inst.C.E. Pp. xiv + 173. London: Chapman and Hall, Ltd., 1927. Price 10s. 6d.

The author of this book is lecturer in civil engineering at the University of Birmingham, and he has set himself the task of explaining without unnecessary detail the main principles of sewage disposal in a manner suitable for students of the subject. This task has been very successfully accomplished within the limits of a small text-book containing 11 chapters.

After a brief historical introduction, the author discusses the factors which influence the quantity and quality of the sewage which has to be dealt with at the disposal works, but he does not perhaps sufficiently stress the fact that the design of the works should be based upon careful gaugings of the flow and analyses of the sewage. In the several illustrations of storm-water overflows the omission of a dip-plate or other device for preventing the discharge of objectionable floating matters direct to the stream should be noted, and the value of Fig. 2, showing the daily fluctuations of flow, would be enhanced by the inclusion of a horizontal dotted line indicating the average flow.

Five chapters are devoted to a discussion of the processes and works by which a satisfactory effluent can be produced. These include land treatment, screening, grit or detritus tanks, settlement (including septic) tanks, contact beds and percolating filters, and bio-aeration. The discussion is well compressed into 100 pages, and the chapter on bio-aeration tanks gives a very clear idea of the present position of the activated sludge process. Settlement tanks six times as long as they are wide would probably be generally regarded as too long.

The three final chapters of the book deal with sludge disposal, lay-out and cost of works, and sewage disposal in rural districts. The works of several towns are briefly described, and subsoil irrigation is recommended for country houses. This system is not generally considered as satisfactory as that recommended by the Ministry of Agriculture for small holdings.

Throughout the book frequent reference is made to the recommendations of the Royal Commission on Sewage Disposal, and to the requirements of the Ministry of

Health with regard to sewerage and sewage disposal works for which a local authority seeks sanction to borrow money to be repaid over a period of years.

The book is well balanced and can be safely recommended to the student of civil engineering and to all who wish to understand the principles of sewage disposal.

H. T. CALVERT

HISTORY OF EXPLOSIVES INDUSTRY IN AMERICA. By A. P. VAN GELDER and H. SCHLATTER. With an Introduction by Dr. C. E. MUNROE. Pp. xxxviii + 1132. Prepared from data collected by, and published under, the direction of the Institute of Makers of Explosives. New York: Columbia University Press; Humphrey Milford, Oxford University Press, 1927. Price 50s.

The time was certainly ripe, if not overdue, for the publication of a history of the development of the explosives industry in America. All those concerned can be congratulated on the volume under review, which is certainly worthy of the theme with which it deals.

The book is fittingly introduced by that doyen of explosives experts, Dr. Charles E. Munroe, who deservedly praises the thoroughness with which the two authors have accomplished their task.

There is one criticism which may be permitted. The technical side of the development of the explosives industry has received rather scant attention, the bulk of the volume being concerned with the commercial and industrial phases. The accounts of the rise, progress and decline or absorption of the many American explosives companies, while useful for historical reference, are apt to be somewhat dull, especially to the British reader.

One can hardly resist a comparison of this volume with the corresponding British history, "The Rise and Progress of the British Explosives Industry," which was published in 1909 under the auspices of the International Congress of Applied Chemistry. The latter takes the form of a series of more or less disconnected essays by experts on the most important sections of the industry, e.g., "Nitrocellulose," by MacDonald; "Permitted Explosives," by De Mosenenthal, etc., and the matter is dealt with mainly from the aspect of technical development. The American history, on the other hand, is a much fuller and more connected story mainly on the commercial side, and can certainly claim to be a better history. However, to a technical man, there is no doubt which is the more readable book.

For the general arrangement, printing, etc. of the book, there can be nothing but praise. It is profusely and well illustrated.

The last chapter dealing with "Explosives in the Making of America" deserves special mention. It shows in graphic manner the important part explosives have played in the development of modern civilisation, and is a record of achievement of which any industry might be proud.

Two slips which were noticed might be pointed out. The dedication is marred by a common mis-spelling, and on p. 19 the charge of black-powder for a ballistic pendulum is stated to be 35 hundred-weight.

J. WEIR

PARLIAMENTARY NEWS

Food Preservatives

Mr. Chamberlain informed Lieut.-Colonel Ruggles-Brise that preservatives were not allowed in dairy produce of any kind, whether imported or home produced, except in butter and cream, and the prohibition would apply to these articles also on January 1, 1928.—Dec. 8.

Oil Extraction (Bergius Process)

In reply to Colonel Day, the Duchess of Atholl said that the question of the results obtained at the Fuel Research Station, Greenwich was now under consideration, but it was probable that publication would be delayed until the investigations had been further advanced. No English process for the conversion of coal into oil by hydrogenation had been brought to the notice of the Fuel Research Board. As regards low-temperature carbonisation, besides the work undertaken at the Fuel Research Station, investigations had been conducted into, and reports had been published on, the following English processes: the "Parker" plant at Barugh, the Midland Coal Products, Ltd., plant at Netherfield, the "Fusion" rotary retort, the "Freeman" multiple retort of the British Oil and Fuel Conservation, Ltd., and the "Crozier" retort. The report on the last-mentioned was now in the Press.—Dec. 12.

Beet-sugar Subsidy

In a written reply to Sir D. Newton, Mr. Guinness stated that the price to the growers of beets delivered at established factories in each of the seasons 1928, 1929 and 1930 agreed between the National Farmers' Union and the Factories Committee will be 46s. per net ton of 15½% sugar content. Taking past results as a guide, the following calculation showed how the receipts of the sugar factories were related to the price which the beet grower received for the raw material. The average extraction of sugar for the last three seasons for factories in Great Britain was 13.3% and the average sugar content in beets was 17.01%. The white sugar content of 15½% would therefore be about 12.12%, or about 2.4 cwt. of sugar for each ton of beet delivered to the factory.

	s.	d.
The world price of 1 cwt. sugar at present is approximately	17	0
Add subsidy (at October, 1928 September, 1931, rates)	13	0
Add preference	4	3
	34	3
Amount obtained by factory on 1 cwt. of sugar after allowing for marketing charges	33	0
2.4 cwt. of sugar from 1 ton of beet at 33s.	79	2
4/5ths cwt. of molasses which with subsidy gives	6	0
1.1/7th cwt. of dried pulp	5	8
	90	10
The factory pays the grower for beet	46	0
Leaving the factory share of the receipts per ton of beet	44	10

The above statement does not enter into the relative costs of growing beet or of manufacturing sugar.—Dec. 13.

Sugar-beet Cultivation in Scotland

Sir J. Gilmour informed Mr. T. Henderson that in 1926 the area returned to the Board as under sugar beet was 3649 acres. The area as estimated by the companies in January, 1927, from which sugar beet was delivered to the factories was 3390 acres. The amount of subsidy paid was £74,058.13s., being £63,980 8s. 10d. in respect of sugar, and £10,078 4s. 2d. in respect of molasses. The area in 1927 as returned to the Board was 10,352 acres. The amount of subsidy paid for the crop of 1927 up to the present date was £32,316 1s. 9d. being in respect of sugar £32,088 1s. 7d. and in respect of molasses £228 0s. 2d. Dec. 13

Income Tax (Scientific Societies)

In a written reply to Mr. Clayton, Mr. Churchill stated that appeals to the High Court were pending against decisions of the Special Commissioners of Income Tax holding that two societies were not entitled to exemption from Income Tax on charities. These two societies, after discussion between representatives of a large group of learned and scientific societies and the Revenue authorities, had been taken as test cases. Unless these decisions of the Special Commissioners on appeal were reversed by the Courts, it would not be possible for the Inland Revenue to continue to make repayments of tax in respect of income of the general funds of other societies of the same character. Dec. 15.

Dead Sea Salts (Concession)

In reply to Colonel Howard Bury, Mr. Ormsby-Gore said there were discussions in 1926 between certain of the applicants with a view to combining interests, but the applications subsequently submitted were made on behalf of individual groups and not on behalf of any combine of groups. He also informed Lieut.-Commander Kenworthy that he understood that Major Tulloch and Mr. Novomeysky were supported by independent capital that was in no way connected with any of the existing chemical industries or potash owners or potash sellers. Dec. 19

Beet-Sugar Factories

Mr. Guinness informed Mr. Thurtle that fourteen beet-sugar factories were actually engaged in the manufacture of home-grown sugar during the 1926-27 season. Five other factories were planned with a view to working in the next season. Dec. 19

Oil Extraction (Bergius Process)

Lord Eustace Percy informed Mr. Hardie that the experimental Bergius plant at the Fuel Research Station has a throughput of about one ton of coal per day. The reaction chambers of the plant are made from medium mild steel. Dec. 20.

Olive Oil (Adulteration)

In a written reply to Sir B. Peto, Sir K. Wood stated that his attention had been drawn to the fact that, in order to utilise the stocks of ground nuts in Spain that had accumulated during this year, the mixing of oil from these nuts with olive oil had been authorised. He had no power to prohibit the importation of mixed oil. It would be illegal under the Sale of Food and Drugs Act to sell the mixed oil as olive oil, but there was nothing in those Acts to prevent its sale under some accurate description. Dec. 21.

COMPANY NEWS**BRITISH DRUG HOUSES, LTD.**

The usual quarterly dividend of 1½% has been announced on the preference shares.

SULPHIDE CORPORATION, LTD.

At the thirty-first annual ordinary general meeting, held on December 22, the chairman, the Rt. Hon. the Earl of Kintore, congratulated shareholders on a considerably improved profit and on prospects which seemed to point to the maintenance or increase of that profit in the present year. Increased output at Broken Hill and Cockle Creek had been realised; the reduction, however, in average metal prices, and especially in lead, had been so progressive and acute as to much more than neutralise the benefit of the favourable features in the year's work. As a result, the net profit was less than last year by £115,550. Instead of paying, as last year, 10% on both classes of shares, the company was now able to recommend only the payment of 7½% on the preference shares. During the year there was a large increase, due to reopening work, in the quantity of crude ore raised from the Central mine, Broken Hill. It was almost certain that there would be a further large increase of tonnage from the Central mine in the current year, the average so far having been about 2400 tons per week, equivalent to 120,000 tons for the year. Milling work at Broken Hill also showed a substantial increase, the tonnage of lead concentrates produced having been 25,289 t. (20,948 t.), and of zinc concentrates, 29,948 t. (23,552 t.). There had been increased production in all departments at Cockle Creek, the chief products manufactured there being sulphuric acid, superphosphates and cement. The third contact acid plant was completed and put into commission in May last. The demand for this class of acid still exceeded the supply, and the company was constructing a fourth contact plant. During the year 20,770 t. of mono-acid were produced (18,333 t.), and production of superphosphates rose from 31,294 t. to 33,879 t. Costs, however, were higher in the past year by about 3s. 6d. a ton high-grade, owing to an increase in the cost of phosphate rock and acid. The largest increase was in the cement department, the production of cement having risen from 24,328 t. to 42,884 t., whilst there had been a further increase in the current year. The English works at Seaton Carew suffered from the coal strike, with the result that production of spelter was only 3675 tons, as compared with 4955 t., and of sulphuric acid 7566 t. (9758 t.). Since work was resumed in December last, it had been continuously maintained on a considerably increased scale, so that the whole year's production should be considerably larger than anything previously achieved. The chairman stated that in a recent metal review it was estimated that the world's production of lead in 1927 would be approximately only 3·4% higher than it was in 1926, and yet the price of lead had fallen nearly 50%, whilst the profits of lead producers had fallen to an even greater extent. The cure for this appeared to lie in a cartel system, under which production should be so regulated as to avoid an excess of production unless there was a corresponding increase in demand for consumption. Meanwhile, reduction of output was being

brought about by the drastic effect of prices so low as to make production unprofitable for the less favourably situated mines, which no doubt was having considerable effect. In this connexion, the chairman of the North Broken Hill Co., speaking recently in Australia, said that although the immediate outlook was gloomy, he considered that an optimistic long view was justified, because he believed that a large proportion of the world's normal requirement of lead could not be profitably produced at the present low price of the metal.

SOUTH METROPOLITAN GAS CO., LTD.

A Bill to extend the limits of supply by the South Metropolitan Gas Company and to increase its capital has been deposited for next Session in the Private Bill Office of the House of Commons. The Bill proposes to extend the existing limits of supply so as to include a small area in Wandsworth and Mitcham, mainly bounded by the Southern Railway and the boundary between the counties of London and Surrey. Power is also sought to raise £1,000,000 additional capital by the issue of further ordinary or preference stock and to borrow on this capital a further sum of £500,000. Further borrowing powers are also sought to be exercised in respect of the issued capital to the extent of one half of the authorised capital of £7,997,395 actually raised. The company also proposes to amend its Act of 1920 with regard to the limitation of dividends so as to enable the company to issue ordinary stock of the same denomination as the existing ordinary stock, and to make all future issues of preference stock at such a rate of interest as the directors may determine at the date of the issue thereof.

LEEDS FIRECLAY CO., LTD.

The thirty-eighth annual meeting was held on December 20, Mr. C. F. Spencer, chairman, presiding. Notwithstanding the heavy loss of £11,263 for the five months to November 30, 1926, during the remaining seven months the loss was converted into a profit of £12,887, so that in effect the result for last year was better, from an operative standpoint, than the previous year. The directors had sufficient confidence in the position of affairs to recommend increased dividends on both preference and ordinary shares. After payment of dividends, and adding a further sum to reserve, £157,364 remained to be carried forward. As indicated at an extraordinary general meeting on November 25, an agreement was entered into on December 1 by the Farnley Iron Company (Fireclay Works), Ltd.—which is controlled by the Leeds Fireclay Co., Ltd.—to acquire the clay works and interests of the Farnley Iron Co., Ltd. The directors were unanimously of opinion that the arrangement would prove of great value to the company. Not only would an area of 750 acres be added to its mineral resources, but economies resulting from co-ordination of management and certain reductions in expenditure already arranged for should show an immediate saving of several thousands of pounds per annum. To raise the necessary funds in connexion with this arrangement, the company proposes to issue 100,000 preference shares at a premium. The company had also acquired the exclusive British rights of the Plasmann process for the low temperature carbonisation of coal. Early in 1926

the attention of the company was directed to the successful results attained by the Chemisch-Technische Gesellschaft, of Duisburg, and after careful investigation of the process and patents, the company concluded an arrangement to take over the British rights for this process. The salient features of the process were the continuous and automatic process which, without briquetting, would produce a smokeless fuel in large firm lumps from coal slacks or fines; the tar or crude oil produced was of remarkable purity, and was free from coal dust in suspension; and as the process was automatic, labour operating costs were considerably reduced. The chairman had inspected the first large plant in operation in Germany, a retort treating 50 tons of coal per day, being the first instalment of a plant to deal with 400 tons a day, and was very favourably impressed. The company had now on order a small plant to deal with 2½ tons of coal per day, which it was installing in order to test the suitability of the many different grades of British coals for treatment by this process and it was hoped that this oven would be delivered in January.

NOVOCRETE AND CEMENT PRODUCTS CO.

A net loss of £13,143 is shown for the year ended June 30, and, as a result, the debit balance on profit and loss account now stands at £35,775. The report states that in October 1926, the Factory at Park Royal was completed, and manufacture started. Although sales have increased, it has taken longer than expected to work sales up to a level on which receipts would balance outgoings. The directors are asking shareholders for authority to issue debentures up to £20,000 as and when required.

MARGARINE UNION, LTD.

This company has been formed with an authorised capital of £3,100,000, divided into £1,500,000 7% cumulative preferred shares of £1, of which £1,000,000 has been issued; £1,500,000 ordinary shares of £1, of which £1,000,000 has been issued; £100,000 6% deferred shares of 1s., all issued. The company will acquire control of the organisation of Van den Berghs, Ltd., and N.V. Margarine Unie has been formed in Holland to acquire control of the organisations of Anton Jurgens United (Margarine) Works, and Van den Bergh's Fabricken. These concerns are the three largest manufacturers of margarine in the world, owning, or controlling through their subsidiaries, factories and distributing organisations in Great Britain, Holland, France, Belgium, Germany, Norway, Sweden, Denmark, Italy, and the Dutch Indies. The aggregate issued capitals of Margarine Union, Ltd., and N.V. Margarine Unie will amount to £6,391,666, and their assets will include the entire holdings of ordinary shares of the Jurgens and Van den Bergh families in the three above-named concerns. The directors of Margarine Union, Ltd., are the Rt. Hon. the Earl of Bessborough, C.M.G. (chairman), His Excellency Dr. R. J. H. Patijn (vice-chairman), Messrs. A., H., R., and E. Jurgens, Messrs. S., A., L., and D. van den Bergh, Mr. J. H. Tresfon, and Mr. P. Rykens. The registered office is at Finsbury Court, E.C.2. It is reported that the Margarine Union has acquired a substantial interest in a Continental margarine concern owning seed crushing, oil refining and margarine factories.

MARKET REPORT

This Market Report is compiled from special information received from the Manufacturers concerned. Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid Acetic, 40% tech.—£19 per ton.
 Acid Boric, Commercial.—Cryst., £30 per ton; Powder, £32 per ton; Extra fine Powder, £34 per ton.
 Acid Hydrochloric.—3s. 9d.—6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric 80° Tw.—£21 10s.—£27 per ton makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bisulphite of Lime.—£7 10s. per ton f.o.r. London, packages extra.
 Bleaching Powder.—Spot, £9 10s. per ton d/d.; Contract, £8 10s. per ton d/d., 4-ton lots.
 Borax, Commercial.—Crystals, £19 10s.—£20 per ton; Granulated, £19 per ton; Powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chloride, Solid.—£5—£5 5s. per ton, carr. paid.
 Copper Sulphate.—£25—£25 10s. per ton.
 Methylated Spirit, 61 O.P.—Industrial, 2s. 2d.—2s. 7d. per gal.; Pyridinised Industrial, 2s. 4d.—2s. 9d. per gal.; Mineralised, 3s. 3d.—3s. 7d. per gal.; 64 O.P. 1d. extra in all cases. Prices according to quantity as from Jan. 1, 1928.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammon. Sulphate.—£38 per ton d/d.
 Potash, Caustic.—£30—£33 per ton. Potass. Bichromate.—4½d. per lb. Potass. Chlorate.—3½d. per lb. ex whf. Lond. in cwt. kegs.
 Salammoniac.—£45—£50 per ton. Chloride of Ammonia.—£37—£45 per ton, carr. paid.
 Salt Cake.—£3 15s.—£4 per ton d/d. bulk.
 Soda, Caustic, solid.—Spot lots; delivered in 4-ton lots. £15 2s. 6d.—£18 per ton, according to strength. 20s. less for contracts.
 Soda Crystals.—£5—£5 5s. per ton ex railway depots or ports.
 Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—£10 10s. per ton, carr. paid. Sod. Bichromate.—3½d. per lb. Sod. Bisulphite Powder 60/62%.—£17 10s. per ton delivered, home market, 1-cwt. iron drums included, £15 10s. f.o.r. London. Sod. Chlorate, 2½d. per lb.
 Sod. Phosphate.—£14 per ton, f.o.b. London, casks free.
 Sod. Sulphate (Glauber's Salt)—£3 12s. 6d. per ton.
 Sod. Sulphide conc. solid 60/65.—Spot £13 5s. per ton, contracts £13 carr. paid. Sod. Sulphide cryst.—Spot £8 12s. 6d. per ton, contracts £8 10s. carr. paid. Sod. Sulphite, Pea Cryst.—£14 per ton, f.o.b. London, 1-cwt. kegs included.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 5½d. per lb. according to quality. Crimson.—1s. 4d.—1s. 6d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—1s. 9d. per lb.
 Barytes.—£3 10s.—£6 15s. per ton, according to quality.
 Cadmium Sulphide.—2s. 6d.—2s. 9d. per lb.
 Carbon Bisulphide.—£20—£25 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£45—£50 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 1d. per lb.

Diphenylguanidine.—3s. 9d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d.—6½d. per lb.
 Lamp Black.—£35 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron."—£13 12s. 6d. per ton, f.o.r. London.
 Sulphur.—£9—£11 per ton, according to quantity. Sulphur Precip. B.P.—£47 10s.—£50 per ton, according to quantity.
 Sulphur Chloride.—4d.—7d. per lb., carboys extra.
 Thiocarbamide.—2s. 6d.—2s. 9d. per lb., carriage paid.
 Thiocarbamilide.—2s. 1d.—2s. 3d. per lb., according to quantity.
 Vermilion, pale or deep.—6s.—6s. 3d. per lb.
 Zinc Sulphide.—1s. per lb.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £10 5s. per ton. Good demand. Grey, £14 10s.—£15 per ton. Liquor, 9d. per gal.
 Charcoal.—£6—£9 per ton, according to grade and locality. Foreign competition severe.
 Iron Liquor.—1s. 3d. per gal. 32° Tw.; 1s. per gal. 24° Tw.
 Red Liquor.—9d.—10d.
 Wood Creosote.—1s. 9d. per gal., unrefined.
 Wood Naphtha.—Miscible, 3s. 11d.—4s. 3d. per gal. Solvent, 4s. 3d. per gal.
 Wood Tar.—£4—£5 per ton.
 Brown Sugar of Lead.—£40 15s. per ton.

TAR PRODUCTS

Acid Carbollic.—Crystals, —7½d.—7½d. per lb. Crude 60's, 2s. 5d. per gal. prompt; lower for 1928 delivery.
 Acid Cresylic, 99/100.—2s. 11d.—3s. per gal. 97/99.—2s. 4d.—2s. 5½d. per gal. Pale, 95%, 2s. 3d.—2s. 4d. per gal. Dark, 95%, 2s. 1d.—2s. 2d. per gal.
 Anthracene Paste.—A quality, 2½d. per unit, 40%—£5 per ton; Anthracene Oil.—Strained, 8d.—8½d. per gal. Unstrained, 7½d.—8d. per gal.
 Benzole.—Crude 65's, 9½d.—9½d. per gal., ex works in tank wagons; Standard motor, 1s. 1½d.—1s. 2½d. per gal., ex works in tank wagons; Pure, 1s. 5d.—1s. 7d. per gal., ex works in tank wagons.
 Toluole. 90%, 1s. 4d.—1s. 8d. per gal. Pure, 1s. 10d.—2s. per gal.
 Xylol.—1s. 3d.—1s. 10d. per gal. Pure, 1s. 9d. per gal.
 Creosote.—Cresylic 20/24%, 10d.—11d. per gal. Middle Oil, 8d.—9d. per gal. Heavy, 8½d.—9d. per gal. Standard specification, 7½d.—7½d. per gal. ex works. Salty, 7d. per gal., less 1½%.
 Naphtha.—Crude, 9d.—10d. per gal. Solvent 90/160, 9½d.—10½d. per gal. Solvent 95/160, 1s. 3d.—1s. 4d. per gal. Solvent 90/190, 9½d.—1s. 3d. per gal.
 Naphthalene Crude.—Drained Creosote Salts, £5 per ton. Whizzed or hot pressed, £8 per ton.
 Naphthalene.—Crystals, £13—£13 10s. per ton. Flaked, £14—£15 per ton.
 Pitch, medium soft.—85s.—90s. per ton, f.o.b. according to district. Market firm.
 Pyridine.—90/140.—6s.—6s. 6d. per gal. 90/180—3s. 6d.—5s. per gal. Heavy.—3s.—3s. 6d. per gal.

INTERMEDIATES AND DYES

In the following list of Intermediates delivered prices include packages except where otherwise stated.
 Acid Gamma.—4s. 6d. per lb.
 Acid Amidonaphthol disulpho (1.8.2.4.)—10s. 9d. per lb.
 Acid A.—3s. per lb.
 Acid Naphthionic.—1s. 6d. per lb.
 Acid Neville and Winther.—4s. 9d. per lb.
 Acid Sulphanilic.—8½d. per lb.
 Aniline Oil.—8d. per lb., naked at works.
 Aniline Salts.—8d. per lb., naked at works.
 Anthranilic Acid.—6s. per lb., 100%.

Benzaldehyde.—2s. 3d. per lb.
 Benzdine Base.—3s. 3d. per lb. 100% basis d/d.
 Benzoic Acid.—1s. 8½d. per lb.
 o-Cresol 29/31° C.—5½d. per lb.
 m-Cresol 98/100%.—2s. 3d.—2s. 5d. per lb.
 p-Cresol 32/34° C.—2s. 3d.—2s. 5d. per lb.
 Dichloraniline.—1s. 10d. per lb.
 Dimethylaniline.—1s. 11d. per lb.
 Dinitrobenzene.—8½d. per lb., naked at works. £75 per ton.
 Dinitrochlorbenzene.—£84 per ton d/d.
 Dinitrotoluene.—48/50° C.—8d. per lb., naked at works.
 Dimnitrotoluene.—66/68° C.—9d. per lb., naked at works.
 Diphenylamine.—2s. 10d. per lb. d/d.
 α-Naphthol.—10d. per lb. d/d.
 β-Naphthol.—10d. per lb. d/d.
 α-Naphthylamine.—1s. 3d. per lb.
 β-Naphthylamine.—3s. per lb.
 o-Nitraniline.—5s. 9d. per lb.
 m-Nitraniline.—3s. per lb. d/d.
 p-Nitraniline.—1s. 8d. per lb.
 Nitrobenzene.—6d. per lb., naked at works.
 Nitronaphthalene.—1s. 3d. per lb.
 R. Salt.—2s. 2d. per lb.
 Sodium Naphthionate.—1s. 8½d. per lb. 100% basis d/d.
 o-Toluidine.—8½d. per lb.
 p-Toluidine.—2s. per lb., ex works, naked.
 m-Xylidine Acetate.—2s. 6d. per lb. 100%.
 N.W. Acid.—4s. 9d. per lb. 100%.

PHARMACEUTICAL AND PHOTOGRAPHIC CHEMICALS

Acid, Acetic, Pure, 80%.—£39 per ton, ex wharf London, in glass containers.
 Acid, Acetyl Salicylic.—2s. 3½d.—2s. 5d. per lb.
 Acid, Benzoic B.P.—2s.—2s. 3d. per lb. for synthetic product, according to quantity. Solely ex Gum—1s. 1s. 3d. per oz., according to quantity.
 Acid, Boric B.P.—Cryst. 36s. 39s. per cwt. Powder 40s.—43s. per cwt.; Extra Fine Powder, 42s. per cwt., according to quantity. Carriage paid any station in Great Britain in ton lots.
 Acid, Camphoric.—19s.—21s. per lb.
 Acid, Citric.—1s. 6½d.—1s. 7d. per lb. Less 5%.
 Acid, Gallic.—2s. 8d. per lb. for pure crystal in cwt. lots.
 Acid, Pyrogallie, Cryst.—7s. 3d. per lb. Resublimed. 8s. 3d. per lb.
 Acid, Salicylic.—B.P. pulv. 1s. 2½d. 1s. 3½d. per lb. Technical 11½d.—11½d. per lb.
 Acid, Tannic, B.P.—2s. 8d.—2s. 10d. per lb.
 Acid, Tartaric.—1s. 3½d. per lb. Less 5%.
 Acetanilide.—1s. 6d.—1s. 9d. per lb. for quantity.
 Amidol.—7s. 6d.—9s. per lb. d/d.
 Amidopyrin.—8s.—8s. 3d. per lb.
 Ammon. Benzoate.—3s. 3d.—3s. 5d. per lb., according to quantity.
 Ammon. Carbonate B.P.—Lump £37 per ton. Powder £39 per ton, in 5-cwt. casks. Resublimed.—1s. per lb.
 Atropine Sulphate.—9s. per oz.
 Barbitone.—5s. 9d.—6s. per lb.
 Benzonaphthol.—3s. 3d. per lb.
 Bismuth Carbonate.—10s. 4d.—10s. 7d. per lb. Bismuth Citrate.—9s. 10d.—10s. 1d. per lb. Bismuth Salicylate.—9s. 10s.—10s. 1d. per lb. Bismuth Subnitrate.—8s. 4d.—8s. 7d. per lb. Bismuth Nitrate.—6s. 1d.—6s. 4d. per lb. Bismuth Oxide.—13s. 10d.—14s. 1d. per lb. Bismuth Subchloride.—13s. 10d.—14s. 1d. per lb. Bismuth Subgallate.—8s. 1d.—8s. 4d. per lb. Extra and reduced prices for smaller and larger quantities respectively; Liquor Bismuthi et Ammon. Cit. B.P. in W. Qts.—1s. 1d. per lb.; 12 W. Qts.—1s. per lb.; 36 W. Qts.—11½d. per lb.
 Borax B.P.—Crystal 25s. per cwt. Powder 26s. per cwt., according to quantity, carr. paid any station in Great Britain in ton lots.

Bromides.—Ammonium.—1s. 11d.—2s. 1d. per lb.
 Potassium.—1s. 7½d.—1s. 9½d. per lb. Sodium.—1s. 10d.—2s. per lb. Granulated ½d. per lb. less.
 All spot. Large quantities at lower rates.
 Calcium Lactate B.P.—1s. 2½d.—1s. 3½d. per lb.
 Camphor, refined flowers, 2s. 11d.—3s. 1d. per lb., according to quantity; also special contract prices.
 Chloral Hydrate.—3s. 2d.—3s. 4d. per lb.
 Chloroform.—2s. 3d.—2s. 7½d. per lb., according to quantity.
 Cresote Carbonate.—6s. per lb.
 Ethers: S.G. 730, 10½d.—1s. 1½d. drums. Other gravities at proportionate prices.
 Formaldehyde.—£39 per ton. Ex wharf in barrels.
 Guaiacol Carbonate.—4s. 9d.—5s. per lb.
 Hexamine.—2s. 3d.—2s. 6d. per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochlor.—English make offered, 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 4d. per gal. f.o.r. makers' works, naked. B.P.—10 vols., 2s.—2s. 3d. per gal.; 20 vols., 3s.—4s. per gal.
 Hydroquinone.—3s. 10d. per lb.
 Hypophosphites.—Calcium 3s. 6d. per lb. for 28-lb. lots. Potassium 4s. 1d. per lb. Sodium 4s. per lb.
 Iron Ammon. Citrate—B.P.—2s. 1d.—2s. 4d. per lb. Green, 2s. 4d.—2s. 9d. per lb. U.S.P. 2s. 2d.—2s. 5d. per lb.
 Iron Perchloride.—18s.—20s. per cwt., according to quantity.
 Magnesium Carbonate.—Light Commercial £31 per ton net.
 Magnesium Oxide.—Light Commercial £62 10s. per ton, less 2½%; Heavy Commercial £21 per ton, less 2½%; in quantity lower; Heavy Pure 2s.—2s. 3d. per lb.
 Menthol.—A.B.R. recryst., B.P., 15s. 6d. January delivery per lb. net. Synthetic detached crystals, 9s.—12s. 6d. per lb., according to quantity; Liquid (95%), 11s. 3d. per lb.
 Mercurials, B.P.—Up to 1 cwt. lots—Red oxide, 7s. 6d.—7s. 7d. per lb., Levig, 7s.—7s. 1d. per lb.; Corrosive sublimate, Lump, 5s. 9d.—5s. 10d. per lb., Powder, 5s. 2d.—5s. 3d. per lb.; White precip., Lump, 5s. 11d.—6s. per lb., Powder, 6s.—6s. 1d. per lb., extra fine, 6s. 1d.—6s. 2d. per lb.; Calomel, 6s. 4d.—6s. 5d. per lb.; Yellow Oxide, 6s. 10d.—6s. 11d. per lb.; Persulph B.P.C., 6s. 1d.—6s. 2d. per lb.; Sulph. nig., 5s. 10d.—5s. 11d. per lb. Special prices for larger quantities.
 Methyl Salicylate.—1s. 5d.—1s. 7d. per lb.
 Methyl Sulphonat.—9s.—9s. 3d. per lb.
 Metol.—9s.—11s. 6d. per lb. British make.
 Paraformaldehyde.—1s. 9d. per lb. 100% pdr.
 Paraldehyde.—1s. 1d.—1s. 4d. per lb.
 Phenacetin.—2s. 6d.—2s. 9d. per lb.
 Phenazone.—4s.—4s. 3d. per lb.
 Phenolphthalein.—6s. 6d.—6s. 9d. per lb.
 Potass. Bitartrate.—99/100% (Cream of Tartar) 96s. per cwt., less 2½%.
 Potass. Citrate.—B.P.C. 1911, 1s. 8d.—1s. 11d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb.
 Potass. Ferricyanide.—1s. 9d. per lb. in cwt. lots.
 Potass. Iodide.—16s. 8d.—17s. 2d. per lb., according to quantity.
 Potass. Metabisulphite.—6d. per lb., 1-cwt. kegs included. F.o.r. London.
 Potass. Permanganate.—5½d. per lb. spot.
 Quinine Sulphate.—1s. 8d.—1s. 9d. per oz. bulk in 100 oz. tins.
 Resorcin.—2s. 10d.—3s. per lb. spot.
 Saccharin.—55s. per lb., and lower in quantity.
 Salol.—2s. 4d. per lb.
 Sod. Benzoate, B.P.—1s. 8d.—1s. 11d. per lb.
 Sod. Citrate, B.P.C., 1911—1s. 8d.—1s. 11d. per lb.; B.P.C., 1923.—2s.—2s. 1d. per lb.; U.S.P., 1s. 11d.—2s. 2d. per lb., according to quantity.
 Sod. Ferrocyanide.—4d. per lb., carr. paid.
 Sod. Hyposulphite.—Photographic £15 5s. per ton, d/d consignee's station in 1-cwt. kegs.

Sod. Nitroprusside.—16s. per lb.
 Sod. Potass. Tartrate (Rochelle Salt).—90s.—95s. per cwt. net.
 Crystals, 5s. per cwt. extra.
 Sod. Salicylate.—Powder, 1s. 7d.—1s. 9d. per lb. Crystal,
 1s. 8d.—1s. 10d. per lb. Flake, 1s. 10d. per lb.
 Sod. Sulphide.—Pure recryst. 10d.—1s. 2d. per lb.
 Sod. Sulphite, anhydrous.—£27 10s.—£28 10s. per ton
 according to quantity, delivered U.K.
 Sulphonol.—6s. 9d.—7s. per lb.
 Tartar Emetic B.P. cryst. or powder.—2s. 1d.—2s. 3d. per lb.
 Thymol, Puriss.—10s.—10s. 3d. per lb., according to
 quantity. Natural.—14s. 3d. per lb.

PERFUMERY CHEMICALS

Acetophenone.—7s. per lb.
 Aubepine (*ex Anethole*).—11s. per lb.
 Amyl Acetate.—2s. per lb. Amyl Butyrate. 5s. 3d. per lb.
 Amyl Salicylate.—3s. per lb.
 Anethole (M.P. 21/22° C.).—5s. 6d. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s.
 per lb. Benzyl Alcohol free from Chlorine.—2s. per lb.
 Benzaldehyde free from Chlorine.—2s. 6d. per lb. Benzyl
 Benzoate.—2s. 6d. per lb.
 Cinnamic Aldehyde.—Natural, 16s. 6d. per lb.
 Coumarin.—10s. per lb.
 Citronellol.—13s. 3d. per lb.
 Citral.—8s. 3d. per lb.
 Ethyl Cinnamate.—6s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—8s. 3d. per lb. Geraniol (Palmarosa).—17s. 9d.
 per lb. Geraniol.—6s.—10s. per lb. Heliotropine.—
 4s. 9d. per lb. Iso Eugenol.—13s. per lb. Linalol.—
 (*ex Bois de Rose*) 14s. per lb.—(*ex Shui Oil*) 9s. 9d. per lb.
 Linalyl Acetate.—(*ex Bois de Rose*) 17s. 6d. per lb.—
 (*ex Shui Oil*) 13s. 9d. per lb.
 Methyl Anthranilate.—8s. 6d. per lb.
 Methyl Benzoate.—4s. per lb.
 Musk Ketone.—35s. per lb.
 Musk Xylol.—8s. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—12s. per lb.
 Phenyl Ethyl Alcohol.—10s. 6d. per lb.
 Rhodinol.—31s. 6d. per lb. Safrol.—1s. 6d. per lb. Terpeneol.
 —1s. 8d. per lb. Vanillin.—15s. 3d.—16s. 6d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 11s. per lb. Anise.—2s. 9d. per lb.
 Bergamot.—26s. per lb. Bourbon Geranium.—13s.
 per lb.
 Camphor.—9d. per lb. Cananga, Java, 15s. 9d. per lb.
 Cassia, 80/85%.—7s. 3d. per lb. Cinnamon, Leaf.—6d.
 per oz. Citronella.—Java, 1s. 9d. per lb., c.i.f. U.K.
 port, for shipment over 1928; Ceylon, Pure, 1s. 7d.
 per lb. Clove, pure 5s. per lb.
 Eucalyptus, Australian.—2s. 1d. per lb. Lavender.—Mont
 Blanc, 38/40%, 17s. per lb. Lemon.—8s. 6d. per lb.
 Lemongrass.—4s. 6d. per lb. Orange, Sweet.—11s. 3d.
 per lb. Otto of Rose.—Anatolian, 35s. per oz., Bulgarian,
 75s. per oz. Palma Rosa.—10s. 3d. per lb. Peppermint
 —Wayne County, 16s. 9d. per lb. Japanese, 8s. per
 lb. Petitgrain.—7s. 9d. per lb. Sandalwood—Mysore,
 26s. 6d. per lb., 90/95%, 16s. 6d. per lb.

PATENT LIST

The complete Specifications notified as accepted are open to inspection at the Patent Office immediately, and to opposition not later than Feb. 20th, 1928. They are on sale at 1s. each at the Patent Office Sale Branch, Quality Court, Chancery Lane, London, W.C.2, on Jan. 5th, 1928. Complete Specifications marked * are those which are open to public inspection before acceptance. The remainder are those accepted.

I.—Applications

Beurrier. Centrifugal separators. 33,927. Dec. 15. (Fr., 15.12.26.)
 Brayshaw. Conveyor furnaces. 33,937. Dec. 15.

Fitch. Heating-furnaces. 34,260. Dec. 17. (U.S., 18.12.26.)
 Green. Apparatus for filtering fluids. 33,765. Dec. 14.
 Iva Alti Forni e Acciaierie d'Italia, and Aurelj. Furnaces. 33,511. Dec. 12.
 Korot. Grinding-mills. 33,609. Dec. 12.
 Parker, Winder, & Achurch, Ltd., and Smith. Mixing-machines. 33,576. Dec. 12.
 Soc. L'Air Liquide. Carrying out exothermic chemical reactions. 33,743. Dec. 13. (Fr., 24.12.26.)
 Vernay. Rotary drying-apparatus. 34,128. Dec. 16. (Fr., 18.12.26.)
 Vigers and Woodward. Rendering porous materials resistant to chemicals. 33,657. Dec. 13.

I.—Complete Specifications

19,644 (1926). Baume, Chambige, and Boutier. Preparation of emulsions or suspensions. (262,724.)
 22,675 (1926). Wright. Apparatus for drying. (281,785.)
 28,745 (1926). Johnson (L.-G. Farbenind.). Apparatus for stirring and mixing. (281,852.)
 352 (1927). Habermann. Centrifugal driers and separators. (265,561.)
 5389 (1927). Easterbrook, and Brown & Son (Alembic Works), Ltd. Mixing and stirring apparatus. (281,904.)
 11,600 (1927). Kocour. Apparatus for determining strength of solutions. (270,338.)
 15,353 (1927). Wright. Apparatus for effecting intimate contact of gases and liquids. (281,958.)
 16,395 (1927). Krupp Grusonwerk. Apparatus for expressing liquid constituents from materials. (273,294.)
 21,453 (1927). Fesen. Centrifugal separators and driers. (278,327.)
 *17,009 (1927). Maschinenfabr. Beth. Bag filters. (281,994.)

II.—Applications

Burne. Briquetting fuel. 34,112. Dec. 16.
 Carpenter, and South Metropolitan Gas Co. Operating gas-producers etc. 34,119. Dec. 16.
 Coppée et Cie. Coke oven. 34,164. Dec. 16. (Belg., 26.7.27.)
 L.-G. Farbenind. Manufacture of hydrocarbons poor in hydrogen. 33,562. Dec. 12. (Ger., 3.1.27.)
 Johnson (L.-G. Farbenind.). Production of olefines etc. 33,849. Dec. 14. Conversion of hydrocarbons. 33,850. Dec. 14. Oxidation of hydrocarbons. 34,227. Dec. 17.
 Jones. Carbonisation of coal etc. 33,602. Dec. 12.
 Koppers Co. Gas purification. 34,139. Dec. 16. (U.S., 22.1.27.)
 Coke ovens. 34,143 and 34,145. Dec. 16. (U.S., 29.1.27 and 12.2.27.)
 Parker. Extracting volatile constituents from carbonaceous materials. 33,900. Dec. 14. (U.S., 14.12.26.) Retorts. 33,902-4. Dec. 14. (U.S., 14.12.26.)
 Uhlmann. Manufacture of briquettes. 33,586. Dec. 12. (Ger., 11.12.26.)

II.—Complete Specifications

22,193 (1926). Spatz. Distilling crude oil from shale. (281,769.)
 27,431 (1926). Karrick. Distillation of carbonaceous material. (261,362.)
 27,836 (1926). Deutsche Bergin A.-G. Elaborating the products arising during liquefaction of coal by hydrogenation. (262,738.)
 5061 (1927). Hoyois. Washing coal, ores and like substances. (266,725.)
 6086 (1927). Soc. Internat. des Proc. Prudhomme Houdry. Hot desulphurisation of gases derived from distillation or pyrogeneration of combustibles. (267,138.)
 *31,280 (1927). Humphreys & Glasgow, Ltd. Apparatus for making carburetted water-gas. (282,034.)
 *33,272 (1927). Siemens & Halske A.-G. Determining the content of combustible gas in gas mixtures. (282,080.)

*33,586 (1927). Uhlmann. Manufacture of briquettes. (282,104.)

IV.—Applications

British Celanese, Ltd., and Ellis. Manufacture of dyestuffs. 33,683. Dec. 13.

Carpmael (I.-G. Farbenind.). Manufacture of compounds containing sulphur. 33,621. Dec. 12. Manufacture of dyestuffs. 33,704. Dec. 13.

I.-G. Farbenind. Manufacture of azo dyestuffs. 33,619. Dec. 12. (Ger., 13.12.26.) Manufacture of arylaminonaphthalene derivatives. 33,719. Dec. 13. (Ger., 13.12.26.) Manufacture of dyestuffs. 33,870. Dec. 14. (Ger., 14.12.26.) Production of vat dyestuffs. 34,226. Dec. 17.

Inmay (I.-G. Farbenind.). Manufacture of 2:3-amino-naphthol etc. 33,992. Dec. 15. Manufacture of azo dyestuffs. 34,116. Dec. 16.

Johnson (I.-G. Farbenind.). Production of 4'-halogen-2-benzoylbenzoic acid etc. 33,848. Dec. 14.

State Import & Export Trading Office Gostorg, and Kis-litzin. Manufacture of black colouring matter. 34,018. Dec. 15.

IV.—Complete Specifications

22,154 (1926). British Dyestuffs Corp., Baddiley, Chorley, and Brightman. Secondary disazo dyes. (281,767.)

23,162 (1927). British Dyestuffs Corp., Payman, and Wignall. Manufacture of derivatives of 2:3-hydroxynaphthoic arylides. (281,795.)

*22,689 (1927). Newport Co. Para-amino-ortho-benzoylbenzoic acid, and process of making same. (282,001.)

*23,771 (1927). I.-G. Farbenind. Manufacture of anthraquinone derivatives. (282,004.)

*33,355 (1927). Fabr. de Produits de Chimie Organique de Laire. Manufacture of primary anines. (282,083.)

*33,619 (1927). I.-G. Farbenind. Manufacture of azo dyestuffs. (282,107.)

*33,719 (1927). I.-G. Farbenind. Manufacture of arylaminonaphthalene-derivatives. (282,111.)

V.—Applications

Bahre. Treatment of fibres. 33,776—7. Dec. 14.

British Celanese, Ltd., and Kinsella. Apparatus for manufacture of artificial silk. 34,223. Dec. 17.

Dreyfus. Manufacture of artificial fibres etc. 33,915—7. Dec. 15. Manufacture of cellulose derivatives. 34,291—3. Dec. 17.

Grunert. Spinning artificial filaments etc. 34,129. Dec. 16. (Ger., 24.12.26.)

Lindner. Production of cleaning etc. agents. 33,844. Dec. 14.

V.—Complete Specification

10,499 (1927). Inmay (I.-G. Farbenind.). Manufacture of esters of the cellulose series. (281,927.)

VI.—Applications

Carpmael (I.-G. Farbenind.). Dyeing cellulose derivatives. 33,703. Dec. 12. Manufacture of solutions for dyeing. 33,707. Dec. 13.

Petrie, and Petrie & McNaught, Ltd. Machines for wet treatment of yarns. 34,014. Dec. 15.

Sandoz Chemical Co., Ltd., and Woodhead. Dyeing cotton materials. 34,261. Dec. 17.

VI.—Complete Specifications

10,952 (1927). I.-G. Farbenind. Dyeing and printing cellulose esters and ethers. (269,934.)

*23,147 (1927). Arnold Print Works. Treatment of cellulose fabrics. (282,002.)

*31,486 (1927). British Celanese, Ltd. Dyeing textile fibres etc. (282,036.)

VII.—Applications

Carpmael (I.-G. Farbenind.). Manufacture of cyanides. 33,708. Dec. 13.

Croad (Hanovia Chem. & Manuf. Co.). Removal of cupric oxide. 33,828. Dec. 14.

Gerrard, and Reid Processes, Ltd. Burning limestone etc. 34,118. Dec. 16.

Inmay (I.-G. Farbenind.). Manufacture of alkali metal salts. 33,994. Dec. 15.

Smith. 33,570. See X. Manufacture of lead peroxide. 33,715. Dec. 13.

Soc. Gén. Métallurgique de Hoboken. Manufacture of sulphuric acid. 34,039 and 34,081. Dec. 15 and 16. (Ger., 23.2.27.)

VII.—Complete Specifications

26,053 (1926). Haworth and Nelson, Ltd. Concentrating aqueous solutions of acetic or formic acid. (281,827.)

8894 (1927). Colombo y Manni. Chambers for the manufacture of sulphuric acid. (270,661.)

*32,705 (1927). I.-G. Farbenind. Producing carbon disulphide. (282,049.)

VIII.—Applications

Atel, Haurez, and Motte. Ovens for ceramic products. 33,812. Dec. 14.

Hochbert. Manufacturing refractory articles of clay. 33,580. Dec. 12.

Singer. Production of artificial plagioclase compounds. 33,851. Dec. 14. (Ger., 17.12.26.) Treatment of ceramic materials. 33,852. Dec. 14. (Ger., 17.12.26.) Preventing ageing of ceramic materials. 33,853. Dec. 14. (Ger., 18.12.26.)

IX. Applications

Cookson. Building etc. material. 34,010. Dec. 15.

Knibbs. Production of cement. 34,158. Dec. 16.

Magure. Treating stone, cement, etc. 34,130. Dec. 16.

Vitalba. Manufacture of Portland cements etc. 33,682. Dec. 13.

IX.—Complete Specification

21,975 (1926). Oakley. Manufacture of artificial stone and plaster. (281,757.)

X. Applications

Croad (Hanovia Chem. & Manuf. Co.). Production of crystalline cuprous oxide upon copper surfaces. 33,830. Dec. 14.

Eisen u. Stahlwerk Hoersch, and Heidenham. Hardening substances of iron, steel, etc. 34,236. Dec. 17. (Ger., 28.12.26.)

I.-G. Farbenind. Manufacture of porous metals. 33,721. Dec. 13. (Ger., 13.12.26.) Manufacture of metal catalysts. 33,871. Dec. 14. (Ger., 14.12.26.)

Nelissen. Preparing articles for nickel plating. 34,212. Dec. 17. (Belg., 30.12.26.)

Smith. Reduction of metallic oxides. 33,570. Dec. 12.

Stahlwerk Becker. Manufacture of steel. 34,001. Dec. 15. (Ger., 30.12.26.)

Stephens (Vulcan-Feuering A.-G.). Cupola furnaces. 34,124. Dec. 16.

Verein, Stahlwerke A.-G. Annealing carbon-containing iron etc. 33,583. Dec. 12. (Ger., 8.1.27.)

X.—Complete Specifications

17,038 (1926). Dietzsch. Treatment of ores of copper and other metals. (281,741.)

22,143 and 32,015 (1926). Smith, Garnett, and Holden. Magnetic alloys. (281,763.)

23,316 (1926). Gustafson. Hardening copper and copper alloys. (281,799.)

27,598 (1926). McGuinness. Furnaces for roasting ores. (281,837.)

- 29,351 (1926). Wittke. Reducing zinc ores. (279,370.)
 5061 (1927). Hoyois. See II.
 7429 (1927). Hall and Bradbury. Aluminium alloy. (281,912.)
 13,863 (1927). Soc. Gén. Métallurgique de Hoboken. Roasting zinc sulphide ores. (271,877.)
 14,611 (1927). Kelly. Alloys. (281,950.)
 16,968 (1927). Johnson (I.-G. Farbenind.). Manufacture of pure iron. (281,963.)
 24,543 (1927). Cozens, and Metallization, Ltd. Coating materials by metal-spraying. (282,116.)
 *28,021 (1927). Krupp A.-G. Raising the yield point of steel alloys. (282,015.)
 *29,255 (1927). Rhenania-Kunheim Ver. Chem. Fabr. Dissociating zirconium ores. (282,023.)
 *32,375 (1927). Broken Hill Proprietary Co. Blast furnaces (282,042.)
 *33,484—5 (1927). Manos. Alloys. (282,095 6.)
 *33,721 (1927). I.-G. Farbenind. Manufacture of finely-porous metals. (282,112.)

XI.—Applications

- Beatty (Bell Telephone Laboratories). Production of insulating materials. 34,043. Dec. 15.
 Berliner Batterie-Fabrik. Electric batteries. 34,265. Dec. 17. (Ger., 13.4.27.)
 Crond (Hanovia Chem. & Manuf. Co.). Securing electrical contact with crystalline cuprous oxide. 33,831. Dec. 14.
 Pritchett, and Pritchett & Gold & E.P.S. Co., Ltd. Electric accumulators. 34,090 1. Dec. 16. (Ger., 16.12.26.)
 Soc. Electro-Métallurgique de Montricher. Electric furnaces. 34,199. Dec. 17. (Fr., 28.12.26.) Electrodes. 34,200. Dec. 17. (Fr., 21.12.26.)

XI.—Complete Specifications

- 22,196 (1926). Joel. Electric secondary batteries or accumulators. (281,770.)
 *33,105 (1927). British Thomson Houston Co. Filaments for incandescent lamps etc. (282,066.)
 *33,501 (1927). Mallon. Electric accumulators. (282,100.)

XII.—Applications

- Erba A.-G. Manufacture of Turkey-red oils etc. 33,976. Dec. 15. (Ger., 28.7.27.) Manufacture of highly sulphated oils. 33,977. Dec. 15. (Ger., 23.6.27.)

XII.—Complete Specifications

- 19,644 (1926). Baume, Chambige, and Boutier. See I.
 2894 (1927). Petroff. Treating drying and semi-drying fats and oils. (281,896.)

XIII.—Applications

- Bakelite Ges. Production of phenol-aldehyde condensation products. 33,897. Dec. 14. (Ger., 14.12.26.)
 Soc. Anon. La Fibre Diamond. Manufacture of synthetic resin. 34,163. Dec. 16. (U.S., 16.12.26.)

XIII.—Complete Specification

- *16,079 (1927). Schmidt. Production of artificial materials from condensation products of urea with formaldehyde etc. (281,993.)

XIV.—Application

- Goodyear Tire & Rubber Co. Preparation of rubber. 34,149. Dec. 16. (U.S., 11.2.27.)

XIV.—Complete Specification

- *26,342 (1927). Naugatuck Chemical Co. Treating rubber latex. (282,011.)

XV.—Applications

- Carpmael (I.-G. Farbenind.). Stuffing leather. 33,795. Dec. 13.
 Greiner. Production of solid glue etc. 34,222. Dec. 17. (Ger., 28.3.27.)
 Ilford, Ltd., and Shepherd. Concentrating gelatin etc. 33,595. Dec. 12.

XV.—Complete Specifications

- 8191—2 (1927). Ehrenreich. Preparation of skins of fish, in particular of sharks, for tanning. (281,918—9.)

XVI.—Application

- Imperial Chem. Industries, Ltd., and Shale. Fertilisers and manufacture thereof. 33,655. Dec. 13.

XVII.—Applications

- Blanker. Manufacture of sugar. 34,003. Dec. 15. (Ger., 8.1.27.)

- Nouvelles Industries Chimiques. Recovery of nitrogen from vinasses etc. 34,174. Dec. 16.

XVII. Complete Specification

- 24,953 (1926). Howard, Ltd., and Rowland. Apparatus for diffusing sugar beet etc. (281,813.)

XIX.—Applications

- Nyrop. Production of fodder etc. 33,895. Dec. 14.
 Manufacture of cream powders. 33,896. Dec. 14.
 Stabback. Preservation of edible products. 33,747. Dec. 13.

XIX.—Complete Specifications

- 25,739 (1926). I.-G. Farbenind. Treating out seed to destroy smut spores. (275,539.)
 *33,107 (1927). Chem. Fabr. Schlutup. Leaching out protein-containing substances such as fish waste. (282,068.)
 *33,394 (1927). Massard. Producing an almond-milk product. (282,088.)

XX. Applications

- Boedecker. Preparation of monoalkyl ethers. 33,971. Dec. 15.

- I.-G. Farbenind. Manufacture of 6-alkoxy-8-amino-quinolines. 33,620. Dec. 12.

- Imray (I. G. Farbenind.). Manufacture of orthoamino-diaryl ethers. 33,993. Dec. 15. Manufacture of oxy-diarylketones. 34,117. Dec. 16.

- Schering-Kahlbaum A.-G. Manufacture of alkyl- β -halogen-ethyl ketones. 33,881. Dec. 14. (Ger., 15.12.26.) Manufacture of metal etc. mercapto acid esters. 34,051. Dec. 15. (Ger., 16.12.26.)

XXI.—Application

- Burg, and Schwickerk Ges. Treating light-sensitive layers. 34,132. Dec. 16. (Ger., 26.1.27.)

XXI.—Complete Specification

- *8071 (1927). Grinten. Manufacture of photographic sensitive layers. (281,604.)

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific reference number:—*British India*: Bleaching and dyeing plant (502); 1330 lb. bismuth carbonas B.P.; 580 lb. bismuth salicylas B.P. and 4420 lb. bismuth subnitrates B.P.; 1040 lb. iodoformum B.P. and 1625 lb. iodum B.P.; 31,900 lb. glycerinum B.P. (Director-General, India Store Department, Branch No. 10, Belvedere Road, Lambeth, S.E.1). *Canada*: Branded coal tar disinfectant (504); leather (505). *Egypt*: Two centrifugal pumping sets (A.X. 5691); alum. (B.X. 4092). *Holland*: Raw and technical materials for pastrycooks and bakers (515). *Rumania*: Leather (519). *Turkey*: Centrifugal pump (A.X. 5683). *United States*: (Crockery, glassware (524)

Safeguarding of Key Industries

The Board of Trade gives notice that representations have been made to it under Section 10 (5) of the Finance Act, 1926, regarding the exemption of metaldehyde from the Safeguarding duty. Communications should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1. before January 23, 1928.

Beet Subsidy

According to a supplementary estimate issued on December 9, an additional £900,000 is required to pay the beet-sugar subsidy during this financial year. The amount of the original estimate was £4,500,000, but this has been found to be insufficient.

New Branch of Brotherton & Company, Ltd.

With a view to giving their customers in Lancashire even more efficient service than hitherto, and ensuring quick despatch of all orders, Messrs. Brotherton & Co., Ltd., are opening an office on Monday, January 2, 1928, at 53, King Street, Manchester. The Manchester Branch, controlling local stocks of Hydrosulphites, etc., will be under the management of Mr. F. T. Cutler, and with him will be associated the present traveller, Mr. R. B. Penrose.

Scottish Dyes, Ltd.

The 1928 diary of Scottish Dyes, Ltd., reminds us that during 1927, this firm produced 12 new colours, comprising 9 Caledon colours, Soledon Dark Blue, Solway Chrome Green and Celatene Blue. The diary contains in addition to the usual diary and space for notes, much useful information about the properties, application and identification of the Caledon, Solway, Celatene and Soledon colours. It is interesting to note that Caledon colours are now prepared in special form under the name of "Caledon Dye-cretes" for colouring concrete, either by mixing with the gauging waters or by application as a wash after dilution with water.

News from Advertisements

Applications are invited from chemists of eminence for the post of principal of the Technological Institute, Cawnpore (p. vi of issue of December 16, 1927).

The Senate of the University of London invites applications for the Ramsay Memorial Chair of Chemical Engineering tenable at University College (p. vi of issue of December 23, 1927).

There are now 129 firms represented in our Buyers' Guide.

PUBLICATIONS RECEIVED

TABLES ANNUELLES DE CONSTANTES ET DONNÉES NUMÉRIQUES DE CHIMIE, DE PHYSIQUE, DE BIOLOGIE ET DE TECHNOLOGIE. Vol. VI. Part I. Pp. xxiv + 679. Paris: Gauthier-Villars et Cie.; New York: McGraw-Hill Book Co., 1927.

EINFÜHRUNG IN DIE CHEMIE UND TECHNOLOGIE DER BRENNSTOFFE. By Dr. E. Börmstein. Pp. 152. Halle (Saale): Wilhelm Knapp, 1926. Paper 6.30 rm.; bound 7.50 rm.

DIE SCHWELUNG VON BRAUN- UND STEINKOHLE. By A. Thau. Pp. xvi + 722. Halle (Saale): W. Knapp, 1927. Paper 49 rm.; bound 52 rm.

DIE CHEMIE DER BRAUNKOHLE. Edited by Prof. E. Erdmann and Dr. M. Dolch. Second edition. Part III. Die Deutsche Braunkohlenindustrie. Pp. xiii + 321. Halle (Saale): W. Knapp, 1927. Paper 30 rm.; bound 42 rm.

KOHLE, KOKS, TEER. ABHANDLUNGEN ZUR PRAXIS DER GEWINNUNG, VEREDELUNG U. VERWERTUNG DER BRENNSTOFFE. Edited by Dr. J. Gwosdz. Part II. Schwelgas. By Dr. H. Trutnovsky. Pp. viii + 124. Paper 9.40 rm.; bound 10.90 rm. Part 12. Die Reaktionsfähigkeit des Koks. By R. Mezger and F. Pistor. Pp. viii + 88. Paper 7.20 rm.; bound 8.80 rm. Part 14. Verbrennung im Gaserzeuger und im Hochofen. By A. Korevaar. Pp. viii + 137. Paper 8.40 rm.; bound 9.90 rm. Halle (Saale): W. Knapp, 1927.

STANDARD CATALOGUE OF SCIENTIFIC APPARATUS. 1928. Vol. I. Chemistry. Pp. xxii + 1141. London: Baird & Tatlock (London), Ltd., 1928.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN. Edited by Prof. E. Abderhalden. Abt. I, Chemische Methoden, Teil II, Heft 3. Alkaloide. By R. Seka. Lieferung 246. Pp. 217-632. Berlin: Urban & Schwarzenberg, 1927. 22 m.

GREIENS HANDBUCH DER ANORGANISCHEN CHEMIE. 8th new and enlarged edition. Edited by the Deutsche Chemische Gesellschaft. Enlarged by R. J. Meyer. System No. 6. Chlor. Pp. xiv + 442. Berlin: Verlag Chemie GmbH, 1927. 68 m. Subscription price 54 m.

THE MINERAL INDUSTRY OF THE BRITISH EMPIRE AND FOREIGN COUNTRIES. Statistical Summary (Production, Imports and Exports), 1924-1926. Imperial Institute. Pp. 356. H.M. Stationery Office, 1927. 8s.

FUEL FOR MOTOR TRANSPORT. Fourth Memorandum. Power Alcohol from Grasses, Straws and Waste Vegetable Materials. Pp. v + 26. Fuel Research. Department of Scientific and Industrial Research. H.M. Stationery Office, 1927. 9d.

LEHRBUCH DER CELLULOSECHEMIE. By Dr. E. Heuser. Third edition. Pp. xi + 278. Berlin: Gebrüder Borntraeger, 1927. 16-80 m.

DIE FARRIKATION DER ALKALOIDE. By Dr. J. Schwyzer. Pp. 123. Berlin: J. Springer, 1927. Paper, 10-50 rm.; bound, 12 rm.

TEXTILCHEMISCHE ERFINDUNGEN. By Dr. A. Lehn. Lieferung I. Pp. vii + 100. Wittenberg: A. Ziemsen Verlag, 1927. 10 m.

THEORIE DES ANTRIEBS UND KRAFTBEDARFS VON PAPIERMASCHINEN. By H. Rappold. Theorie der Harzleimung. By E. Oman. Schriften des Vereins der Zellstoff- und Papier-Chemiker und -Ingenieure. Band 18. Pp. 71. Berlin: Otto Elsner, 1927. 4 rm.

INVESTIGATIONS OF FUELS AND FUEL TESTING. 1926. Canada Department of Mines. Mines Branch. Pp. vii + 184. Ottawa: F. A. Acland, 1927.

ELEMENTS OF OPTICAL MINERALOGY. AN INTRODUCTION TO MICROSCOPIC PETROGRAPHY. By N. H. and A. N. Winchell. Entirely rewritten and much enlarged by A. N. Winchell. Second edition. Part II. Descriptions of Minerals. Pp. xvi + 424. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. 21s. 6d.

BIOCHEMICAL LABORATORY METHODS FOR STUDENTS OF THE BIOLOGICAL SCIENCES. By C. A. Morrow, Ph.D. Pp. xvii + 350. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, 1927. 18s. 6d.

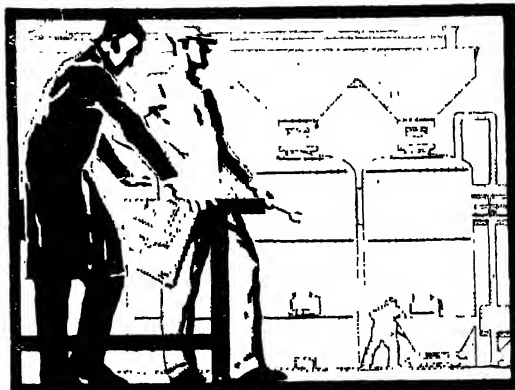
THE MICROSCOPY OF DRINKING WATER. By G. C. Whipple, revised by G. M. Fair and M. C. Whipple. Fourth edition, rewritten and enlarged. Pp. xix + 586. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1927. 35s.

BRITAIN'S FUEL PROBLEMS. Pp. xvi + 592. London: The Fuel Economist, 530, Abbey House, S.W.1, 1927. £2 2s.

BRITISH INDUSTRIES FAIR 1927 SUPPLEMENT

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BRITISH INDUSTRIES FAIR

February 21—March 4, 1927

CHEMICAL SECTION.

The British Industries Fair, organised by the Department of Overseas Trade, is again being held at the White City, Shepherd's Bush, London, and once more chemical industry will be housed in the same commanding position at the Shepherd's Bush entrance in Hall "A," which has become known as the Chemical Hall, because it has been utilised so often for the chemical exhibits. The Association of British Chemical Manufacturers, which, like all our most valued organisations, has achieved the dignity of a short title, and is known familiarly as the A.B.C.M., has again made itself responsible for this representation of the industry. A number of new and interesting products will be exhibited, and there will be abundant evidence of the steady advance of the fine chemical industry, whilst the heavy chemical industry will prove that it is no less alert to modern tendencies and developments.

When we visited the Fair, preparations were proceeding apace for the opening, and though all we saw comprised busy workers and stands, some finished and draped, some nearly finished, some in process of acquiring their decorations of figure and fact, there could be no possible doubt that the stand of the great company which we now know as Imperial Chemical Industries, Ltd., will be the dominating feature of the Chemical Section. We have called it a stand, but it is rather an edifice, erected to the glory of chemical industry, and when the public sees the rich effect which has been produced with the aid of the combined products of the British Dyestuffs Corporation, Brunner, Mond & Co., Nobel Industries, Ltd., and the United Alkali Company, they will agree that the architect, Mr. Joseph Emberton, has been properly inspired by his great theme. Such a great organisation is exceedingly difficult to represent, but the trade buyer and the general public alike—the Fair is open to the public in the evenings—will be able to grasp the enormous scope of Imperial Chemical Industries. At each end of the stand is a semicircular series of steps, one end being occupied by an immense and fascinating flow-sheet, which shows the intricate series of products derived from raw materials such as air, limestone, coal and brine, all materials of which the company has abundant supplies. Jars containing specimens are linked up with coloured threads so that all may see the infinite variety of essential products controlled by the company. At the other end there will be exhibits of fertilisers by Nitram, Ltd. (the selling agents to the Sulphate of Ammonia Federation), complete with a little field and model cows to illustrate the value of manuring grassland. The fertilisers will include superphosphate and compound fertilisers, and nitrogenous fertilisers will speak of Billingham. The manufacture of an orange dye will be demonstrated by the

British Dyestuffs Corporation, using two colourless intermediates, and the demonstration will include salting out, filtration, and the dyeing of silk with the dried dye. Nobel Industries will provide a general display of the uses of nitrocellulose, of ammunition, and other of their well known products. The central hall of the edifice will be rich with fabrics and colours which will speak of colours from the British Dyestuffs Corporation, cellulose varnishes and metallic powders from Nobels, and paints and varnishes from Naylor Brothers (who are now associated with Nobels). The furniture will express Nobel varnishes, Rexine and Pegamoid artificial leather; indeed, as far as is possible in the space, the manufactures of Imperial Chemical Industries will be expressed in concrete form. The activities of such an organisation cannot be described in such a limited space as this, but there is no real difficulty, as Stands 10 and 17 in the Chemical Section provide a convincing demonstration of the strength and scope of this new union in the chemical industry. Further, a handsome book will be available, containing not only a fascinating article by Sir Alfred Mond on the history of the company, but an interesting account of its world-wide activities.

Thanks to the courtesy of the various exhibitors, we are able to give an account of the stands in the Chemical Section. The different stands are dealt with in alphabetical order.

Acme Chemical Co., Ltd.

On Stand No. A. 28, this Tonbridge firm is exhibiting insecticides for agricultural and horticultural purposes, amongst which may be noted arsenite of soda (powder and paste) for the dipping of cattle and for the destruction of locusts, white ant poison, and arsenate of lead, which is used upon cotton plants, tobacco plants, fruit trees, and so on. Amongst other products of this firm are weed killer, lawn sand, and worm killer for golf courses.

Frederick Allen & Sons (Poplar), Ltd.

On Stand A. 2 will be seen the pure inorganic chemicals manufactured by this Poplar firm, including specialities such as Epsom salts, which are claimed to be second to none in quality and appearance, calcium chloride exsicc., ferri. sulph. exsicc., and other exsiccated salts. There will also be hydrochloric, sulphuric and nitric acids of special purity for research work, liquid ammonia, and pure chemicals for pharmaceutical, photographic and analytical purposes. Of heavier chemicals, this firm manufactures sal acetos and oxalates of all kinds, such as manganese oxalate, sodium oxalate, ammonium oxalate, copper oxalate and the like, as well as potash sulphuret, fertilisers and insecticides, from which representative exhibits will be chosen.

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Albright & Wilson, Ltd.

This firm, which, we are under the impression, will be found in the same position as at the last Fair—on Stands 13 and 14, opposite the entrance to the Chemical Section—is to make an interesting display of "Silicon Ester," to demonstrate its value in the preservation of stonework. This firm is known the world over for its phosphorus (of which it is the sole manufacturer in the British Empire), phosphorus compounds, and acid calcium phosphate, and these will be on show with the Ibex and Antelope brands of aerating materials. Last year this exhibit included interesting specimens of technical and pure carbon tetrachloride, ammonium persulphate, pure precipitated sulphur, and other important products, amongst which we remember crystal sticks of pure phosphoric acid, which is being used as a substitute for various organic acids.

A. Boake Roberts & Co., Ltd.

In view of the rapidly extending applications of cellulose lacquers, special interest attaches to the stands (Nos. A. 8 and A. 19) of Messrs. Boake Roberts & Co., who manufacture a complete range of all the solvents, plasticisers and artificial resins which are required for the preparation of these lacquers. A wide range of these materials, for which particularly high quality is required, will be shown, and cellulose acetate of a very high grade will be included. The most recent products of the firm in this class of chemicals are diacetone alcohol, diamyl phthalate, and pale glycerin resin ester.

The firm is now producing about 240 fine chemicals, compared with five in 1914, the latest additions being 100% heliotropin, cineole, safrol, citronellol prepared by a new process, and synthetic menthol in dry, detached crystals. The exhibit will include a range of fine chemicals of the nature of synthetics, isolates and terpeneless essential oils. There will be some interesting intermediates, types of peppermint oil suitable for all applications; compounded perfumes suitable for soap and similar application, and a wide range of flavouring essences, essential oils and colours for edible purposes. Liquid sulphur dioxide in cylinders, sulphites, bisulphites and metabisulphites, and phosphates of a high degree of purity will also be on view.

Boots Pure Drug Co., Ltd.

On Stand A. 6 this firm will provide not only an exhibit of its saccharin, chloroform, alkaloids and other pharmaceutical products, but will display an imposing series of research chemicals and large samples of cyanacetic ester, diethyl malonate, and hydroxylamine hydrochloride. It is interesting to note that Messrs. Boots propose to exhibit some rare chemicals which have never been shown before.

British Drug Houses, Ltd.

The most striking feature of this exhibit (Stands Nos. A. 11 and A. 16) is the section devoted to synthetic and other fine chemicals, used in medicine and in research and general laboratory work, manufactured by this company. The presence of such compounds as both natural and synthetic thyroxine, and of the intermediate products made in the course of the production of the

latter, as well as of many other organic medicinal products as, for instance, phenol-tetraiodophthalein, the non-toxic dye used in cholecystography, and ephedrine, the alkaloid used in the new method of treating asthma, bears witness to the fact that the B.D.H. directors are almost in advance of the times. Indeed, the whole exhibit demonstrates that the company intends to do its share in maintaining British prestige in the fields of chemical research and industry.

In addition to the products mentioned above, examples which, among the large number exhibited, will attract special attention are the Borocaines, the new, non-toxic local anaesthetics; Caprokol (hexylresorcinol), which is a remarkable urinary antiseptic; ether puriss. B.D.H., a comparatively new product, which is the result of researches carried out in the B.D.H. laboratories with the object of making an absolutely pure and perfectly stable anaesthetic ether, free from peroxides, but which costs no more than ordinary anaesthetic ether; contramine and thiohistamine, organic sulphur compounds used in treating various infections; and, of course, insulin. The British Drug Houses, Ltd., were the pioneers in Great Britain of the manufacture of insulin, their insulin plant being acknowledged to be second to none, and it is interesting to note that this brand of British insulin is now exported to every part of the civilised world. The samples of pituitary extract will testify to the company's enterprise in developing the manufacture of organo-therapeutic products, and there will be new additions to the B.D.H. list of alkaloids, including ephedrine. Last, but not least, there will be a comprehensive display of B.D.H. laboratory fine chemicals, of which the number exceeds 3500 and is being added to daily, and there will be a range of indicator dyes for the determination of hydrogen-ion concentration, of microscopic stains, and specimens of specialities such as acriflavine, tetraform, pure glucose and lactose, medicinal colloidal solutions and many others. Recent advances in our knowledge of nutrition and of the vitamins have drawn attention to the important significance of cholesterol, with the result that it is being employed in several directions in medicine, as well as in experimental work relating to vitamins. As a final example of the enterprise of the British Drug Houses, Ltd., it may be stated that the manufacture of cholesterol has been undertaken in recent months by the firm, which can now supply cholesterol in a pure crystalline condition.

W. J. Bush & Co., Ltd.

There is much of romance in the Chemical Section for those who know something of chemistry and chemical industry, but to the ordinary man a most direct appeal is made by Stand A. 7, at which Messrs. W. J. Bush & Co., Ltd., are exhibiting. This firm's exhibit may be divided into the main groups, first, that consisting of essences, essential oils and perfumes, and second, fine chemicals and cream of tartar. In a twinkling one is translated from Hackney to the lemon groves of Sicily, for this firm is world-renowned for the highest-grade fruit essences and perfumery, and is showing some of its leading specialities. For example, essential oil of lemon, produced at their Messina and Californian factories;

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peppermint, distilled at their Mitcham factory; and various fruit essences. Prominent among fine chemicals is vanillin, of which this company is the oldest British maker. Coumarin, thymol, ionone and many others are also exhibited. Certain important intermediates for dye manufacturers are shown, prominent among which are salicylic acid, aceto-acetic ester, sulphanilic acid and benzoyl chloride. Among synthetic drugs are salicylic acid, sodium salicylate, acetanilide and methyl salicylate. The comparatively new industry of nitrocellulose varnishes and polishes is being catered for in the production of a range of solvents, of which ethyl, butyl, and amyl acetates are important examples. Plasticisers are also exhibited.

Joseph Crosfield & Sons, Ltd.

A unique example of the skill with which the soap maker meets the world's every need for cleansing materials will be seen on Stand A. 22, that of Joseph Crosfield & Sons, Ltd., of Warrington. In household soaps alone there are Crescent, Umbrella, Camel, Guardian Pink, and Rainbow Carbolic soap, which are designed to meet every domestic or institutional need. There are various qualities of bar soap, mottled soap, a series of toilet soaps and Glitto, a well-known polishing powder which finds use not only on inanimate things in the home, but is very efficacious in removing dirt and grease from the hands. In addition to Glitto, there will be seen "Feather Flakes," "Carbosil," and "Persil," products familiar to all. In the midst of such a profusion of cleansing materials, it should not be forgotten that though Messrs. Crosfield apply their "Pyramid" brand to soap, it also applies to the firm's silicate of soda as glass or in solution, or that caustic soda, glycerine, cement, and doucil—a base-exchanging and vapour-absorbing material—are also important products of the firm. All these manufactures will be displayed in addition to the remarkable range of soaps.

The Erasmic Co., Ltd.

On their stand No. 21—the Erasmic Company will include the well-known Peerless Erasmic soap, and will introduce for the first time a complete series of toilet necessities to complete the line. The full series so greatly are we indebted to the arts of the soap maker comprises soap, perfume, face powder, lip stick, "poudre compacte," vanishing cream, bath crystals, shaving sticks, shaving cream, and shaving powder. Of interest also will be the Himalaya Bouquet Series, and the series of toilet articles presented under the title of "Old London Lavender Water." A particular feature of this display will be the artistic presentation of the products in well-designed and attractive containers.

Fletcher Miller, Ltd.

This firm describes itself as the "Engineers' Chemists," and on Stand A. 34 will be seen samples of the cutting and lubricating oils which the firm supplies to the engineering, textile and leather trades at home and abroad. The chief product is "Cooledge" water-soluble cutting oil, which is free from rosin, gumming materials or impurities, free from odour or sediment, economical in use, and is produced under the closest scientific supervision. An

interesting cutting and lubricating product is "Swift" oil, which contains sulphur in permanent suspension, while "Urtenol" is a combination of oils for the textile trades which possesses great penetrative and detergent properties, and enables operations to be simplified, thus increasing the output without danger of weakening the fibres. The use of "Urtenol" is recommended for all textile materials, whether in the caustic boil before bleaching in boiling off, or for wetting out before dyeing and mercerising. It is stated to remove weaving stains due to mineral oils, and prevent any discoloration during storage. "Sorbolene" is a fat liquor for the leather trades, and is used in the tanning and dyeing process to give greater elasticity to the leather and enable fuller shades to be obtained in dyeing.

Gas Light and Coke Company

The Gas Light & Coke Co.'s Products Works will again stage (Stand A. 12) a wide range of tar, ammonia, and cyanogen products, of which the company is the largest individual maker in the country. Road tar of established reputation and reliability is to the fore, and, when properly applied, stands above criticism concerning the alleged poisoning of streams and water-courses. We hear that an innovation is being made in the marketing of the tar this season, which will greatly facilitate its use in road surfacing work in the home counties. The exceptionally efficient distilling plant of the company enables them to make pure benzene and toluene, distilling within a fraction of 1° C., and xylene within 2°—the last-named is unusually high grade.

The phenol of this firm, besides being of good melting point, is noted for its non-reddening colour-keeping quality.

Liquid carbolic acid (cresols) really free from naphthalene, and giving a clear solution in caustic soda, is a standard production, and liquid carbolic acid (50% meta-cresol) is also manufactured. The pyridine bases to be shown are supplied in five grades, yielding 90% at 140°, 160°, 180°, 210° and 230° respectively. The naphthalene is of the best quality, well suited to dye manufacture. Beta-naphthol, free from alpha-naphthol, is a leading intermediate, and salicylic acid is also produced in technical and B.P. qualities.

The principal shades of Prussian blue will be exhibited upon a slowly rotating table, on which the colour will stand out amid the whiteness of naphthalene, the blackness of pitch, and the pallid green of refined anthracene.

Non-caking sulphate of ammonia will be shown as marketed in 2 cwt. bags and in bulk, and also in the small bags favoured in the Japanese market. Liquid ammonia made in all strengths up to saturation point will be on show. Let it be noted that the exhibit is lighted by "daylight" gas mantles, showing everything in its true colours.

The Graesser-Monsanto Chemical Works, Ltd.

When quality and price are equal, it is sometimes an advantage to have another criterion to help in the decision where an order shall be placed. There comes in the question of service. The Graesser-Monsanto Chemical Works, Ltd., having obtained a reputation second to none for quality, are making a special feature

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of "service." The Graesanto Service Department is at the disposal of all their customers. The products of the firm include: Pure phenol, 40/41° C., pure cresols, and cresylic acids, uniform and standardised.

From phenol and cresol the firm manufactures such derivatives as salicylic acid, ortho-cresotinic acid, and both the ortho- and para-chlorophenols. From the technical salicylic acid is made a very attractive-looking B.P. salicylic acid of a high degree of purity, and an acetyl-salicylic acid B.P. of the highest quality and in three types—crystal, powdered and granular. The last-named is of special interest to tablet-makers, as it is possible to use it for tabletting without previous granulation. There are two other products which never escape notice—Vanillin-Monsanto and Saccharin-Monsanto. They both displace Nature's attempts at chemical production. Vanillin-Monsanto has the delicate aroma and true flavour of the vanilla bean: but it is 40 to 50 times stronger in flavouring strength, it is made under hygienic conditions in ideal surroundings, and every batch is guaranteed to be uniform in quality and strength. Vanillin-Monsanto has helped in making some of the world's most famous chocolates. Saccharin-Monsanto is known the world over; it is 550 times stronger than sugar, and, in addition, has the advantages of uniformity and purity. It saves labour and storage space, and is very economical in use.

Hopkin & Williams, Ltd.

This firm will show on Stand No. A. 32 their well-known chemical reagents for analytical and research purposes, prepared to specifications in their book, "Analytical reagents, standards and tests," which has passed several editions since it was published in 1911. This firm have been manufacturing fine chemicals since the middle of last century, and already before the late war were producing between two and three thousand articles of this description. Since then this number has been largely increased, and they are showing a few typical substances which will indicate the wide range of the work they are undertaking. Among the exhibits will be found adipic acid, cyclohexylchloride, methyl benzothiazole, hydrazine hydrochloride, nitroso-beta-naphthol, potassium hydrogen phthalate, mandelic acid, hippuric acid, glycine, and a number of organic sulphides and mercaptans. They are also manufacturing indicators used for hydrogen-ion determination, whilst another part of the chemical manufacture in which they specialise is the preparation of uranium salts. Chemical solutions for separation of mineral mixture—Clerici's solution, cadmium borotungstate, and so on—are also shown.

The company has also a branch established in Travancore, which exploits monazite sand and the accompanying sand ilmenite and zircon. Monazite sand products are dealt with by their associated company, Thorium, Ltd., at Ilford, who are showing a full range of thorium and the allied rare-earth salts. It should be noticed that this company has succeeded in establishing the rare-earth industry in England in spite of competition from abroad, and has provided a source of thorium free from foreign control for the incandescent mantle trade.

A by-product in the treatment of monazite sand is meso-thorium, which closely resembles radium, and is

much used in the preparation of luminous compounds for gun-sights, compass and watch dials, etc. Monazite sand contains only about the equivalent of 9 milligrams of meso-thorium per ton, but, notwithstanding this exceedingly minute proportion, Thorium, Ltd., succeed in extracting two-thirds or three-quarters of the total amount present. Specimens of self-luminous preparations are shown. A collection of cerium, lanthanum, neodymium and praseodymium salts are shown, some of which have already found application in various industries.

An interesting and valuable development is the use of ilmenite, which accompanies monazite in the sand deposits, as a source of white titanium pigment, used to replace zinc oxide and white lead in the manufacture of paint. The titanium pigment is a white substance comprised chiefly of titanium oxide which has a greater covering power than either zinc oxide or white lead, and is likely in the future very largely to displace white lead on account of its innocuous character.

As a by-product in the treatment of ilmenite, a very pure form of iron is obtained, quite free from silicon and titanium, which will probably find some important metallurgical application. The other chief mineral accompanying ilmenite, viz., zircon, is a source of zirconium oxide, a highly refractory substance used for the construction of furnace bricks and similar substances.

Howards & Sons, Ltd.

Howards & Sons, Ltd., of Ilford, who occupy Stand No. A. 5 in the Chemical Section, are one of the oldest established firms in the chemical trade. They were established in 1797 by Luke Howard, F.R.S., quaintly described in the public Press of that period as a "most respectable chymist" and a well-known figure in the scientific world of his day. At about this time the employees numbered about eight, and it is significant of the value placed upon the firm's products that the steadily increasing demand for "Howards' quality" has led to such expansion that the firm now employs over 500 chemists and workpeople, and the factory at Ilford covers over half a million square feet of floor space.

Among the fine chemicals the manufacture of which has contributed so much to the firm's reputation, specimens will be shown of Howards' quinine, first made by the firm over 100 years ago, and to-day the only quinine made in England; also of its salts and derivatives. Among other products of the firm may be mentioned benzoates, bromides, ethers, aspirin, iodides, mercurials, bismuths, caffeine, calcium lactate, calomel, camphor, cinchona preparations, Epsom and Glauber salts, iron salts, hydrogen peroxide, lithias, magnesias, synthetic menthol, pulv. seidlitz and soda tart., sodii bicarb., salicylates, medicinal spirits, syrup ferri. phosph., zinc salts, thymol, agotan, the great remedy for rheumatism, and medicinal tablets of all kinds.

It will be of interest to our readers to note the newer developments at Howards' Ilford factory. As the result of very considerable and costly work in their research laboratories, they have recently placed on the market some very important solvents of the cyclohexanol group, i.e., cyclohexanol pure, cyclohexanol

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commercial, "Sextol," cyclohexanone, "Sextone," methyl cyclohexanone, "Sextone B," cyclohexanol acetate, "Sextate," cyclohexanol phthalate, ethyl oleate and diacetone alcohol. These new solvents and plasticisers are of the greatest importance, and have shown excellent results as solvents for incorporation in soaps for textile, laundry and dry-cleaning purposes, preparing drilling oils and emulsions for machinery and textile trades, polishes for wood, boots, metal, as a penetrating agent and "leveller" in dyeing, and solvents for fats, oils, resins, shellacs, celluloid, rubber, gums in the varnish, paint, enamel, rubber, artificial leather, waterproofing, etc., industries. In the manufacture of cellulose lacquers, Howards' Sextone and Sextone B are extremely valuable as solvents of nitrocellulose of the "medium-boiler" type, assisting the flow of lacquer and preventing "blushing." Frequently, when a new preparation is discovered showing any great improvement over old methods, the price is found to be a great difficulty, but in this instance the manufacturers claim that Sextone B is the cheapest "medium-boiling" solvent on the market. Lacquers containing Sextone can be brushed or sprayed on, and they give very hard coats on drying. There is a vast number of uses for these new solvents, and fresh fields are continually being explored.

Johnson & Sons, Ltd.

This firm makes assaying, mining and general chemicals, but it is perhaps best known to the general public as the source of the convenient packets of British-made photographic developers, such as Amidol-Johnsons, Metol-Johnsons, Hydrokinone, Pyrogallol-Johnsons, and Glycin. All these developers, which are made by the firm in large quantities in thoroughly up-to-date plant in an equally up-to-date works at Hendon, will be exhibited on Stand A. 27, in addition to the packets, solutions, Scaloids, etc. required by the amateur photographer. Other interesting exhibits to be seen on this stand are gold chloride and silver nitrate, as well as caustics, test books, and a range of pharmaceutical, general, technical and fine chemicals. The display will interest anyone who is interested in photography, either from a professional, process, medical or amateur viewpoint, but the consumer of chemicals for technical, laboratory or factory use will find not a little to interest him as well.

Malehurst Barytes Co., Ltd.

At Stand No. A. 35 will be displayed the firm's various grades of fine-ground barytes, which are entirely of British manufacture, the mineral being mined from the company's own mines at Minsterley, in Shropshire, and prepared in its own works. A great deal of up-to-date machinery has been installed to enable the barytes to be dealt with in a proper, scientific manner. Amongst other points in connexion with the firm's barytes, we may note that it is all air-leveigated. In addition to exhibits of various grades of barytes, there will be shown on the stand various instruments which are used in the examination and testing of the firm's products.

May & Baker, Ltd.

The products manufactured by this firm cover a very wide range, and on its stand (Nos. A. 9 and A. 11) will be

found both chemicals of interest to many branches of technical industry as well as some of the latest achievements in the application of chemistry to the cure of disease.

In the latter domain the firm has always held a prominent position in the manufacture of those arsenical products used in the treatment of syphilis and of tropical diseases. Arsenobillon (606), novarsenobillon (914) and arseno argenticum (silver-salvarsan) have all been manufactured by the firm since the earliest days of their introduction into therapeutics. To these products must now be added tryparsumide, an organic arsenic compound, the outcome of research in the Rockefeller Institute of New York, which is being successfully employed in the treatment of neuro-syphilis and sleeping sickness. The manufacture of this product is carried on in this country solely by this firm under licence from the Rockefeller Institute. Another product manufactured by this firm of the same category, which is finding increasing favour in the treatment of amoebic dysentery is Stovarsol (acetyloxyaminophenyl-arsinic acid).

The use of bismuth in the treatment of syphilis has proved to be of considerable value when used in conjunction with arsenic. One of the most useful of such products is Bistovol, the outcome of investigations carried out in the Pasteur Institute of Paris by Prof. Levaditi. This product is a combination of bismuth and stovarsol, and is now manufactured by this firm. Other interesting bismuth preparations are shown. Other products of therapeutic value are Mercurochrome, a mercury compound of fluorescein, a powerful antiseptic of low toxicity, and Mentarine, a new diuretic, which is a derivative of theobromine.

Hypnotics are important specialities of this firm. Butylethylmalonylurea is manufactured and supplied by them under the name of Soneryl, and has been largely adopted in medical practice. Other hypnotics and sedatives are phenobarbital and its sodium salt, which are manufactured and supplied by the firm under the trade name of Gardenal and Gardenal-sodium. The introduction of these products represents a great advance in the therapy of epilepsy, in the treatment of which Gardenal has been shown to be a highly effective palliative. As in the case of Soneryl, there is no tendency to habit formation with the use of gardenal.

In addition to the foregoing, the firm manufactures all the more generally-employed preparations of the various pharmacopœias. Foremost among such preparations may be mentioned the various salts of bismuth. Among anaesthetics, pure ether and chloroform are represented. Baker's anaesthetic ether answers the most stringent tests for purity, and the pure chloroform for anaesthesia is of equally high standard. Among other pharmacopœial products manufactured may be mentioned barium sulphate (for X-ray examinations), calomel and other mercurial preparations, camphor, bromides, iodine, and iodides, lithium salts, rochelle salt, seidlitz powder, etc.

On the more purely industrial side, first and foremost stand the mercurials. The firm is the largest manufacturer of mercurial salts in the Empire. Among these may be mentioned red and yellow oxides of mercury, used largely in the preparation of antifouling paints.

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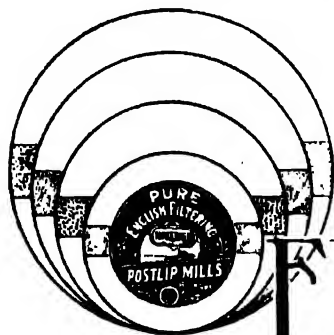
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Attention may also be drawn to the manufacture of solvents, *e.g.*, ether technical, all qualities, chloroform, amyl acetate, etc., to saponin, which finds employment in many directions, to diphenylguanidine, which is the standard accelerator in the rubber industry, to cyanides, molybdates, and many other similar products which find employment in all those industries in which chemistry bears a part.

Thomas Morson & Son, Ltd.

This exhibit (Stand A. 4) will consist chiefly of a demonstration of colloidal powders by means of special apparatus designed to show the very fine character of the individual particles of Osmo-Kaolin "Morson" and bismuth carbonate "Morson." Firstly by means of a "powder fountain" a fine spray of the material is thrown up inside a glass-sided case. The fountain is illuminated by powerful beams of light, and after a while the interior of the case is filled with a "powder fog."

The movement of the particles of colloidal powder is thus seen clearly, and the extremely fine condition of the powder may be readily appreciated. The extraordinary illumination effects as the fog of powder slowly clears are very striking, and the demonstration will provide an excellent example of the action of powder whose particles are in such a fine state of sub-division. Such finely divided matter possesses the property of increased physical and chemical activity, and therein lies the value of the medicinal action and applications in technical operations.

Aerosols, or finely divided matter dispersed in a gas, are closely similar to the corresponding hydrosols, or colloids formed as a result of the disperse systems of sols in water. In recent years it has been shown that the normal characteristics of a substance are profoundly altered when it is reduced to a finely divided state. This is due to the large specific surface which renders the substance more directly available for intimate activity. In the two products, Osmo-Kaolin and bismuth carbonate, forming the outstanding features of this exhibit, the above characteristics are ingeniously demonstrated.

Other products, such as iodides, glycerophosphates, Kreosote and scale preparations which have been manufactured by Thomas Morson & Son, Ltd., for many years, are also shown in addition to a number of chemicals used more particularly for technical purposes.

Salt Union, Ltd.

The exhibit (Stand No. A. 23) is designed to show the large number of products manufactured from natural brine by the Salt Union, Ltd. There is a model at the front of the stand of the Winsford Vacuum Works, where pure dried vacuum salt is manufactured under the most modern scientific conditions, the whole process being carried out in such a way that the salt is not touched by hand at any stage. At these works, also, a number of

well-known table salts are manufactured and packed under the most hygienic conditions. Amongst these may be mentioned Union Salt, Falk Salt, Falcon Salt, and the new iodised salt "Salodine," all of which are displayed in this exhibit.

Other products which are displayed and to which special attention is drawn are: A full range of the different grades of evaporated salt, from the coarse bay salt to the very fine dairy and table salt. "Tansel" is a specially prepared salt for curing hides. It effectively prevents the growth on the hide of those micro-organisms which have been shown to be the cause of salt stains. Owing to the careful grading of the crystals "Tansel" produces a maximum salting effect in a minimum time. Light carbonate of magnesia and calcium carbonate are by-products recovered in the special process of purification of brine for the production of pure salt. This calcium carbonate is particularly suited for stone-dusting in collieries, owing to its fine state of division and freedom from caustic alkalis. "Salunol" (hypochlorite of soda) is largely used in the bleaching of goods in the textile industry throughout the country, and is also a powerful disinfectant. Bleaching powder and caustic soda (solid and liquid) are produced by electrolysis of brine at the company's Weston Point works.

"Cut lumps" are made in handy sizes from the old-fashioned salt squares, and are carefully packed in such a way that they are received in a clean dry condition. Salt cubes are similar to the above, but of such a size that one cube is equal to a teaspoonful of salt. "Congo blocks" and "Dominoes" are used as currency by the natives on the West Coast of Africa, and therefore great care has to be exercised in their manufacture to ensure that they are of exact size and weight.

South Metropolitan Gas Co.

Visitors at the Fair will be pleased to feel an "Old World" atmosphere in stand arrangement in the Chemical Section. "At the Sign of the Benzene Ring" (Stand A. 15) is the replica of an ancient tavern, which presents some idea of the chemical operations of the South Metropolitan Gas Company, whose activities have extended throughout South London for over a century.

The tavern is constructed in an agreeable manner—so much so that it is hoped that enquirers will be drawn within its comfortable portals and rest awhile in cosy settles before a blazing log fire (a recent production of the company) and in these congenial surroundings a Metro representative will explain, if it be wished, how Metro creosote is used on the timberwork of the tavern, how Metro road tar has made the path smooth and firm to the door, how the crazy-paved courtyard is interestingly exemplified by the presence of Metro sulphate of ammonia in bulk.

As well as the prominent display of Metro disinfectant fluid, black varnish, motor benzol, etc., many samples of coal tar and ammonia products and inorganic products will be seen at the lattice windows of the inn, leaded windows in which is incorporated the symbolic "Benzene Ring" to emphasise to many industries the importance of benzene, naphthalene and anthracene—Metro manufactures.

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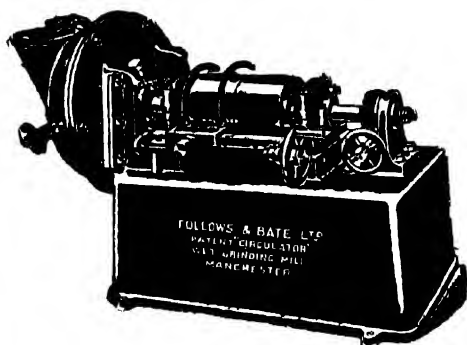
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At Stand No. A. 25 some very interesting exhibits will be provided by Thomas Tyrer & Co., who will first of all delight the chemist by the show of sterling brand analytical reagents, and will then interest him by the display of manufacturing technique afforded by the exhibits of pharmaceutically pure bismuth carbonate in a wide range of densities. Fine plates of metallic bismuth showing interference colours will again lend themselves to trap the unwary visitor into thinking that they are coal-tar dyestuffs. Then there will be specialities such as the cobalt compounds used as driers for paints and the like; nickel salts (including nickel formate, previously only made in America, but now made by Thomas Tyrers in important quantities for use in hydrogenating oils) for use in the preparation of nickel catalysts; very pure chemicals for use in certain photographic processes, and various other chemical products of industrial importance. Of special interest are the scale preparations, including a series of double citrate, and there are the citrates of sodium and potash (such valuable aids in the feeding of infants), as well as a series of bismuth salts.

Whiffen & Sons, Ltd.

This exhibit (Stand No. A. 1) will consist of pharmaceutical and technical fine chemicals, manufactured at the company's Battersea and Fulham Works. The specimens are commercial samples and representative of bulk supplied in execution of orders. It is of interest to note that the firm, Whiffen & Sons, Ltd., comprises the original business of Thomas Whiffen, established in 1859 at Battersea, with which is incorporated the much older business of George Atkinson & Co., established as far back as 1654, and acquired by the late Thomas Whiffen in 1887. In the veterans' race for the oldest firm still in existence this claim to date back to the time of Cromwell surely entitles them to a place in the final heat. Prior to 1884, whilst manufacturing was permitted within the City boundaries, George Atkinson's factory stood at No. 66, Aldersgate Street, E.C. In 1884 it was removed to Southall, and remained there until 1923, when it was removed to the present modern riverside premises at Carnwath Road, Fulham, which still preserve the original title of "Aldersgate Chemical Works."

Among the items of outstanding interest are specimens of iodide and bromide preparations, present in comprehensive array and forming one of the staple products of the firm, in which they have specialised upwards of a century.

There will also be vermilion in all shades, pale orange to deep red. Some of the specimens have been exposed to light for more than fifty years without deterioration. Details of the firm's transactions in vermilion exist that date back two centuries. Among other distinctive specimens will be noticed:—Caffeine in masses of unbroken acicular crystals, unmatched for appearance and purity; and emetine and the principal salts, standard preparations for hypodermic administration.

There are also:—Quinine salts, complying with requirements of the various official standards; this special manufacture has been carried on at Battersea for upwards of 70 years. Nicotine for horticultural

purposes, manufactured under Customs' supervision since 1890, also nicotine pure for medicinal use, and salicylate and tartrate salts for treatment of skin disease. Strychnine and salts in bulk and in one ounce bottles under the brand "Jacob Hulle," by which it has been known for 75 years (Whiffen & Sons, Ltd., claim to be the oldest British manufacturers of strychnine). Salicin, the active principle of willow bark, discovered by Leront in 1830 and first manufactured by Thomas Whiffen in 1876. Camphor, resublimed from crude, in bells, tablets and flowers of bulky form and exceptionally white appearance. Other interesting specimens include atropine, pure and sulphate, hyoscyne and hyoscyamine, theobromine, prunella balls in new small sizes, samples of essential oils distilled at Fulham, and expressed oil of almonds answering all B.P. tests and extra pale in colour.

Williams (Hounslow), Ltd.

This firm (Stand No. A. 26) will be exhibiting a full range of their dyestuffs in crystals and powder, soluble in water, spirit, oil, wax, benzene, naphtha, etc., for application to leather, boot and floor polishes, soaps, inks (writing, ruling, endorsing and printing), wood, spirit, and oil varnishes, nitrocellulose lacquers, cotton, wool, silk, jute, hemp, coir yarn, cinematograph films, rubber buttons, horn, ivory, bath salts, raffia, lake-making, etc., and in addition to the dyes themselves they display various articles showing the application of the dyes. A special section will be devoted to harmless colours for foodstuffs etc., of which the firm are the leading specialists in the country. The firm are in a position to supply dyes in strict conformity with the laws of all the principal countries of the world. In addition, particular mention should be made of the firm's nigrosines and indulines, of which they are the oldest and largest makers in the United Kingdom.

IN OTHER SECTIONS**Ayrton Saunders & Co., Ltd.**

The exhibit on Stand No. A. 32 will be mainly pharmaceutical in character, and will include specimens of the Crookes' Collosols, as the firm is the export distributing agent for the products of the Crookes Laboratories. The Collosol products include colloidal preparations used by the medical profession, such as Collosol sulphur, iodine, aurum, argentum, selenium, kaolin, ferro-manganese, calcium, antimony, manganese, and palladium, as well as colloidal preparations of cod-liver oil, aluminium hydroxide, and so on.

Beetle Products Co., Ltd.

This firm, which is associated with British Cyanides, Ltd., is showing (Stand No. G. 21) its synthetic resin in various forms, as well as white moulding powders for electrical fittings and similar work, and coloured moulding powders with which translucent effects can be obtained.

Birkbys, Ltd.

The chief exhibit on this Stand No. J. 138 will be "Elo," a synthetic resin, for use in making mouldings, as insulating powder and for many other uses. This

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Thermometers of an improved type are made by this London firm (Stand No. J. 205) to meet the requirements of industry or research laboratories for any range between -200° C. and +520° C. These precision thermometers have thermometric glass bulbs (N.P.L. standard blue stripe), are filled with nitrogen, and are claimed to be practically permanent, so that after long use the error, if any, is very small.

Blackie & Son, Ltd.

This well-known firm of publishers is to be housed at Stand No. L. 184, where its many books will be represented. Many well-known technical and scientific books have been published by this firm, such as, to mention a few, Dr. Cranston's "Structure of matter," Martin and Gamble's "Colour and methods of colour reproduction," "Photography as a scientific implement," Sexton and Davidson's "Fuel and refractory materials." These will be represented, as will be others of the "Applied Physics Series," mathematical books, dictionaries, and so on.

The Guelph Patent Cask Co., Ltd.

On Stand No. K. 65 will be found samples of the casks made at Millwall by the Guelph Patent Cask Company. The speciality to be shown this year for the first time is a cask with a paper bag lining. For many purposes this is in every way as effective as the "lined" style of cask, whilst it has the advantage of being considerably cheaper. The Guelph casks are made of birch grown in the company's forests in Canada, and are supplied in nine diameters, ranging from 10—22½ in., and in lengths from 10—34 in., increasing in quarter-inch stages. Thus it is possible to supply a cask which can be wholly filled, whereas a partly-filled cask will be subjected to risk of breakage from blows from its contents in the rough handling which is inevitable during transport. Four main types of cask are supplied: the "Plain" for ordinary dry goods or pasty materials like soap; "Iron-bound," preferred for the export trade on account of their strength; "Lined" with cardboard or paper, and used for dyes and chemicals, being tight enough to hold the finest powder; and "Tin-lined," used to convey liquids and goods which deteriorate on exposure to the air, being both waterproof and airproof.

Thomas Hedley & Co., Ltd.

As well as in the Chemical Section, soaps are also to be found in the main hall at Stand No. D. 56, where Messrs. Thomas Hedley & Co., Ltd., of Newcastle-on-Tyne, are showing Fairy olive oil soap, Fairy soap flakes, Dyso (ammonia wash powder), Fairy toilet, carbolic and other soaps, candles, "Glim" scouring powder, and the "Fleuroil" disinfectant spray.

James A. Jobling & Co., Ltd.

In another Section is the stand—No. G. 63—of James A. Jobling & Co., the manufacturers of the well-known Pyrex glass. Some fine products for domestic use will be on view, such as Pyrex transparent ovenware. Even the homely teapot has become magically transparent and translated in Pyrex. There will be a range of Pyrex heat-resisting glass globes for lighting purposes, and, of course, a comprehensive display of Pyrex laboratory glassware—beakers in all the necessary forms, as well as flasks, distilling flasks, moisture-test flasks, beaker flasks, evaporating dishes, test tubes, and a range of glass tubing in various thicknesses. Of interest is the Pyrex capillary tubing. It will be remembered that Pyrex is a low-expansion borosilicate glass of great stability, resistance to acids and alkalis, and hardness. The low coefficient of expansion makes it possible to produce Pyrex beakers and flasks with walls thicker than usual, which greatly increases the durability of the vessels without diminishing the resistance to sudden heating and cooling.

Ogilvy & Co.

This London firm of optical engineers is showing on Stand No. J. 203 an interesting selection of microscopical apparatus, amongst which we may mention a cheap, but well-made, microscope suitable for science classes. The exhibits also include a very neat micro-projection drawing apparatus which can be fitted to any standard microscope; a Brinell-Ogilvy microscope for measuring Brinell impressions or for use as a general workshop microscope; a variety of models of microscopical illuminating apparatus; and a very accurate Akehurst-Ogilvy substage mechanism, which can be adapted to any full-size microscope.

Stewarts & Lloyds, Ltd.

The exhibit of this Glasgow firm, which is to be found in another Section, is of considerable interest to chemical engineers, who can do little without piping. From the point of view of pipe work alone this exhibit will well repay attention.

Wilson, Warden & Co., Ltd.

Amongst an array of aneroid barometers and meteorological instruments on Stand No. J. 54 are some interesting barographs, thermographs and hygrographs, which are supplied, not only in the ordinary form, but also constructed with a solid white metal, which is non-corrodible, and is suitable for places where corrosion is likely or for humid climates.

Wray Optical Works, Ltd.

Stand No. J. 206 will be rich in photographic lenses, process lenses and prisms and so on, a specially interesting exhibit being the Kingslake Nephelometer, which is claimed to be the most accurate instrument yet designed for the measurement of the turbidity of liquids. Determinations of turbidity (opalescence) often form a convenient and sensitive method of quantitative analysis, and the instrument should be of interest to chemists. Sets of light filters will also be exhibited.

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at
**THE ROYAL AGRICULTURAL HALL,
London.**

**THE INTERNATIONAL OIL,
CHEMICAL AND COLOUR
TRADES EXHIBITION**



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INTERNATIONAL OIL, CHEMICAL, AND COLOUR TRADES EXHIBITION

* From all accounts, it appears that the International Oil, Chemical and Colour Trades Exhibition, which will be held from June 11 to 18 at the Royal Agricultural Hall, in London, promises to be highly successful. The exhibition is the first of its kind in this country, and it is of a different nature from the usual type of exhibition. The industries which use and make chemical products are so wide spread and so intimately related with the chemical plant industry and the oil industry, that it became necessary to bring all these groups together to ensure a comprehensive display not confined to one or more sections of the industry. From the notes about the exhibits which we print below it will be seen that the different branches, both large and small, of the industry are very well represented. The time of year is propitious for an exhibition, the British makers of chemicals, colours and plant have many interesting products to show, and contrast is added by the presence of foreign manufacturers. Under such conditions an interesting and successful week seems certain. In the notes on the exhibits which we are able to print, thanks to the courtesy of the various exhibitors, the different firms are mentioned in alphabetical order.

Albro Fillers & Engineering Co., Ltd.

A range of vacuum-operated fillers will be shown. The single-head type is hand-operated, stands on a bench, and is suited for filling bottles with varnish stains, dyes and other liquids. Other types include the two-head, operated by a pedal; the automatic three-head, and the six-head fillers. Rotary types, either hand-fed or automatically operated, are supplied with from 6 to 16 heads, the output of the 16-head rotary machine being 80 bottles a minute. Other machines are an enclosed vacuum-operated powder filler for filling bottles, tins, jars, cartons, but not paper bags; various types of the firm's automatic trip-motion fillers for paint, varnish, oils, etc.; a lidding machine; and so on.

Morris Ashby, Ltd.

Samples will be shown representing the products of the largest zinc-oxide manufacturers in the world, including zinc oxide both in bulk and made up into paint, and painted panels. Demonstrations will be given of the methods for testing the fastness to light, and lithopone will be available in powder and paint form, as well as on painted panels. In addition to samples of vegetable and lamp blacks and gas carbon blacks, there will be specimens of Gilsonite—for which the firm is the sole agent in the United Kingdom—in its raw state. Gilsonite is used in the varnish trade and in making black and bituminous plant, and its various uses will be illustrated.

Attwood's Spraying Equipment, Ltd.

This exhibit will consist of all the firm's spraying units, including the following types: the "V" pistol, the "V.S." pistol with spreader nozzle, the "D" pistol, and the "A" and "B" air brushes. Various examples

of work done with this spraying equipment, which includes exhaust cabinets and fans and portable outfits, will be on view.

W. & T. Avery, Ltd.

This stand emphasises the fact that weighing machines used in industry need to be suited for their particular purpose; and in order to increase the economic value of the scales, they should give *visible* indications of weight, with the elimination of as many hand operations as possible. Most of the scales exhibited call for only *one* hand operation; the others, none at all. One scale, called No. A 557, "load and look" platform weigher, actually will not give a weight indication at all if the single hand operation—a much simplified movement—is not executed correctly. The scales of most interest to the trade, however, will probably be Nos. A 771 and No. 45. The first (A 771) can be set so that a run of containers can be filled to a pre-determined load in quick time, without fresh settings of the scales. The second (No. 41) is a fully automatic liquid weigher, which requires no attention during weighing operations. It is actuated by gravity, and total weights can be easily calculated from the indications of the automatic counter attachment. A similar type, No. 45, is suitable for dry, free-running granular material. Many other interesting machines are shown.

W. & S. Barron & Son, Ltd.

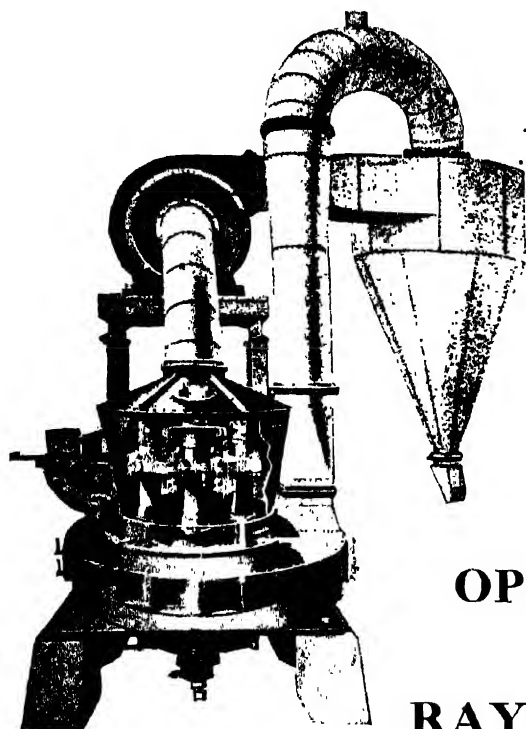
Three machines, in various sizes, are to be shown by this Gloucester firm. The first is the 36-in. size "Dreadnought" grinder, fitted with natural burr stones and designed to do all classes of fine grinding—colours, chemicals, oxides, etc.—usually done on flat grindstones. This grinder is claimed to possess all the advantages of the flat millstone as regards quality of work, whilst little floor space is occupied, and maintenance charges and stone dressing are reduced to a minimum. The second machine is the Barron impact grinder—really an improved form of disintegrator—which grinds and dresses in one operation. It grinds everything that a disintegrator can deal with, and to greater fineness, and it will reduce many substances which a disintegrator will not handle. The third machine will thoroughly sift and intimately blend a wide range of dry powders, such as self-raising flours, tooth powders, colours, tartaric acid, and so on.

Chas. H. Betts & Co., Ltd.

This firm will exhibit samples of bronze, aluminium and lustre powders, gold enamels, lacquers, leather stains, etc. Amongst the exhibits is "Bituminol" varnish, an elastic black coating for iron, steel, woodwork, corrugated sheets, etc., which resists acid fumes or sea water, and has high electrical insulation properties.

Blackstone & Co., Ltd.

The chief exhibit will be a Blackstone fuel oil engine, developing 55 b.h.p. at 240 rev. per min. This engine starts from cold on any grade of fuel oil that can be



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pumped, the fuel being injected mechanically by a special "spring injection" device. The fuel consumption is very low, 0.4 lb. per b.h.p.-hr. for full and $\frac{3}{4}$ load in the single-cylinder types of 50 b.h.p. and over. There is also the Blackstone fuel oil heater and purifier, which both filters and heats the oil, and a combined petrol engine and compressor, for charging compressed air bottles.

S. Briggs & Co., Ltd.

Stainless steel, Corronil and Monel metal are amongst the metals in which this Burton-on-Trent firm specialises. On the stand will be found steam-jacketed pans in stainless steel, Corronil and Monel metals, as well as in aluminium and tinned copper. A well-finished copper still will occupy the central position, and varnish pans in varying sizes will also be shown.

E. A. Brough & Co.

On the stand of this Liverpool firm of iron and sheet metal workers and welders will be shown various classes of drums and tapers, including a number of drums subjected to severe tests made at the Liverpool University and by other independent authorities. Of special interest will be a demonstration of welding, showing particularly how the firm's "indestructible" steel necks are welded on to the drums.

'Buhler Brothers

Four machines will be shown on this stand. First comes a Buhler 4-roll grinding mill, which is distinguished by its three grinding passages. Some interesting features are to be noted in the construction of the mill, which is used for grinding pigments in turpentine, for paste or liquid paints and colours in spirit, as well as for printer's ink. A 3-roll mill is also shown, which is used when the large output of the 4-roll machine is not required. For dry colours, the hammer mill is shown, a type in which the sieves can be changed very quickly. The fourth machine is the "Detacheur," running at 2800 rev. per min., and used for grinding and sieving dry colours.

Building & Metal Export Co.

The exhibit will include red lead, white lead, orange lead, litharge (canary and half-flake), and acetate of lead, manufactured by the Società Lavorazione Metalli, Minerali e Derivati di Milan, a combine of Italian producers, for which the company is the sole agent.

Bush, Beach & Gent, Ltd.

Amongst the exhibits will be sal ammoniac, anhydrous ammonia (synthetic), calcium chloride, potassium hydroxide, carbonate, nitrate, and permanganate, barium carbonate and sodium nitrate, a variety of chemicals for the paint trade, and samples of "Carboraffin" and "Decolit" decolorising carbons. Associated with this stand is the exhibit of the London Fumigation Co., Ltd., which is showing "Zyklon B," the latest development in the use of hydrogen cyanide as a fumigator, and "Horo," for the extermination of rodent pests in the open.

J. Harrison Carter, Ltd.

A variety of interesting exhibits will be on view at this stand. In the electro-magnetic separator, which can also be used as an automatic feeder, separation is effected by

one or more pairs of electro-magnets mounted in a reciprocating tray, cut-out valves being provided to cut off the feed if the current fails. In the new model the dynamo used to excite the magnets will be driven from the crankshaft, thus rendering the machine independent of external supplies of electrical power. A mixer and kneader will be shown, suitable for moist and sticky materials, but also suitable for dry powders which are not too different in gravity. The machine is designed for a power drive, but hand-operated types are available. A mill is shown which grinds a wide variety of materials—colours, whiting, steamed, dried or green bones, paper pulp, bread, shellac, and many more. The hand-driven vertical end runner mill shown is useful for laboratory work, requiring the treatment of small amounts of colours. This mill can be cleaned very easily, and is available with pestle and mortar made of various materials. One size of grinding and kibbling mill is shown which is specially useful for breaking up lumpy materials in small quantities, but can be fitted with special plates for fine grinding. The firm's granite and iron edge runners will also be exhibited.

Cornbrook Chemical Co., Ltd.

This Stockport firm is showing a wide range of lake and fine pigment colours in lump form, together with examples of the finished articles coloured with these products. Paper dyed with Prussian blue, coated papers of various shades and qualities, linoleum, window blinds, paints and enamels, printing inks—these are some of the more striking forms in which colours will appeal to the eye.

John Dale Manufacturing Co.

On Stand No. 5 will be found a varied assortment of boxes and canisters made of tinplate, both plain and decorated, suitable for powders, pastes or liquids.

Aluminium containers are shown which are specially designed for the perfumery and allied trades. Collapsible tubes and perfume sprinklers are on view, and there is an interesting display of the stoppers with composition heads which are becoming so popular for bottled goods. The stoppers may be had with specially embossed designs, and in all colours.

J. Davies & Allen

Special lines of gold and silver paint, unmixed, known as "Glossolar" gold and silver enamel, as well as aluminium paint, bronze powder and aluminium powder in all shades and qualities, "Glossolar" art enamels and products such as stencils, brushes, etc. are shown.

Thos. Firth & Sons, Ltd.

A comprehensive range of manufactures made from Firth "Staybrite" and stainless steel is exhibited by this well-known Sheffield firm. "Staybrite" steel has a yield point of about 15 tons per sq. in. and an elongation of 55% to 70%, this exceptional ductility being combined with a remarkable resistance to corrosion. It may be cold-pressed to a degree far in advance of the so-called "stainless iron," and, moreover, it presents no difficulties in manipulation, since it can be welded, soldered, brazed and riveted without trouble. The exhibits will demonstrate the extraordinary resistance

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make these and can in all probability give you what you require,
whilst for **Copper, Brass or Cupra Nickel Tubes** you might
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Yours faithfully,

THE BRITISH CHEMICAL PLANT
MANUFACTURERS' ASSOCIATION.



British Plant for British Chemicals

of Firth "Staybrite" and stainless steels to the action of boiling acids such as nitric and nitro-sulphuric mixtures and many other chemicals, in addition to the corrosive action of paint. Numerous examples of chemical plant and apparatus made from these materials will be on view.

T. B. Ford, Ltd.

At Stands "C," Nos. 75 and 80, may be seen an excellent range of filter papers in sheets and circles of various sizes, and in white, grey and pink colours, also filter pulp with and without asbestos. The papers and pulp are of a high standard of quality, and have been produced after long and careful study of the particular requirements of the oil, chemical, and colour trades, of beer and vinegar brewers, wine and spirit bottlers, maltsters, sugar refiners, and so on, and have proved after long usage to give excellent results in filtration. For analytical, quantitative, qualitative and pharmaceutical purposes in laboratories and schools, this firm provides three high-grade filter papers of a very low ash weight and a perfect level sheet of equal filtering power all over.

Joseph Foster & Sons

This exhibit consists of motor-driven mixers suitable for mixing or diluting paints, enamels, inks, pastes, patent foods and so on. Three types will be shown, the type "A" vertical mixer being provided with two sets of stirrers, which revolve in opposite directions: the capacity is 25 galls. Type "B" vertical mixer, of 20 galls. capacity, has also two sets of stirrers, which revolve on their own axes and rotate round the centre of the pan; both types possess means for lifting the stirrers out of the pan. A horizontal mixer is shown, in which the two sets of stirrers revolve in the same direction; this machine has a working capacity of 16 galls.

Fullers' Earth Union, Ltd.

Fullers' earth is a material which has been used for many centuries, but this exhibit may cause some surprise to those who are not aware of the many grades which this company prepares from material mined in its quarries and mines in Surrey and Somerset. The material is shown in its natural state as well as in a variety of final products as used for various purposes. A selection of coloured earths illustrates the capacity which fullers' earth possesses for absorbing and carrying colours, whilst its use for refining and bleaching oils is shown by samples of oils such as palm kernel, rape, cottonseed, nut, soya and so on, both raw and after treatment. A pure colloidal clay made by the electro-osmosis process will be exhibited, the extreme fineness of the material which remains suspended in air like fog being demonstrated by means of powder-spray fountains. A series of microscope slides enables the visitor to study the physical nature of this clay and of fullers' earth, whilst a sectional scale model of the company's mines in Somerset depicts the origin of the material.

Wm. Gardner & Sons (Gloucester), Ltd.

A large exhibit of the latest productions of this firm will illustrate the wide variety of machines made for grinding, sifting, blending and drying powders. There

will be the Gardner "Rapid" sifter and mixer for all dry powders, "Rapid" dryers for rapidly removing moisture from powders, the "Rapid" sifter, mixer, and essence spray for adding liquids, essences and so on to powders during mixing, and machinery for spraying and adding moisture to powders. Amongst the mills are ball mills with various types of lining, and roller grinding mills, and there are the "Quick-Change" dressing machines, with removable barrels to sift coarse or finest grades, the "Rapid" grinder and sifter for grinding and sifting in one operation, a diaphragmic feeder for adding colours, improvers, etc. to bulk material, an agitator mixer, a machine for shredding and granulating wax—and more beside.

The Building Trades Practical Laboratory

This Grimsby firm (proprietors, The Graphite Oils Co., Ltd.) is showing almost exclusively a series of bitumen compound waterproofing materials for application in plastic or semi-liquid consistency. The centre of attraction is a small building erected with common bricks and roofed partly with old slates, partly with porous tiles and some asbestos cement tiles. The walls and roof have been treated in patches with "Protion," which is a red bitumen compound having a finishing colour similar to pressed bricks of deep tone. The makers state that in the process of rendering a wall or roof waterproof the property is simultaneously given a pleasing appearance. "Slatex" semi-liquid bituminous waterproofer for slate roofs is also exhibited. This is slate grey in colour, whilst "Rufoid," an easy working plastic for flat roof insulation and general maintenance work, is also shown with examples of uses in waterworks, lining tanks and so on.

Harts Colours, Ltd.

A wide range of dry and pulp colours for the paint, printing ink, linoleum, paper coating, wall-paper and allied trades is shown, together with examples of the finished products. In each case the specimens of paint and so on are accompanied by samples of the particular colour or colours which have been used.

Harry Heymann, Ltd.

The speciality on this stand will be the "Monopol" and "Culminex" self-priming syphons, which are made in a variety of sizes so that any kind of vessel can be emptied without loss by splashing or spilling. The syphons, which are made in various materials to withstand corrosive liquids, are automatically self-primed, and the flow can be regulated at will. A syphon lift is shown which indicates when the filling of a vessel is complete.

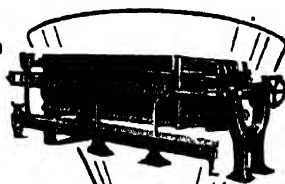
Leonard Hill, Ltd.

At this stand can be seen copies of the "Chemical Engineering and Chemical Catalogue," which includes a large directory of manufacturers of chemicals and plant, an index of trade names, a guide to the uses of products and plant in about one hundred different industries, a selection of data of interest to chemical engineers, industrial chemists and works managers, and a list of many important technical books. In addition, the firm will show its new publication, "Food Manufacture,"

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and will give some idea of the service rendered by its technical and engineering studio.

Bernard Holland & Co.

This firm will show a rotary air compressor or vacuum pump, driven by a 3-phase slip ring induction motor. When used as an air compressor, the machine will deliver 800 cb. ft. of free air per minute at pressures up to 60 lb. per sq. in., and when used as a vacuum pump is suitable for maintaining a vacuum up to 95% of the barometric scale. This machine, which is widely used for handling corrosive gases, is available in twenty-one sizes, with outputs ranging from 14.6 to 4000 cb. ft. per minute, and can also be supplied as two-stage machines. The machine is cooled by water, but an air-cooled machine is also on view. Another exhibit is a small, self-contained, rotary air compressor or vacuum pump, which is fitted to transport lorries for handling sulphuric acid and so on. Examples of the Deville petrol, paraffin or gas engine are also exhibited.

Horton Manufacturing Company, Ltd.

The speciality of this firm is the production of liquid toilet soaps which contain no coconut oil. Samples of these soaps in qualities for factory, mechanics' and domestic use, will be on view, as well as a series of lubricating greases which are supplied only to trade users, specimens of Horton jelly cleanser, and other products.

Howards & Sons, Ltd.

Howards & Sons, Ltd., of Ilford, are exhibiting an interesting range of solvents, chiefly of the cyclohexanol type. Sextone, Sextone B, and diacetone alcohol are medium-boiling solvents for the cellulose lacquer trade; Sextate is a high-boiling solvent, and isopropyl acetate a low-boiling solvent for the same purpose. These solvents are also used in a variety of other trades. Sextone and Sextone B, in addition to their powerful solvent action on nitrocellulose and gums, their properties of assisting the flow of the lacquer, imparting a glossy, smooth, even surface, and preventing "blushing," and their suitability for incorporation in brushing lacquers, have remarkably high dilution ratios with respect to toluene, 7.25 and 5.5 respectively. Sextone, Sextone B and diacetone alcohol are excellent paint and varnish removers. Two plasticisers are also exhibited, cyclohexanol phthalate and oxalate. Sextol finds its chief application as a detergent which is incorporated in soaps for the woollen, cotton, linen, silk, artificial silk, laundry, dry-cleaning and dyeing trades. Cyclohexanol pure is used for the same purposes, but its use is preferable to that of Sextol for dry cleaning. "Vulpex" soap, also shown, is a liquid Sextol soap for use in the textile industry, particularly the woollen industry. Other uses of Sextol are in the preparation of water-soluble solvent and emulsifying agents for fats and oils, and in boot, metal and wood polishes; as a constituent in paint and varnish-removing compositions.

International Combustion, Ltd.

At this stand the chief exhibit, provided by the Grinding and Pulverising Department of International Combustion, Ltd., consists of a working model of the Raymond roller mill. In this machine the material is ground between rollers and a bull-ring, direct contact

of metal to metal being avoided by the provision of ploughs which throw the material up in front of each roller, so that wear is reduced to a minimum. The semi-ground material is lifted by means of a fan to the separator, in which it is graded. The fines then pass to a cyclone and oversize material or tailings fall by gravity back into the mill for retreatment. Pulverising, elevating and conveying are thus carried out in one operation. Photographs are shown of other products of International Combustion, Ltd., including the Hardinge conical ball and pebble mills and Hardinge air classifiers, whilst information relating to the Gayco centrifugal separators, Raymond air separators, Raymond pulverisers, and Hum-mer electric screens, will also be available for enquirers.

G. T. Johnson, & Co.

The principal feature of this stand will consist of samples of a very wide range of steel containers, drums and kegs particularly suitable for oils, paints, colours and chemical goods. Alternative lids and closing processes will be demonstrated.

H. Keller & Co.

As the London agent for J. M. Lehmann of Dresden, this firm is showing Lehmann paint and colour-grinding mills of various sizes, with truly cylindrical rolls of chilled iron or fine-grained porphyry, mounted on ample bronze bearings provided with efficient ring lubrication. A colour-mixing machine, built on the planet system, and a hopper paint mill are also on view.

Langley-Smith & Co., Ltd.

American turpentine, raw, boiled and refined linseed oils, all grades of general lubricating and motor oils, tallow, and American, French, Spanish and Portuguese resin will be amongst the exhibits. The firm is the sole distributor in the United Kingdom of the naval stores of the Hercules Powder Co., which will exhibit wood turpentine, wood rosin, "Solvenol" pine oils, lacquers, etc., the various stages of production being illustrated.

Marchant Bros., Ltd.

Grinding, mixing and straining machines for the printing-ink, paint, pigment and similar industries are shown on this stand. There is a five chilled iron roller grinding mill, with a pair of overhead horizontal mixers, a combination which economises floor space and enables large quantities of material to be dealt with. A micrometer gear is provided for the adjustment of the rollers. Other machines include a triple chilled iron roller grinding mill fitted with a small horizontal pug over the rollers suitable for sample work, etc.; rapid double and single cone mixers with portable pans; a 10-gall. single cone mixer; and a paint and enamel straining machine. The 5-roller grinding mill and overhead mixer will be running throughout the day.

Masson Seeley & Co., Ltd.

This firm is showing the Masseley machines, which enable the user to produce showcards with an untrained staff. A range of models is displayed, and materials to meet every requirement are available. Demonstrations will be given of the machines.

Mastabar Belt Fastener Co.

The exhibit consists of a display illustrating the advantage of the "Mastabar" belt fastener, a simple and efficient device for joining transmission belts. A special tool is made which fits every size of fastener, so that any belt can be quickly and neatly joined.

National Time Recorder Co., Ltd.

This firm is showing a series of its time recorders, which are made in London. Various types are available, including a portable autograph recorder for office use, a time stamp and various other "National" machines.

W. T. Nicholson & Clipper, Ltd.

Amongst the exhibits on this stand are the improved "Klincha" belt lacing machine, tools for use in connexion with belting, the "Klincha" belt cutter and belt-cutting shears, and a new type of belt cutter with a circular knife.

Reckitt & Sons, Ltd.

Here is a comprehensive display of the many shades and qualities of ultramarine supplied by this well-known Hull firm, which has one of the largest plants for the manufacture of ultramarine. The exhibits include: alum-resisting ultramarines for paper manufacture, desulphurised ultramarine for printing inks, desulphurised and alum-resisting ultramarines for use in the manufacture of rubber articles, and ultramarines for coach painting. There is also an interesting exhibit of various manufactured goods in which ultramarines produced by this firm have been used.

W. Rowlandson & Co.

Two types of "Autosell" mixer are shown, the 10 gall. type being fitted with a steel pan and stirrers, and the 2½-gall. type with a "Staybrite" stainless steel pan and stirrers; capacities up to 20 gall. are available. In this machine the pan revolves and the contents react on the stirrer blades, the free revolving head being, like the pan, mounted on ball bearings. The 50-gall. "Rowlandson" mixer on view is steam-jacketed and fitted with tipping gear; this machine is used for blending materials such as meals, paints, soaps, powders, liquids, cellulose varnish, rubber solutions, etc. The 20-gall. "Unique" mixer, fitted with "Staybrite" steel stirrers (not steam jacketed) is used for ointments, face creams, polishes, pastes and preparations in which liquid pastes or powders are blended and cooled to prevent settling. There is also a 5-cwt. "Geyser" mixer, made in capacities up to 40 cwt., and suitable for all dry materials, and a 150 lb. combined sifter and mixer, which can be had in capacities from 50 lb. to 1 ton.

Sachtleben A. G.

Three qualities of blanc fixe are shown by this Cologne firm, ordinary bright for paint and paper, and photographic matte for photographic papers. Various qualities of lithopone are shown, whilst "Sachtloith" is a pure zinc sulphide pigment of unusual opacity and whiteness, which is made by a new process, and should interest manufacturers of cellulose paint.

Sandeman Brothers

The exhibit comprises "Saroni" cleanser, which is a very effective and simple means for cleansing greasy and oily hands, a series of rosin oils, ranging from grease-making oil to refined pale straw oils, as well as rosin spirit; and a display of the firm's greases and lubricants for various purposes.

Sidney Smith & Blyth, Ltd.

A wide range of machinery for mixing, grinding and finishing paints, inks, drugs, etc. is made by this firm, and all its specialities will be on view, most of them being in motion with the actual paint, enamel, etc. being manufactured. There will be four models of the single roller mill, two of the two-roller mill, two of the triple-roller mill, a large combined plant comprising one 30-in. twin horizontal mixer mounted over a 15-in. by 30-in. and 12-in. by 24-in. tandem two-roller mill. A comprehensive range of pug mixers from 18-in. single up to 30-in. twin, will also be on show, together with whirlpool mixers, edgerunner mills, and laboratory plant. A new two-roller mill which has very special features will be on view for the first time.

J. W. & T. A. Smith, Ltd.

This firm makes pulp and dry colours, as well as fine lithographic colours, and advantage has been taken of its resources in colour to display them in glass containers in such a way as to make the stand, which takes the form of a lounge, very attractive and accessible.

Steele & Cowlshaw

Pulverisers are the main feature of this exhibit, the firm's speciality being pulverising cylinders. These are not intended for continuous grinding, but for grinding material in batches. They are charged and discharged according to the class of material to be ground, and the time required to obtain the necessary degree of fineness. Flint pebbles, or porcelain or iron balls are used as grinding medium, the cylinders being usually lined with silex, porcelain, or hard-cast-iron, though special linings can be supplied for particular requirements. Either wet or dry grinding can be used. The machines are also efficient mixers.

Stevens & Manning

The stand will display sieves for every chemical purpose and wire gauzes in steel, iron, tinned steel, galvanised iron, brass, copper, phosphorbronze and Monel metal up to 275 mesh. In addition to silks and other screening material, there will be a "Moto-vibro" screening plant on the Sturtevant system, and paint strainers, steel wool and barrels.

Colin Stewart, Ltd.

An array of fine white silicas is displayed on this stand. The raw materials shown are: (1) crystalline silica or quartz; and (2) amorphous silica. From the latter are prepared the various grades of fine silica sold under the name of "Milowite." This product tests over 98% SiO₂, and owing to its remarkable texture and fineness it finds considerable favour in the paint, colour, chemical and rubber industries. Milowite, despite its softness,

retains abrasive quality, and is suitable for use in metal polish. For uses in which colour and fineness are not of prime importance, "Rostellan" silica is available. Samples of crushed and graded Manx spar, for filtering purposes, building work, etc., of "Albionite," a coloured wood filler, and of "Silicanite," a preparation for castings which expands on heating, are also to be seen.

Strontium Products, Ltd.

In Gloucestershire, where this firm has its works, very pure celestine is found, consequently the actual content of strontium sulphate is rarely below 96%, whilst the product has the advantage of freedom from lime or alkali. As a pigment or extender, strontium sulphate is very similar to barytes. It has a uniform oil absorption equal to that of the best grades of barytes and less than that of cheaper qualities; owing to its slightly lower refractive index, it does not tend to reduce the brightness of the colour with which it is mixed so much, and as its specific gravity is slightly lower the suspension in oil is claimed to be better. Material of uniform standard fineness is available and still finer grades are produced.

Tangyes, Ltd.

Dominating this stand are a 47 b.h.p. heavy oil engine and a 20 b.h.p. fuel oil engine, both of the cold-starting type. The heavy oil engines can be arranged to use tar oils, alcohol, etc., or to use either liquid or gaseous fuels, and are remarkably efficient and economical. Some interesting pumps are shown, including two 6-in. "Tan-Gyro" centrifugal pumps for various heads, a 4 x 6 in. vertical treble ram pump, a 6-stage turbine pump, and a complete range of vertical single ram pumps. A 40-ton hydraulic press and a selection of pulley blocks, lifting jacks, etc. complete the exhibit.

Thomas & Bishop, Ltd.

The chief exhibits are: a demonstration of the advantages of treating belts with "Cling-Surface"; a demonstration of the value of "Permac" as a cheap but efficient jointing material; a working model showing various types of lubricators using "Flexo" grease, supplied in nine densities; a sample of "Flexo" leather and textile belting; and a series of refractory cements, for bonding and protecting fireclay, the uses being illustrated by sample briquettes with "Flexo" joints in fireclay, silica, chrome, bauxite, and magnesia bricks.

Torrance & Sons, Ltd.

Paint-making machinery on this stand includes mills, mixers and pumps. Amongst the mills is the Torrance "Silent Quadrant" triple roller mill, with a micrometer adjustment which enables the rolls to be set at any desired clearance, say one 2000th of an inch. The paint is subjected to an increased grinding pressure, although the rolls do not meet. Other features in this machine are the patent lateral gear, the new scraper knife and an improved type of belt guide. Various sizes of the Torrance Silent Quadrant Mill are shown in addition to examples of the "Micro twin" mill, the "Vortex," "Perfect" and "Little Giant" mixers, and various paint and varnish pumps.

* Thomas Tyrer & Co., Ltd.

"Stirling" chemicals which will be in evidence are products for anti-fouling preparations, colouring glass, and vulcanising rubber; thickeners for lubricating oil and for paint and varnish media, and chemicals, including cobalt salts, for driers. Salts for the preparation of catalysts for hardening oils will be shown, and there will be mordants and other products bearing the familiar "Stirling" brand.

Utrechtsche Machinefabriek

The exhibits of this firm comprise:—an oil-exPELLER, which is an automatic machine for the expulsion of oil from oilseeds and other oil-containing materials; a crusher, made for crushing cattle cake, but also used for breaking salt and ores which are not too hard, and a model of a "Frasmu Battery," a heavy hydraulic plant used for expressing oils.

The Valor Co., Ltd.

Amongst the exhibits on this stand are "Valor" oil cabinets for storing lubricating, light and other oils, hand pumps, and drums for oils, oil filters, transport cans, and a "Valor" waste settling tank. The "Valor" fire extinguishers include various types of soda and acid machines for ordinary use, the "Valor Foamera" extinguisher for oils and inflammable liquids, and the "Valor C.T.C." for motor vehicles, inflammable liquids and electrical fires. In addition, there will be one of the latest 30-gallon "Valor Foamera" extinguishers mounted on wheels, this being the type which is used in oil, paint and other factories.

D. Waldie & Co., Ltd.

The exhibit of this firm consists of samples of turpentine and rosin manufactured by the Indian Turpentine & Rosin Co., Ltd., of Bareilly, India.

Whiffen & Sons, Ltd.

Prominent amongst the exhibits are the specimens of genuine quicksilver vermilion in various shades. The vermilion is made in all shades ranging from pale orange to deep red, and any tint can be matched no matter how delicate. The product is entirely stable, and specimens are shown which have been exposed to light for more than fifty years. They are as bright and good as when first manufactured. A specimen of pure sublimed cinnabar is shown alongside the samples of vermilion. In addition, there is an interesting range of various articles exhibited in which vermilion has been employed, as well as some fine specimens of highly finished paint work, all serving to demonstrate the wide use of this chemical colour, and its superiority above all substitutes where a striking and permanently brilliant red colour is required.

Society of Chemical Industry

Stand No. 51 is that occupied by the Society of Chemical Industry, and here enquiries about the work of the Society or about its publications will be welcomed. Specimens of the publications of the Society will be displayed, and the representatives who will be in attendance will be glad to give any assistance to visitors which is in their power.

TRADE NOTES

In connexion with the special Annual Meeting number several firms have sent us interesting notes about their activities. An account of these communications is given below, the various firms being dealt with in alphabetical order.

Blair, Campbell & McLean, Ltd.

An interesting speciality of this firm is the plant required for the manufacture of cellulose acetate. The firm has made plant for this purpose for a number of years, and has supplied it to many firms in this country and abroad. An important part of a cellulose acetate plant is the kneading and mixing machine, that made by the firm is of special design, and is to be found in practically every works manufacturing cellulose acetate both in this country and on the Continent. The machine produces a very thorough and intimate mixture, and can be regulated very exactly in working. Amongst other plant used in connexion with the manufacture of artificial silk, the firm also manufactures plant for the production of sodium acetate, acetic acid, and acetic anhydride, another speciality being plant for the recovery of acetone. It is worthy of note that cellulose acetate plant is being manufactured on such a large scale in this industry, as it is thought erroneously—that most artificial silk plant is obtained from the Continent.

Borax Consolidated, Ltd.

No one can escape the blandishments of the "Twenty Mule Team" brands of borax and boric acid, which are obtained by Borax Consolidated, Ltd., from North and South America and Asia Minor in the form of crude boron minerals and refined at Kidsgrove, Staffordshire, and Belyedere, Kent. From the permanent wave of the hairdresser, the rotundity of the felt hat, distempered walls, to soap and fire-proofed fabrics, the ordinary citizen cannot escape borax, and the manufacturer requires it and boric acid for use in working, refining, and smelting metals, to produce enamels, to glaze pottery, and to make glasses of low thermal expansion and maximum durability. In addition to its use in the glass industry, borax is equally important in the manufacture of leather, whilst it is a valuable detergent for textiles, and with boric acid finds many pharmaceutical uses.

Brinjes & Goodwin, Ltd.

This Cold Harbour firm reports it is exceedingly busy, as its "Helix" patent triple roller-mill continues in increasing demand. In addition to quite a number of repeat orders from Great Britain, the firm has in hand a repeat order for New Zealand for a duplicate combined plant to one supplied last year, and it is removing Messrs. Lorilleux & Bolton's Printing Ink Factory to large new works at Tottenham and supplying a number of new "Helix" mills in connexion therewith. A second repeat order has been received for mills for B. Winstone & Sons, Ltd., of Shoe Lane, London, E.C., and Stratford, and a further order for mills for the new factory of A. B. Fleming & Co., Ltd., of Edinburgh.

W. J. Bush & Co., Ltd.

Founded in 1851 by the late Mr. W. J. Bush, this business was the first established in England solely for the manufacture of flavouring essences, of which artificial flavours soon became a prominent feature. Later on the distillation of essential oils was undertaken. The business has shown a steady growth, and branches and subsidiary companies were established in several foreign countries, the principal of which are situated in Melbourne, New York and Montreal, and formerly in Moscow. With the advent of synthetic perfumes and flavours the company turned its attention to the manufacture of these products, and was the first to manufacture in England on a commercial scale salicylic acid, vanillin, coumarin, terpineol, and numerous other articles in this field. During the War a considerable demand was made on the company, and the manufacture of a great variety of chemicals was undertaken, many of which have since had to be abandoned for economic reasons, but a new department of the business was created to which a great deal of attention is still being devoted. The company now specialises in solvents and plasticisers for the lacquer industry and a number of intermediates for the coal-tar industry. These developments have necessitated large extensions, not only of the original Ash Grove factory, but the construction of new factories at Widnes, Lancashire, for the heavier chemicals, and also at Mitcham for certain specialities.

Car Owners Mutual Assurance Society, Ltd.

In these days of intense motor traffic there can be but few car owners who are so unwise as to neglect the protection afforded by insurance. It is of interest to note that membership of the Car Owners Mutual Assurance Society, Ltd., converts insurance into a profitable investment, as the Society is conducted on co-operative principles, and the profits—calculated at 10% of the annual premium with any selected insurance company—belong to the members. As the total cost of membership is one guinea only, many car owners will welcome such an opportunity of "getting something back."

T. & C. Clark & Co., Ltd.

Acid-resisting enamelled cast-iron chemical plant is the speciality of this firm, which is one of the oldest firms of its class in the country, as it was the original patentee in 1839 of a lead-free enamel for cast iron. Amongst the cast-iron plant lined with acid-resisting lead-free enamel made to meet the requirements of the chemical and allied trades are jacketed pans, stills, mixers with capacities ranging from 5 to 300 gals., furnace pans, granulators, tanks and cisterns, and an extensive range of small enamelled vessels for use in the manufacture of pharmaceutical products, in laboratories, and for research work. The firm is ready to supply to specification or submit designs to meet particular needs.

Evans, Adlard & Co., Ltd.

Filtering paper is one of the oldest specialities of this firm, which was one of the first British makers to produce

this article. "Postlip" filter papers are produced in a large variety of grades, which practically cover all the requirements of the laboratory (where unwashed papers can be used) and of modern industry. Steadily expanding trade at home and abroad shows that the quality of "Postlip" filter papers is appreciated.

The Gotham Co., Ltd.

The attention of chemists connected with the gas industry is now being directed to gypsum and anhydrite, because they are the cheapest available sources of the sulphate radical. Anhydrite from the mines of the Gotham Co., Ltd., has already been supplied in large quantities for use in the manufacture of sulphate of ammonia by the interaction of carbon dioxide, ammonia, and calcium sulphate. Bearing in mind the present unsatisfactory return from the manufacture of sulphate of ammonia, by the use of sulphuric acid at gas works, it is very likely that gypsum or anhydrite will be brought generally into use as in the case of the sulphate now being produced from synthetic ammonia. The Gotham Co., Ltd., of Nottingham, is one of the largest gypsum producers in this country, and it operates gypsum mines and mills in the counties of Nottinghamshire, Derbyshire, Cumberland, and Westmorland. It is the proprietor of many well-known brands of plaster, gypsum cements, and hard wall plaster, and also manufactures pink meal for cleaning tinplate, and pixie powder, a gypsum stone dust for colliery use.

Robert Jenkins & Co., Ltd.

This firm was established in 1856, and is believed to be the largest manufacturer of welded steel tanks etc. in the British Isles, having a capacity of over 300 tons a month. The firm's products include a wide range of wrought steel, welded boilers of every kind for heating by low pressure hot water and for domestic hot water supply, as well as welded cylinders, annealing and hardening pots, copper boilers and cylinders, steam boilers, and storage tanks for oil, water, petrol, and so on.

Lennox Foundry Co., Ltd.

Tantiron—the first acid-resisting iron to be put on the market—has been made and supplied for the last 18 years by the Lennox Foundry Co., which can thus claim to be the original makers of acid-resisting alloys. The firm also makes the acid-resisting alloys, Tantocopper, Tantnickel, and so on, and chemical plant in all other metals. The factory at New Cross is large and well-equipped, and includes a very up-to-date chemical department for analyses and research. The products of the firm appear to comprise plant for nearly all chemical processes, including plant for the synthetic production of most organic bodies.

Thomas Locker & Co., Ltd.

The first man to weave wire by steam power in England was Mr. Thomas Locker, who founded the firm which bears his name in 1879. A large output is maintained at the firm's Ellesmere wire works, almost entirely confined to wire cloth and metal perforations for use

in rice, flour and cement mills, in gold-mining and in chemical works. The attention which this firm pays to the quality, durability and reliability of its products is well known, and it is interesting to note that an additional line of manufacture—brushes for mill and foundry work—has met with equal appreciation from users.

George Scott & Son (London), Ltd.

Such a wide range of chemical plant is made by this firm that adequate notice is impossible within the space available. Complete plants are supplied for the oil and fat industries, for animal by-product manufactures (glue etc.), for solvent recovery, for making paper, lactose, milk powder, malt extract, caustic soda and so on, whilst the specialities include vacuum evaporating plant for all trade liquors, used in many industries, amongst which the paper industry stands prominent, and practically every known type of dryer, including the successful dryer used in the De Vecchis process for drying sugar beet, which was improved by the firm and installed in Italy in competition with the chief European firms. The firm is associated with Ernest Scott & Co., Ltd., both firms being under one control.

F. Weinreb

This firm manufactures K.K.K. homogeneous lead, tin and nickel-lined material. The disadvantages of loose lead lining are that the lead sheets first begin to show creases, and folds, or blisters, then sagging sets in, and finally they fracture or tear. Loose lead lining is a constant overhead charge. Homogeneous means sameness of structure, and the word homogeneous can be with justice applied to the K.K.K. lead lining as the lead does not separate from the steel or copper even at the highest vacuum, and can only be removed by mechanical force. The initial cost is, of course, higher than that of loose lead lining, but, if properly inspected during the first few weeks after installation, K.K.K. homogenous lead lining lasts for 10, 12, or even 16 years. It is claimed that nearly all artificial silk manufacturers in the world use either K.K.K. lead or tin-lined plant. For chemical reactions which have to take place in nickel or silver the firm supplies homogeneous nickel or silver-lined plant which, if designed for higher internal pressures, are cheaper than vessels made entirely of these expensive metals. Turbo blowers and compressors are another speciality, manufactured since 1910. The firm has supplied SO₂ blowers for the majority of Tentelew plants in the world, some of which have been running for 16 years without requiring any repairs. The firm has devoted also considerable attention to the problem of mixing, stirring and emulsifying, and developed the torpedo-stirrer which sucks in the various constituents at the bottom of the vessel and throws them out in the middle, or top of the contents. This stirrer, which is claimed to be more efficient than any other existing type, did not, however, solve all mixing problems, and led to the development of a new form of emulsifier which is being built at the present time in sizes up to 3,000 gals./hour capacity (measured by its capacity as water pump).

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